LEYSPEC Residual Gas Analyzer (RGA)

Hardware Manual 300781172_002_C0

Part Numbers

220010V01
220011V01
220012V01
220013V01
220020V01
220021V01

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Before using this instrument

0 Before using this instrument

Upon receipt of this product, make sure that the model is the same as you ordered and there is no damage during shipment.

WARNING:

Read this instruction manual before installing, operating, inspecting, or servicing this product to familiarize yourself with safety precautions, specifications and operations.

CAUTION:

No part of this manual shall be copied for a third party without consent by Leybold in writing.

0.1 Safety symbols

Important safety information is highlighted as WARNING and CAUTION instructions; these instructions must be obeyed.

The use of Warnings and Cautions is defined below.

WARNING:

Warnings are given where failure to observe the instruction could result in injury or death to people. The actual symbol shown varies according to the hazard.

CAUTION:

Cautions are given where failure to obey the instruction could result in damage to the equipment, associated equipment or process.

NOTICE:

Emphasizes additional application information and other useful information provided within these operating instructions.

0.2 Safety precautions

Before using the Residual Gas Analyzer, read this manual and the following safety precautions. Leybold is not liable for any accidents, damages or injuries caused by negligence of these safety precautions.

0.2.1 Analyzer tube and sensor unit

WARNING:

Risk of burns. Read this manual before replacing the ion source of the analyzer tube and the secondary electron multiplier (SEM) tube. Before replacement, make sure that the filament is turned off and the ion source has cooled down because the ion source is very hot immediately after use.

WARNING:

If the analyzer tube or its components have been used in an environment that can be hazardous to the human health, dispose of them using an accredited disposal service.

WARNING:

Risk of fire or explosion. The analyzer tube contains a hot cathode (about 1400 °C). If the gas to be introduced into the analyzer tube is combustible or inflammable, check its limit density and the amount of gas before use.

WARNING:

Risk of burns. The surroundings of the ion source are hot during operation because of the hot cathode element. You can be burned if you touch immediately after turning it off. Allow the heaters and pipes to cool to a safe temperature. Do not touch the intermediate pipe during operation or immediately after shut-down because it can be heated to a high temperature by the hot cathode.

WARNING:

Do not disassemble the analyzer tube, sensor unit and cable.

WARNING:

Do not modify the analyzer tube, sensor unit or cable. If modified, any operation and performance are not guaranteed. It could also cause fire or electric shock.

WARNING:

Connect the product to A-class grounding to prevent electrical leakage.

WARNING:

For safety reason, do not touch the metal parts of a terminal, which could be energized with a voltage. Touching the metal parts could cause electric shock.

Before using this instrument

WARNING:

Before turning on power, make sure that the operating voltage and supply voltage are the same. If incorrect power is applied, damage or fire could result.

WARNING:

Whenever replacing a fuse, turn off the power. If a fuse is replaced with power turned on, you can receive an electric shock.

WARNING:

Risk of fire. The specified fuses protect this equipment against fire. Only use the specified fuses and never short circuit the fuse holder.

WARNING:

If the product is damaged, turn off power immediately. Continued use can result in fire or electric shock.

WARNING:

If the product is overheated or produces smoke or an unusual smell, turn off the power immediately. Continued use can result in fire or electric shock.

WARNING:

Do not use this product in a place where it can be splashed with water. If it is splashed, failure, electrical leakage or fire could result.

WARNING:

If the unit malfunctions, the pressure output may be incorrect. If such a failure could cause injury to people or damage equipment, install a suitable control system to indicate the failure and, if necessary, to close down the process system.

WARNING:

When using an EXT I/O connector, make sure that there is no error in the wiring. If you use this product with incorrect wiring the product can be damaged.

WARNING:

Before you switch on the power, make sure that the sensor unit and analyzer tube are correctly connected. If power is turned on without connecting the analyzer tube, components could be damaged.

CAUTION:

There is a discharge fan at the top and a blow fan on the side (opposite the LED display) to cool the sensor unit interior. Provide a space of 100 mm or more on all sides. If the air vent is blocked, heat will build up in the unit which could be a cause of failure.

CAUTION:

Keep the product free from vibration or impact. It could damage the product.

CAUTION:

Aluminium electrolytic capacitors are used for the electric circuit in the sensor unit. Generally, the life expectancy of the aluminium electrolytic capacity is limited and the higher the surrounding temperature, the shorter the life. We recommend that you replace the aluminium electrolytic capacitors once every three years or during repair and overhaul to prevent this product from being damaged.

