

SK00-9664-E7-003-01

ULVAC

G-TRAN series

Multi Ionization Gauge Sensor unit

Analog Output Type

Model SH200-A

Serial Communication Type

Model SH200-R

Specification



ULVAC, Inc.
Components Division

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<http://www.ulvac.co.jp/en/>

1 Specification

The Multi ionization gauge sensor unit SH200 is a vacuum gauge that can measure the high vacuum pressure by connecting a dedicated sensor unit (B-A gauge type).

The following three types of interfaces are available. Users can select the specification that best suits the communication protocol.

- Analog output type : SH200-A (This specification)
- Serial communication type : SH200-R (This specification)
- EtherCAT communication type : SH200-E (Separate specification)

(Hereinafter, SH200 refers to both SH200-A and SH200-R.)

By connecting an optional unit to SH200, SH200 can control each connected unit. According to the unit connected, the three modes below are available to measure from high vacuum to atmospheric pressure.

- ① SH200 stand-alone mode : SH200 only
- ② SWU10-R/SPU combination mode : Pirani gauge (SWU10-R/SPU)+SH200
- ③ SAU combination mode : Pressure sensor unit (SAU)
+SWU10R/SPU+SH200

※ SWU series is available in the Android/Windows-compatible pirani 【SWU10-U】 and RS485 communication-compatible pirani 【SWU10-R】.

SWU written in this specification is SWU10-R. SWU10-U cannot connect to SH200.

※ Each mode is automatically set according to the connected unit.

※ SPU and SWU cannot operate at the same time.

※ SAU cannot connect to SH200 without SPU or SWU.

1.1 Standard specifications

Name	Multi Ionization Gauge Sensor unit	
Model	SH200-A	SH200-R
Interface	Analog output	Serial communication
Compatible sensor ※Separately ordered	Sensor for SH200: 1pc. M-44 (NW16), M-45 (NW25), M-46 (ICF070) 【Option: M-34 (NW16), M-35 (NW25), M-36 (ICF070)】	
Compatible sensor unit ※Separately ordered	Pirani gauge SWU : 1pc. Pirani gauge SPU : 1pc. Pressure sensor unit SAU: 1pc.	※SWU and SPU cannot operate together.

Measurable pressure range (N ₂)	SH200 stand-alone mode: 5.0×10^{-8} Pa to $1.0 \times 10^{+1}$ Pa	
Accuracy (N ₂)	SH200 stand-alone mode: 5.0×10^{-8} Pa to $1.0 \times 10^{+1}$ Pa: $\pm 15\%$	
Repeatability (N ₂)	SH200 stand-alone mode: $\pm 2\%$	
Measuring gas type	Indicate pressure as sensitivity to N ₂ gas	
Emission current	1mA (1×10^{-3} Pa or lower), 10 μ A (1×10^{-3} Pa or higher)	
DEGAS	Electron bombard method SH200 starts DEGAS at an emission current of 1mA, grid voltage of approx. 330V, and approx. 1×10^{-3} Pa or less.	
Sampling time	5 times in 60msec moving average.	
Measured value output	Output voltage DC 0V to 10V, log output 0.75V/1digit Pressure conversion formula (Output voltage V[V] Pressure P[Pa] See section 2.1) $V = 7.25 + 0.75 \times (\log P - 2)$ $P = 10^{\{(V - 7.25) / 0.75 + 2\}}$	
	Update time	60msec
	Resolution	Approx. 2.5mV
	Output impedance	100 Ω
Control input signal	FIL ON/OFF, FIL 1/2, DEGAS ON/OFF Work with open collector input Negative logic	
Control output signal	Sensor error, Setpoint 1/2/3, Emission valid, Filament power monitoring Rated Less than the supply voltage 50mA _{MAX} Saturation voltage 1V	
Communication	USB Type-C	
Serial communication		RS-232C/RS-485 half duplex
	Communication speed	9600/19200/38400 bps

LED display	POWER: White: Startup operation Blue : Normal operation Green: Filament of SH200 is on. Red : SWU/SPU, SAU power supply error, etc. (Only in the combination mode) Blinking green: Filament power abnormality, etc. Blinking red : Filament disconnection, etc.
	SWU/SPU: Pirani gauge SWU/SPU status display ※SWU/SPU combination mode, SAU combination mode only
	SAU: Pressure sensor SAU status display ※SAU combination mode only
Sensor material ※Separately ordered	【M-4*】 Filament1:Ir/Y ₂ O ₃ coated Filmanet2:Ir/Y ₂ O ₃ coated 【M-3*】 Filament1:Ir/Y ₂ O ₃ coated Filmanet2:W Other: PtC-Mo, SUS304, W, Kovar glass, Kovar/Ni plated
Sensor breaking pressure ※Separately ordered	2 × 10 ⁺⁵ Pa (absolute pressure) ※Please consider the breaking pressure of flanges and clamps separately.
Operating temperature range	10°C to 50°C
Sensor temperature upper limit ※Separately ordered	Sensor only 150°C Flange part of sensor 80°C ※With SH200 removed ※When heating, deviations from specifications, such as accuracy, is observed. ※Operating temperature range of SH200 is 10°C to 50°C.
Operating humidity range	15% to 80% (no condensation)
Storage temperature	-20°C to 65°C (Non-energized, no condensation)
IP Rating	IP30