CAUTION:

If a foreign object like a metal or combustible object is admitted into the sensor unit, you must remove it. Continuing to use the product with a foreign object inside can cause it to fail.

CAUTION:

Use this product within the scope of specifications. Use outside the scope of this manual will void the warranty.

CAUTION:

Items in the consumable parts list are not covered under the warranty.

CAUTION:

Risk of damage. Sensitive equipment. Do not allow any shock impacts to this product.

CAUTION:

When returning the product, repack it as originally shipped from the factory. If it is shipped without packing, it could be damaged.

WARNING:

When disposing of this product, dispose of it according to your local government regulations. If the analyzer tube or its parts were used in an environment that can affect the human health or the environment, dispose of them through an approved method.

Before using this instrument

CAUTION:

Risk of filament burnout or unknown states. If the PC software crashes, switch off the sensor unit and restart the software immediately to avoid leaving the analyzer tube in an unknown state.

CAUTION:

Keep the product free from vibration or impact from its surrounding. It could damage the product.

CAUTION:

If there is the isolation valve for this product, turn off the filament and stop measurement. If the filament is kept on in vacuum for an extended time, the ion source and electrode in the analyzer tube could be contaminated or insulation failure could occur.

WARNING:

Risk of electric shock. When installing and removing this product or its parts, make sure the power to the sensor unit is off. Contact with a terminal when power is on could cause electric shock. The secondary electron multiplier (SEM) terminal is energized with a voltage of -0.5 kV to -3 kV when the SEM is turned on.

14.2.2 For AC adaptor

WARNING:

Do not disassemble the AC adaptor.

WARNING:

Do not modify the AC adaptor. If modified, any operation and performance are not guaranteed. It could be a cause of fire or electric shock.

WARNING:

Connect the product to A-class grounding to prevent electrical leakage.

WARNING:

Before turning on power, make sure that the operating voltage and supply voltage are the same. If incorrect power is applied, damage or fire could result.

Before using this instrument

WARNING:

Use a correctly rated plug to connect to the mains power. Incorrect usage could lead to damage or fire.

WARNING:

If the AC adaptor fails, immediately turn off the power. Otherwise, fire or electric shock can result.

WARNING:

If the AC adaptor is overheated, gives out smoke or an unusual smell, immediately turn off the power. Otherwise, fire or electric shock could result if it is kept using.

WARNING:

Do not use the AC adaptor in a place where it may be splashed with water. If the adaptor is splashed with water, failure, electric leak or fire can result.

CAUTION:

Use this AC adaptor within the scope of specifications.

CAUTION:

Repack this AC adaptor as originally shipped from the factory. If it is shipped without packing, it could be damaged.

CAUTION:

When disposing this AC adaptor, dispose it according to your local government regulations. If the analyzer tube or its parts were used in an environment that can affect the human body, dispose of them through an approved method.

1 Introduction

The Leybold range of Residual Gas Analyzers include:

1. LEYSPEC view models

Application: Residual gas analysis and leak test of sputtering system, vacuum evaporation system, and so forth.

2. LEYSPEC ultra models

Application: R&D, residual gas analysis and leak test of sputtering systems, vacuum coaters and others.

Features of the range include:

- Small installation space because the control power supply and the analyzer tube are directly connected to the transducer
- Measurement values shown on the sensor unit
- Leak test and impurity monitoring operated with only two buttons.
- Dedicated PC software for data analysis
- Connection to the PC by Ethernet with up to 16 connections per PC

This manual describes the following models:

- LEYSPEC view100, LEYSPEC view100S, LEYSPEC view200, LEYSPEC view200S
- LEYSPEC ultra 200S, LEYSPEC ultra 300S

1.1 Compliance statements

This product contains Lead (Pb), included in the EU REACH Candidate List of Substances of Very High Concern, in the circuit board, chassis and connector.

This product is EU RoHS compliant with Annex III material exemptions for Lead (Pb).