Power supply voltage	DC 20V to 28V (Ripple, Noise 1% or less) ※Power supply voltage at the end of SH200 connector Steady state : approx. 5.5W Maximum (During degassing) : 8W or less When power turned on : 800mA or less 4msec or less Overvoltage category: Category 1 Connect to circuits where measures are taken to limit transient overvoltages to a sufficiently low level.
GE marking (Verified with SPU and SAU connection)	EN61010-1:2010(Third Edition), A1:2019 2014/35/EU EN61326-2-3:2013 2014/30/EU IEC61000-4-2:2008 IEC61000-4-3:2006+A1:2007+A2:2010 IEC61000-4-4:2004+A1:2010 IEC61000-4-5:2005 IEC61000-4-6:2008 IEC61000-4-8:2009 CISPR11:2009+A1:2010 Group 1 Class A RoHS EN50581:2012 2011/65/EU Display cable length: 40m or less Cable length between SH200 and SWU, SAU, SPU: 2m or less
I/O connector	D-sub15 pin connector (male), M2.6mm screw
Weight	SH200 only: approx. 280g, Sensor (M-44): 80g
Dimensions	Approx. 69mm × 63mm × 90mm (SH200 only)

1.2 SWU/SPU combination mode standard specifications

Measurable pressure range	<p>5×10^{-8}Pa to $1 \times 10^{+5}$Pa (When SWU connected)</p> <p>5×10^{-8}Pa to $1 \times 10^{+4}$Pa (When SPU connected)</p> <p>When pressure drops: SWU/SPU indicates 2Pa or lower, SWU/SPU \Rightarrow SH200</p> <p>When pressure rises: SWU/SPU indicates 3Pa or higher, SH200 \Rightarrow SWU/SPU</p> <p>※SH200 measurement can be forcibly turned off with the control signal.</p>
Accuracy (N ₂)	<p>Please refer to the accuracy of each gauge.</p> <p>In the overlapping pressure range of 0.4Pa to 3.0Pa, the measured pressure of the Pirani gauge (SWU/SPU) and SH200 is adjusted and output.</p> <p>※SWU/SPU and SH200 have gas species dependency. Please note the difference in pressure indication when gauges switch.</p>
POWER LED status	<p>White: Startup operation</p> <p>Blue : Normal operation to SWU/SPU measurement range.</p> <p>Green: Filament of SH200 is on</p> <p>Red : SWU/SPU power supply failure</p> <p>Blinking green: Filament power abnormality, etc.</p> <p>Blinking red : Filament disconnection, etc.</p>
Control input signal	<p>FIL ON/OFF, FIL 1/2, DEGAS ON/OFF</p> <p>Work with open collector input, Negative logic</p> <p>※When FIL ON/OFF signal is Lo input, the filament of SH200 is off.</p>

1.3 SAU combination mode standard specifications

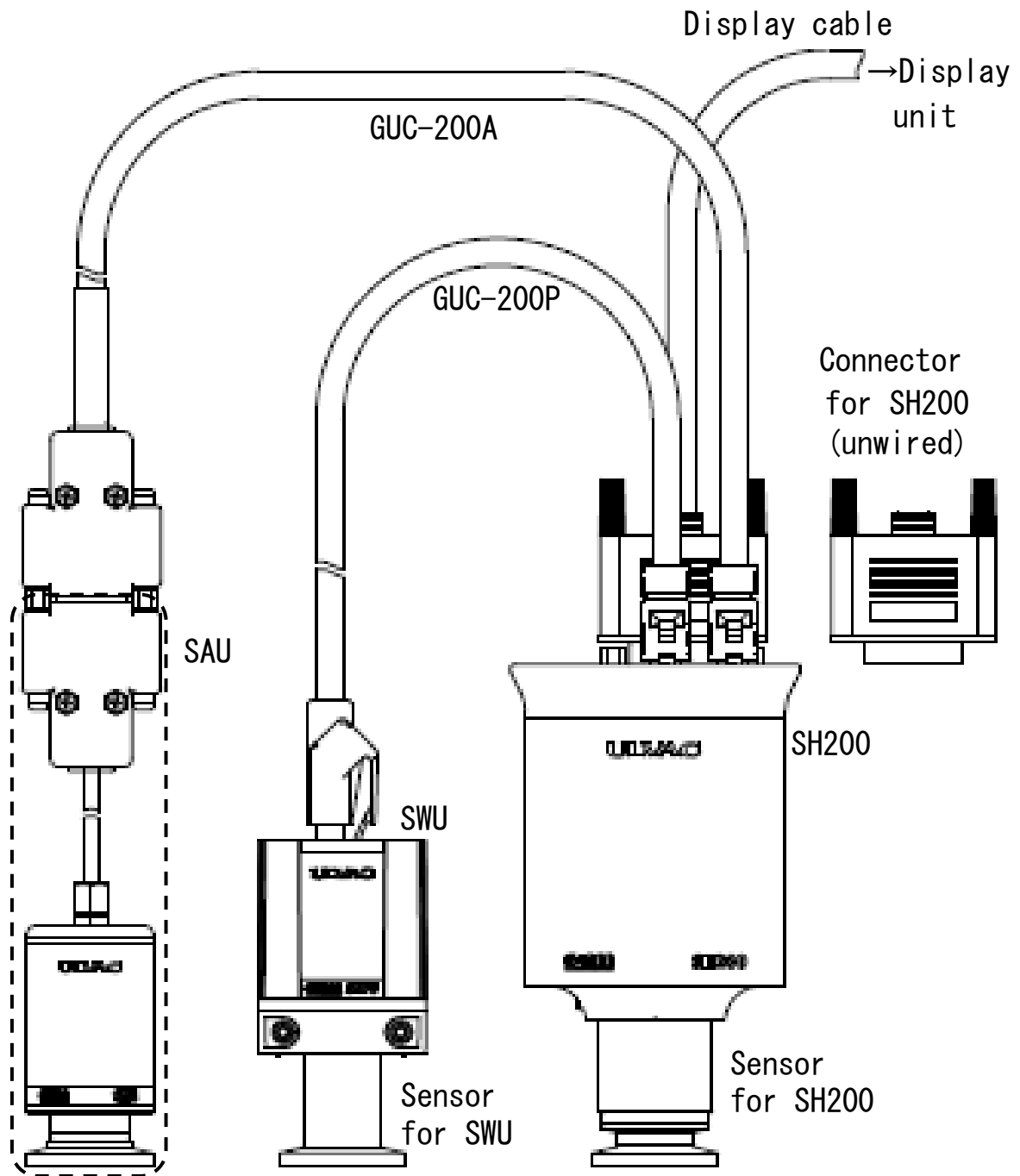
<p>Measurable pressure range</p>	<p>$5 \times 10^{-8} \text{Pa}$ to $1 \times 10^{+5} \text{Pa}$</p> <p>When pressure drops: SAU indicates 10000Pa or lower, SAU \Rightarrow SWU/SPU</p> <p>When pressure drops: SWU/SPU indicates 2Pa or lower, SWU/SPU \Rightarrow SH200</p> <p>When pressure rises: SWU/SPU indicates 3Pa or higher, SH200 \Rightarrow SWU/SPU</p> <p>When pressure rises: SAU indicates 10000Pa or higher, SWU/SPU \Rightarrow SAU</p> <p>※SH200 measurement can be forcibly turned off with the control signal.</p>
<p>Accuracy (N₂)</p>	<p>Please refer to the accuracy of each gauge.</p> <p>In the overlapping pressure range of 0.4Pa to 3.0Pa, the measured pressure of the Pirani gauge (SWU/SPU) and SH200 is adjusted and output.</p> <p>※Since SAU measures by gauge pressure and SWU/SPU measures by absolute pressure, errors between SAU and SWU/SPU occur due to the altitude and air pressure.</p> <p>※SWU/SPU and SH200 have gas species dependency. Please note the difference in pressure indication when gauges switch.</p>
<p>POWER LED status</p>	<p>White: Startup operation</p> <p>Blue : Normal operation to SAU, SWU/SPU measurement range.</p> <p>Green: Filament of SH200 is on.</p> <p>Red : SAU, SWU/SPU power failure</p> <p>Blinking green: Filament power abnormality, etc.</p> <p>Blinking red : Filament disconnection, etc.</p>
<p>Control input signal</p>	<p>FIL ON/OFF, FIL 1/2, DEGAS ON/OFF</p> <p>Work with open collector input, Negative logic</p> <p>※When FIL ON/OFF signal is Lo input, the filament of SH200 is off.</p>

1.4 Include items

Multi ionization gauge sensor unit SH200 (Main unit)	1pc. (Include sensor only when ordering at the same time as sensor)
Quick manual (Regular paper)	1pc.