2 Specifications and configurations

2.1 Technical data and specifications

Series	**LEYSPEC view**				**LEYSPEC ultra**	
Model	**LEYSPEC view100**	**LEYSPEC view100S**	**LEYSPEC view200**	**LEYSPEC view200S**	**LEYSPEC ultra 200S**	**LEYSPEC ultra 300S**
Mass Number Range (amu)	1 - 100		1 - 200			1 - 300
Resolution (M/ΔM)	M/ΔM=1M (10% P.H.)					
Mass Spectrometer	Quadrupole type (QMS)					
Detector	FC	FC/SEM	FC	FC/SEM	FC/SEM	FC/SEM
Sensitivity (A/mbar)	1e-5	400*	1e-5	400‡	FC:2.5e-4A @1.0mA SEM:400‡	FC:2.0e-4A @1.0mA SEM:400‡
Minimum detectable partial pressure (mbar)	e-10	e-14	e-10	e-14	FC: e-12 order SEM: e-11 order	
Max. operating pressure (mbar)	1e-4					
Total pressure measurement	Yes					
Total pressure measurement range	1e-4 - e-7 mbar order					
Linearity (mbar)	-					
Ion source	B-A type with total pressure measurement function					
Filament	Ir/Y_2O_3					
Ionization voltage (eV)	50				25 - 70	
Emission current (mA)	0.5				0.05/0.5/1.0§	
Degassing	Electron bombard 330 V, 5 mA					
Voltage applied to SEM (kV)	-	-1.0 to -3.0	-	-1.0 to -3.0	-1.0 to -3.0	
Max. baking temperature (when sensor unit is connected)	120 °C				250 °C‡	
Max. baking temperature (when sensor unit is disconnected)	250 °C				300 °C	
Power requirements (V)	24 V d.c. ±10%					
Power consumption (W)	50 W					
Ripple & noise (Vp-p)	Less 240 mV					
Rush current†	8.5 (room temperature 25 °C at cold start)					
Power connector	MSTB2.5V/3-GF-5.08					
External I/O connector#	D-SUB 15-pin (M2.6 screw)					
Communication connector	RJ45 female					
Fuse	6.3 A					
Weight (analyzer tube) (kg)	0.55	0.64	0.55	0.64	0.81	
Weight (sensor unit) (kg)	2.1 (without SEM) 2.2(with SEM)				2.4	
IP protection class	IP30 (sensor unit)					

Specifications and configurations

Series	LEYSPEC view				LEYSPEC ultra	
Model	**LEYSPEC view100**	**LEYSPEC view100S**	**LEYSPEC view200**	**LEYSPEC view200S**	**LEYSPEC ultra 200S**	**LEYSPEC ultra 300S**
Operating temperature range[Ø]	10 - 40 °C					
Operating humidity range ††	15 - 80% (not condensing)					
Communication cable	Cat5e (Straight, with shield, maximum length = 100 m					
Communication spec[¤]	Ethernet (TCP/IP ver4)					

* Sensitivity when the SEM voltage is set at -3 kV. Normally, use at 500 mA/mbar or less

§ The initial value is 0.5 mA.

‡ Under standard operating condition (Temperature: 10 - 40 °C. Humidity: 15 - 80%), maximum baking temperature when the sensor unit is connected is 200 °C. For higher temperature baking between 200 and 250 °C, make sure to maintain surrounding temperature less than 25 °C and humidity at
15 - 80%. If the temperature and/or humidity of the sensor unit increases, the resolution will change and the mass number will change. Adjust resolution and calibrate the mass number when temperature and humidity are stable.

† A power thermistor is used to prevent surge currents. Wait until the sensor unit cools before turning on power again.

\# Analogue inputs and partial pressure/total pressure set-points are effective when dedicated software is used for connection. START input is effective in the local mode.

Ø If the temperature and/or humidity change, resolution will change and the mass number will change. Adjust resolution and calibrate mass number when temperature and humidity are stable.

¤ TCP / IP communication can be used only with on wired connection with a Windows PC with dedicated software installed. Only Windows PC devices are supported.

2.2 Standard configuration

2.2.1 LEYSPEC view models

Item	Quantity
Sensor unit	1
Sensor tube	1
Software and instruction manual CD	1
AC/DC adaptor	1
LAN cable	1

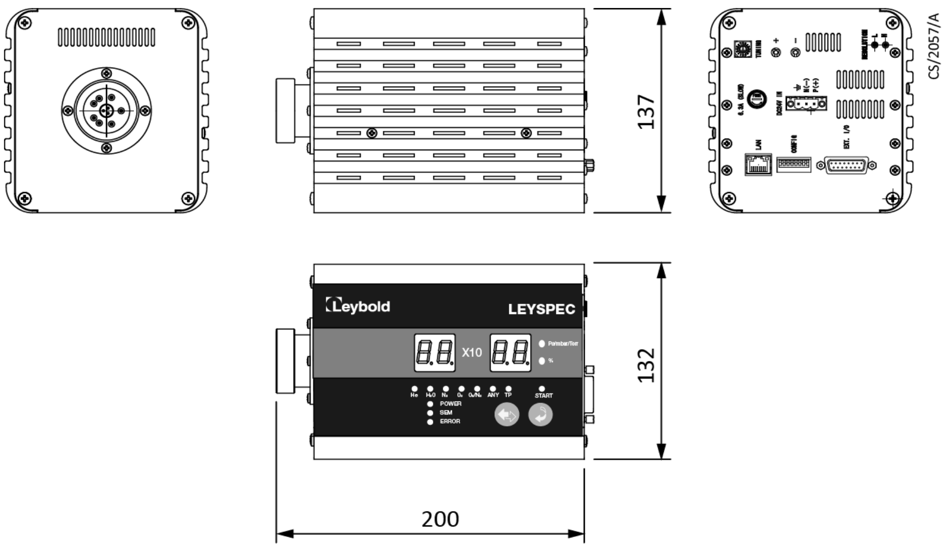


Fig. 2.1 LEYSPEC view dimensions

Specifications and configurations

2.2.2 LEYSPEC ultra models

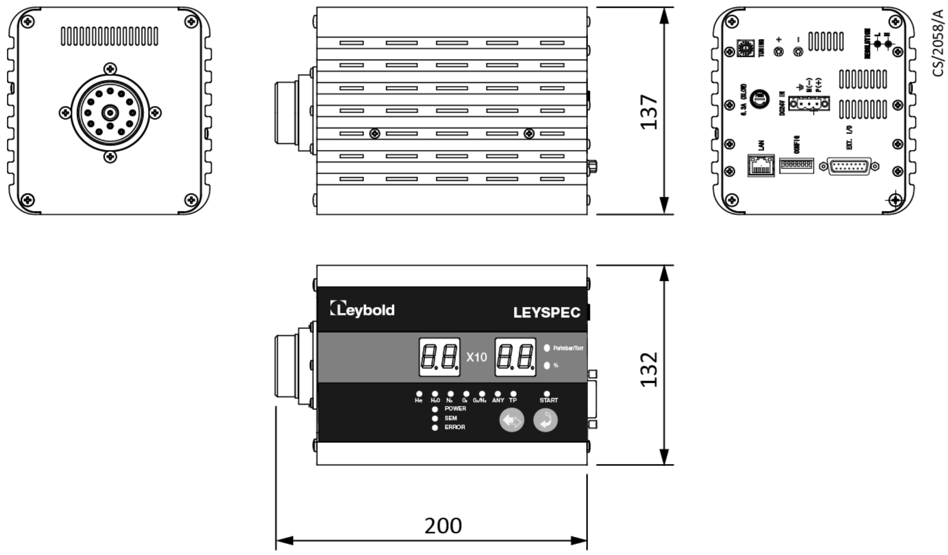


Fig. 2.2 LEYSPEC ultra dimensions

2.2.3 LEYSPEC view100/LEYSPEC view200 (with analyzer tube)

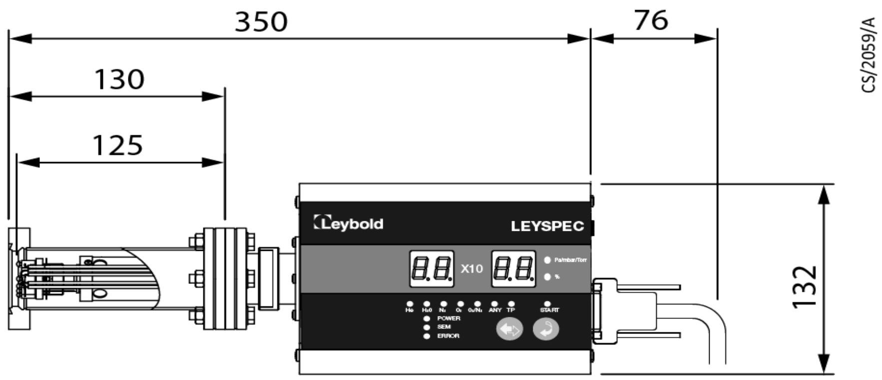


Fig. 2.3 LEYSPEC view100/LEYSPEC view200 (with analyzer tube) dimensions

2.2.4 LEYSPEC view100S/LEYSPEC view200S (with analyzer tube)

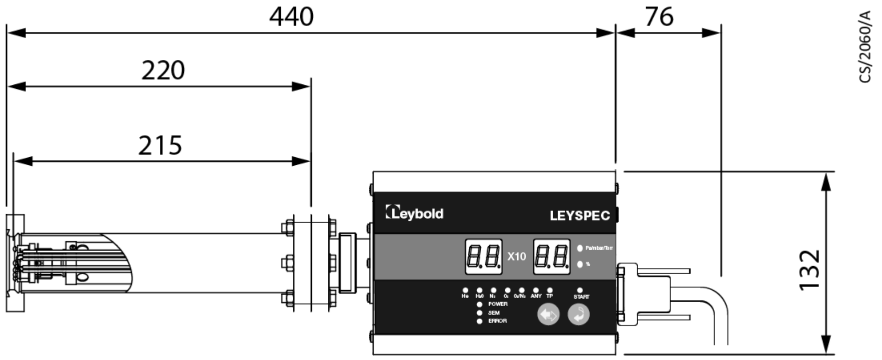


Fig. 2.4 LEYSPEC view100S/LEYSPEC view200S (with analyzer tube) dimensions

2.2.5 LEYSPEC ultra 200S/LEYSPEC ultra 300S (with analyzer tube)

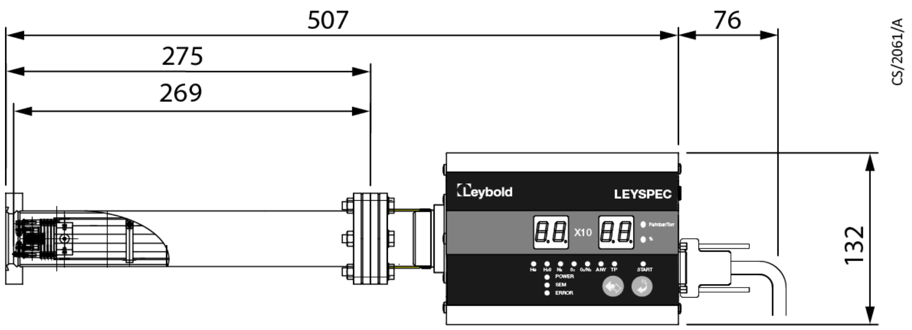


Fig. 2.5 LEYSPEC ultra 200S/LEYSPEC ultra 300S (with analyzer tube) dimensions

3 Buttons and connections

3.1 Front panel buttons and displays

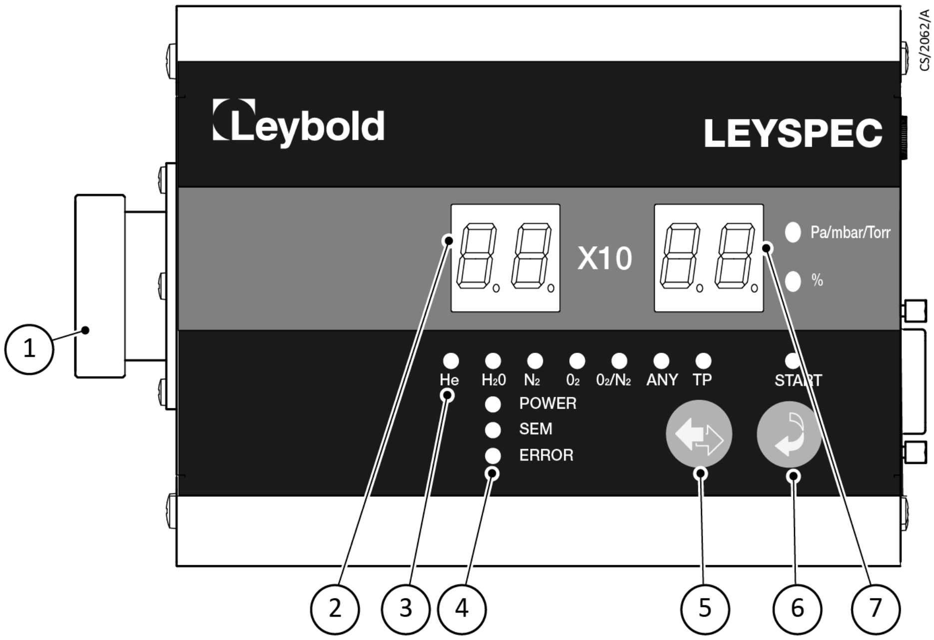


Fig. 3.1 Front panel

Item		Description
1	Analyzer tube connector	For connection to the analyzer tube.
2	Measurement value/fault display	Shows measured partial pressure value. For faults, displays the error code.