1.5 Items that need to be ordered separately

Sensor for SH200 (Flange size)	M-44 (NW16), M-45 (NW25), M-46 (ICF070) M-34 (NW16), M-35 (NW25), M-36 (ICF070)
Connector for SH200	D-sub15 pin 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	Cable between SH200 and display unit 2m, 5m, 10m, 15m, 20m, 25m, 30m, 35m, 40m
Pirani gauge SWU	SWU and SPU cannot operate at the same time.
Sensor for SWU	SWP-16, SWP-25, SWP-R1/8 SWP-P18, SWP-P15, SWP-CF16
Pirani gauge SPU	SWU and SPU cannot operate at the same time.
Sensor for SPU	WP-01, WP-02, WP-03, WP-16
Unit cable GUC-200P	Cable between SH200 and SWU/SPU 0.5m, 1m, 2m
Pressure sensor unit SAU	SAU cannot work without SWU or SPU.
Unit cable GUC-200A	Cable between SH200 and SAU 0.5m, 1m, 2m



※SWU can be replaced with SPU.

1.6 Pin layout

Analog output type SH200-A (D-sub15 pin connector (male), M2.6mm screw)

Pin number	This unit	Function
1	Power supply	Power supply for driving this unit
2	Sensor error	It outputs a signal when an error occurs, such as filament disconnection.
3	Setpoint1	It outputs a signal when setpoint1 is operating.
4	Emission valid	It outputs a signal when the emission current is normal.
5	FIL ON/OFF	It inputs ON/OFF signal of the filament. ※FIL ON signal in SH200 stand-alone mode ※FIL OFF signal in the combination mode
6	FIL 1/2	It inputs a signal when FIL 2 is selected.
7	FIL power monitoring	It output a signal when a filament approaching the end of the product life.
8	Measured value output	It outputs a measured value.
9	Power supply GND	Ground for the power supply
10	Signal GND	Ground for the output signal
11	Setpoint2	It outputs a signal when setpoint2 is operating.
13	DEGAS ON/OFF	It inputs a signal when DEGAS is on.
14	Setpoint3	It outputs a signal when setpoint3 is operating.
15	Signal GND	Ground for the output signal
Case	Frame ground	Ground for frame

Serial communication type SH200-R

(D-sub15 pin connector (male), M2.6mm screw)

Pin number	This unit	Function
1	Power Supply	Power supply for driving this unit
4	RS232C RxD	RxD of RS-232C
5	Terminating resistor for RS485	Terminating resistor for RS-485. It is connected to pin 13.
6	RS232C TxD	TxD of RS-232C
8	Measured value output	It outputs a measured value.
9	Power Supply GND	Ground for the power supply
10	RS485-	Minus of RS-485
12	RS485+	Plus of RS-485
13	RS485+ (For connecting the terminating resistor)	Terminating resistor for RS-485. It is connected to pin5.
14	RS232C GND	Ground for RS-232C
15	Signal GND	Ground for the output signal
Case	Frame ground	Ground for frame

2 Measured value output (common for SH200-A/SH200-R)

This unit outputs the measured value as a voltage signal of DC 0V to 10V.
I/O connector: 8 pin[Measured value output+]-15 pin[GND] (See section1.6)

2.1 Pressure conversion formula

Use the following formula to convert to pressure.

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

P: Pressure

V: Output voltage[V]

k: Pressure unit factor (see table below)

Pressure unit	k
Pa	2
Torr	0.1249
mbar	0

2.2 SH200 stand-alone mode measured value output

The measured value output in several statuses that can occur during a measurement is shown in Table 2-1 Measured value output status (stand-alone mode) below.

Table 2-1 Measured value output status (stand-alone mode)

Operating status	Measured value output voltage
Filament is off	9.9V or higher
Normal measurement	0.27V to 6.5V
SH200 error (such as filament disconnection)	9.9V or higher
Power supply voltage error, sensor unit failure	0.1V or lower

2.3 SWU/SPU combination mode measured value output

The measured value output in several statuses that can occur during a measurement is shown in Table 2-2 Measured value output status (SWU/SPU combination mode) below.

Table 2-2 Measured value output status (SWU/SPU combination mode)

Operating status	Measured value output voltage	
	When SWU connected	When SPU connected
Normal measurement	0.27V to 9.5V	0.27V to 8.75V
$1 \times 10^{+5}$ Pa or higher	9.5V	
$1 \times 10^{+4}$ Pa or higher		8.75V
SH200 filament turned off.	4.25V to 9.5V	5V to 8.75V
SH200 error (such as filament disconnection)	4.25V to 9.5V	5V to 8.75V
SWU/SPU error (such as filament disconnection)	9.9V or higher	
Power supply voltage error, sensor unit failure	0.1V or lower	

※SH200 outputs errors even when SWU/SPU has errors.

However, SH200 error clears when filament turns off.

2.4 SAU combination mode measured value output

The measured value output in several statuses that can occur during a measurement is shown in Table 2-3 Measured value output status (SAU combination mode) below.

Table 2-3 Measured value output status (SAU combination mode)

Operating status	Measured value output voltage	
	When SWU connected	When SPU connected
Normal measurement	0.27V to 9.5V	
Higher than atmospheric pressure	9.5V or higher	
SH200 filament turned off.	4.25V to 9.5V	5V to 9.5V
SH200 error (such as filament disconnection)	4.25V to 9.5V	5V to 9.5V
SWU/SPU error (such as filament disconnection)	8.68V to 9.5V	
SAU error	9.9V or higher	
Power supply voltage error, sensor unit failure	0.1V or lower	

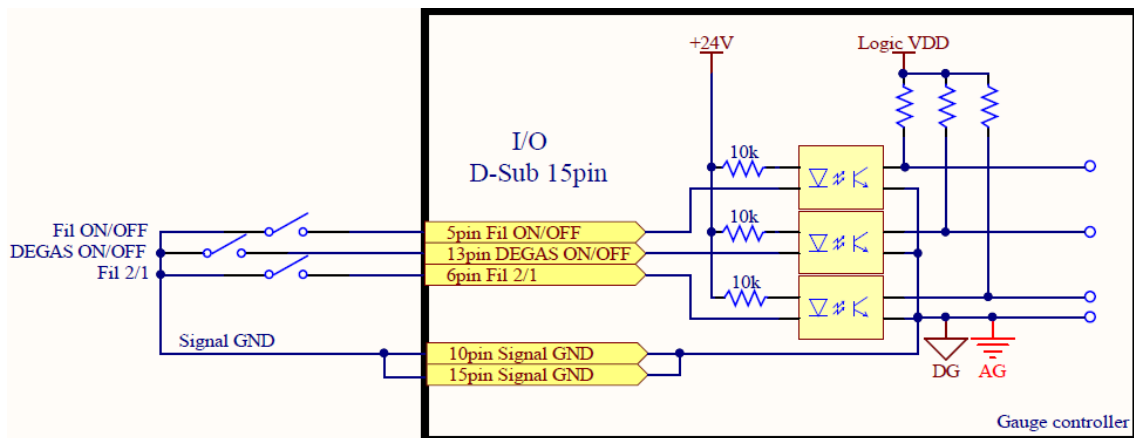
※SH200 outputs errors even when SWU/SPU or SAU has errors.

However, SH200 error clears when filament turns off.

3 Control input/output signal

3.1 Control input signal (Analog output type SH200-A only)

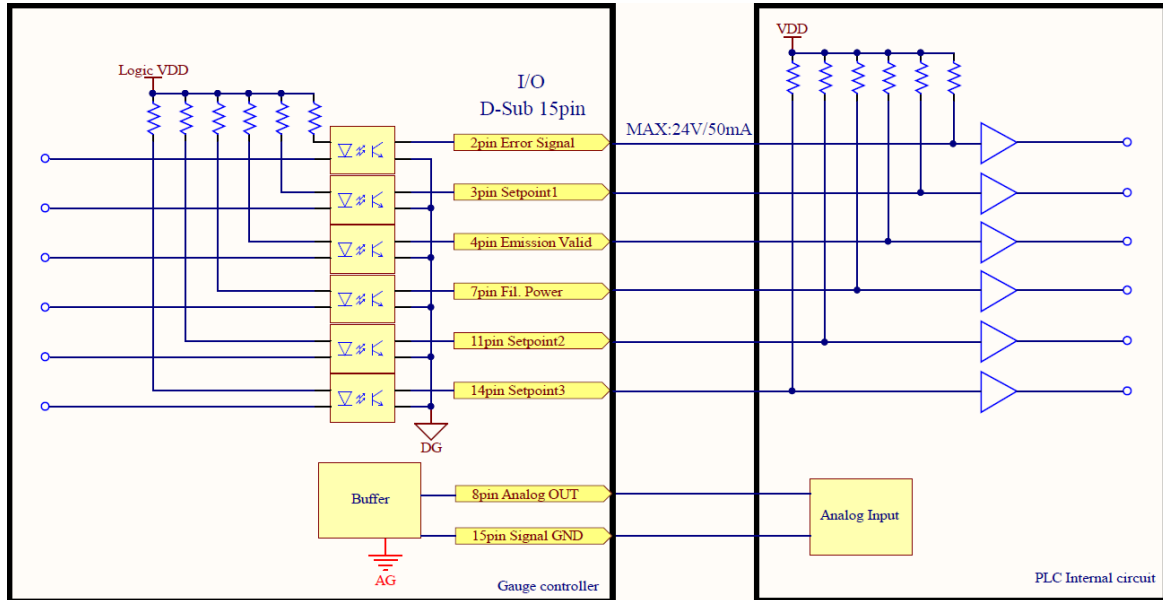
Figure 3-1 SH200-A input signal internal circuit diagram