3	Gas species/total pressure display LED	Displays the gas species and total pressure being measured.
4	POWER	POWER LED (green) comes on when power is applied.
	SEM	Secondary Electron Multiplier (SEM) LED (green) comes on when SEM is used.
	ERROR	ERROR LED (red) comes on if a fault occurs.
5	Gas species/total pressure selection button (CH)	Select the gas species you want to measure or total pressure. The orange LED shows the current selection.
6	Measurement start button (START)	Starts measurement. The upper orange LED indicates that measurement has started.
7	Measurement value units display LED	The unit of measured partial pressure. For O_2/N_2 the display shows a percentage (%).

3.2 Rear panel

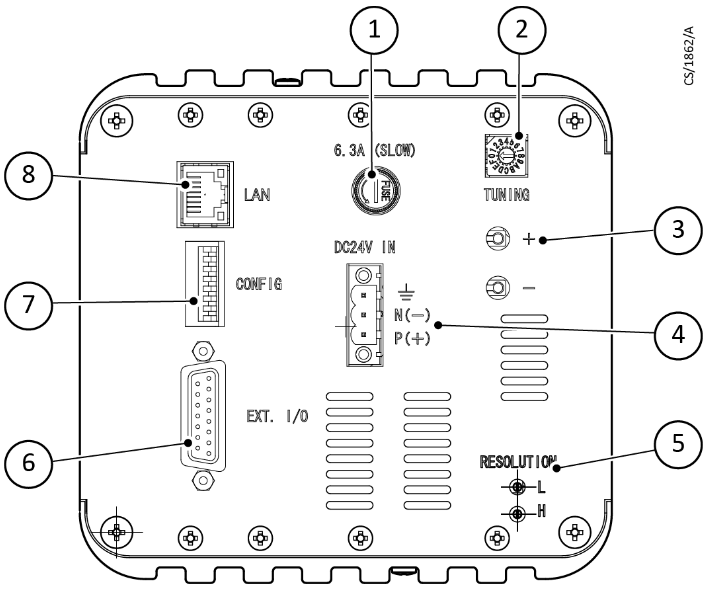


Fig. 3.2 Rear panel

Item		Description
1	Power fuse holder (FUSE)	Over-current protection (Time lag type 6.3 A).
2	Rotary switch for regulating tuning voltage (TUNING)	Regulates RF voltage tuning with the analyzer tube.
3	Tuning voltage check terminal (+, -)	Terminal for checking RF voltage tuning with the analyzer tube.