3.2 Control output signal (Analog output type SH200-A only)

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

Figure 3-2 SH200-A output signal internal circuit diagram



4 How to use serial communication (Serial communication type SH200-R only)

4.1 Communication specifications

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

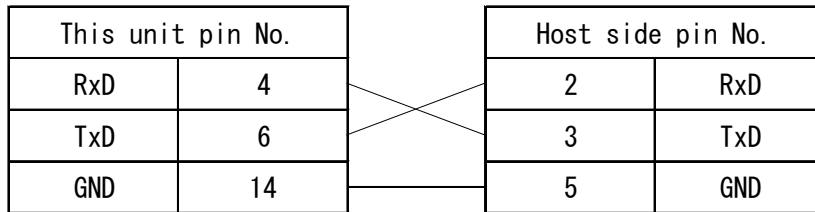
4.2 Settings

4.2.1 Connection diagram

4.2.1.1 RS-232C connection diagram

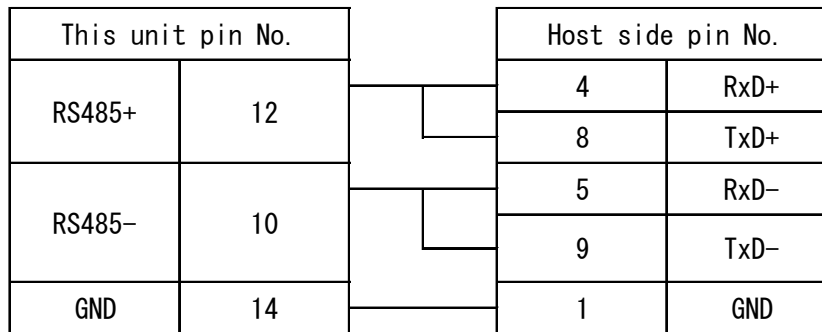
An example of RS-232C connection is shown below.

The host side is a D-sub 9pin



4.2.1.2 RS-485 without terminating resistor (Example)

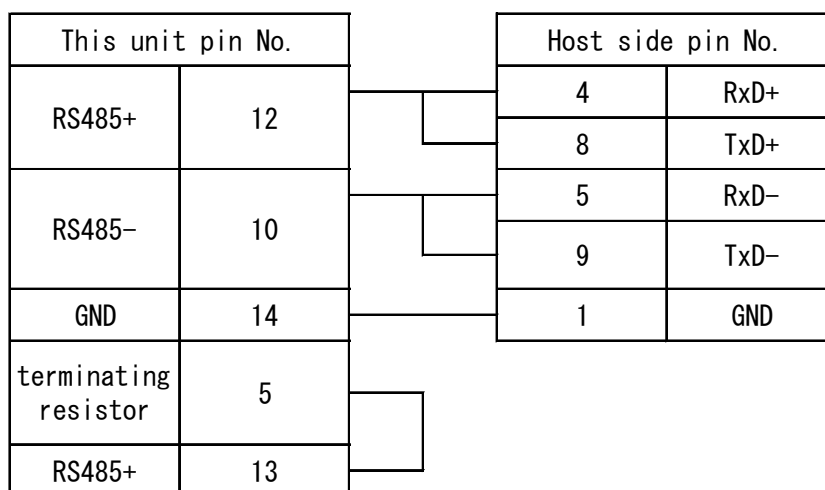
Example) USB serial interface USB-485 manufactured by NATIONAL INSTRUMENTS.



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. All characters must be converted by the hexadecimal notation of ASCII code.

4.3.1 Command list

Command	Description	Command	Description
D	Read measured value and status	1R	Read Setpoint1 value
T	Model and software version	1W	Write Setpoint1 value
ATM	SAU/SWU Atmospheric Pressure Adjustment	2R	Read Setpoint2 value
ZER	SAU/SWU Zero Point Adjustment	2W	Write Setpoint2 value
CLR	Initialize SAU/SWU atmospheric pressure and zero point adjustment Read status	MDR	Read Mode setting
		MDW	Write Mode setting
SR	Write status	4AR	Read Address setting
SW	Check error contents	4AW	Write Address setting
ERR	Check Filament power monitoring value	4BR	Read communication speed
FIL	SAU/SWU Atmospheric Pressure Adjustment	4BW	Write communication speed

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) 3.00E+03 ⇒ 3.00 × 10⁺³
 - e.g. 2) 5.00E+00 ⇒ 5.00 × 10⁺⁰
 - e.g. 3) 4.00E-01 ⇒ 4.00 × 10⁻¹
- When 「E.EEE+EE」 is returned. : Sensor error
- When 「F.FFE+FF」 is returned. : In SH200 stand-alone mode only, when the measurement range is exceeded, or filament is off.
- Please refer to section 4.3 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

Multi ionization gauge sensor unit SH200

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

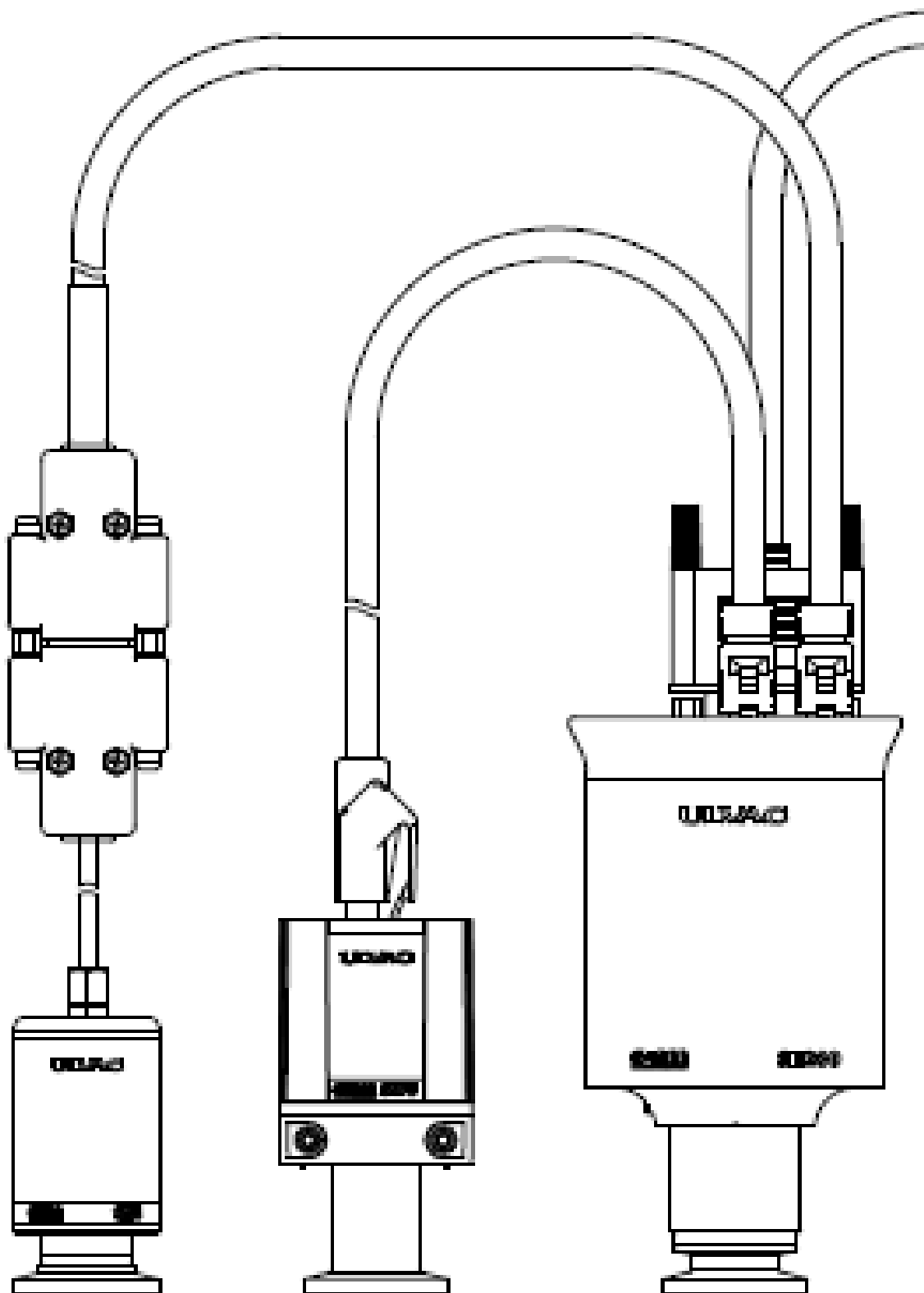
- 1) Products that are out of warranty period.
- 2) Failures and malfunctions caused by natural disasters such as fires, storms, floods, earthquakes, and lightning, and force majeure disasters such as wars.
- 3) Failure or malfunction caused by careless handling or improper use.
- 4) Products that are 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

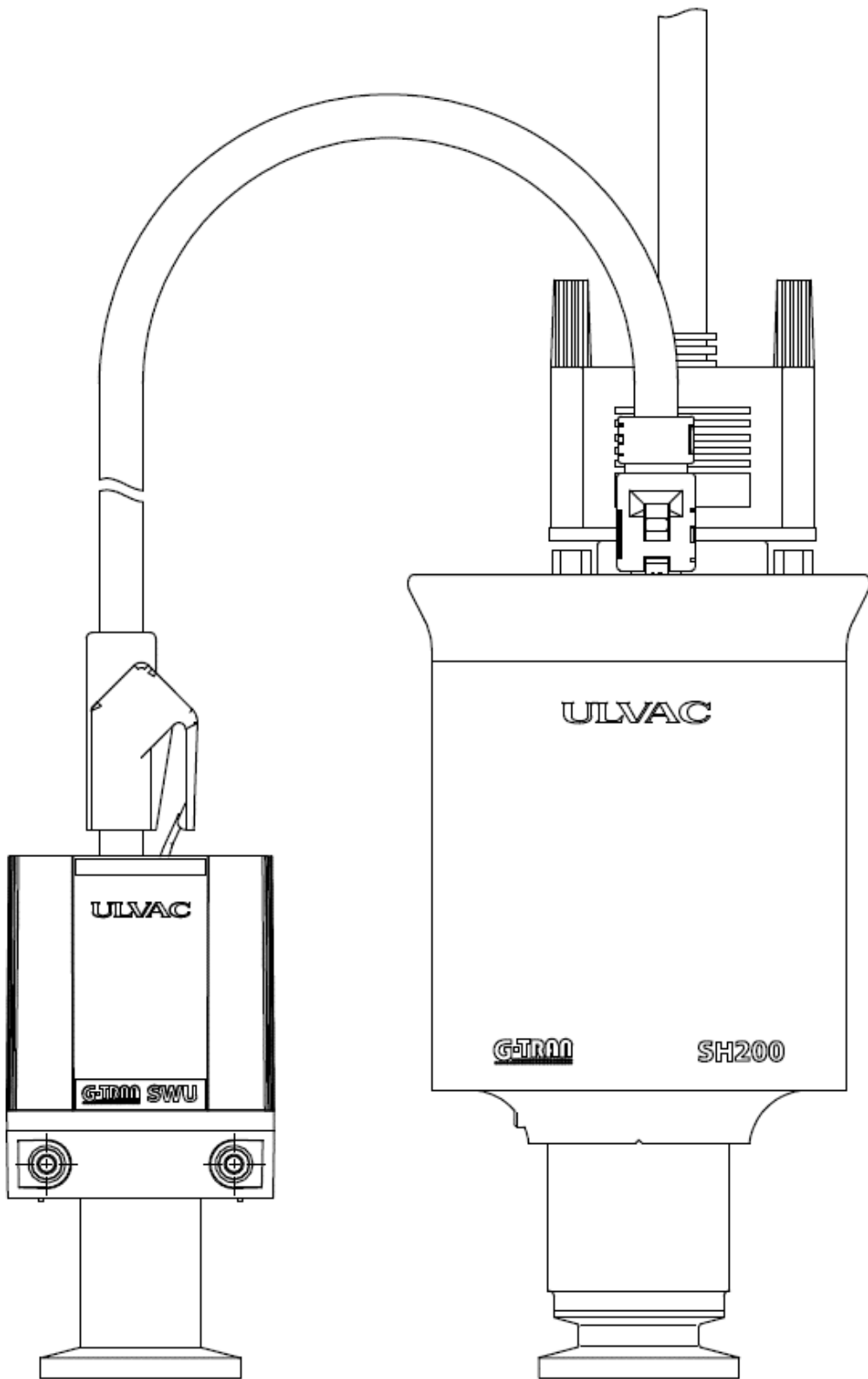
- 1) If there is a separate contract or memorandum regarding specifications besides this instruction manual, the contents of the contract or memorandum will be followed.
- 2) When exporting this product outside of Japan, please notify us and take necessary procedures according to Export Related Legislation 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 SH200, SWU and SAU connection diagram



6.2 SH200 and SWU connection diagram



6.3 SH200 dimensions