4	Power inlet connector (POWER IN)	Power cable connector (includes ground).
5	Resolution adjustment potentiometers (RESOLUTION L, H)	L: Adjusts the resolution of the low mass number. H: Adjusts the resolution of the high mass number.
6	External input/output connector (EXT-I/O)	Signal I/O connector (D-sub 15-pin male).
7	Initial setting DIP switch (CONFIG)	DIP switch for SEM selection, IP address setting, the unit address setting and local/ remote selection.
8	Ethernet connector (LAN)	RJ45 connector (8-pole 8-wire) for connecting the LAN cable.

Ethernet communication connector provides a wired connection for a Windows PC with dedicated software installed. Only Windows PCs are supported.

3.3 EXT-I/O connector

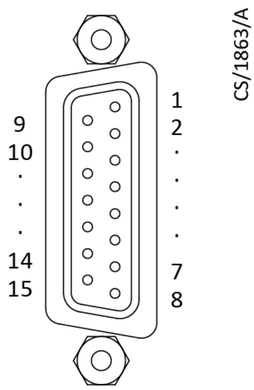


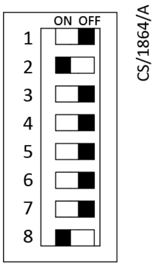
Fig. 3.3 I/O pin connector assignment

Terminal No.	Signal identification	Termina l No.	Signal identification
1	Analogue input 1 (INPUT)	9	A-GND (INPUT)
2	Analogue input 2 (INPUT)	10	A-GND (INPUT)
3		11	START input ON/OFF (INPUT)
4	Error output OK/NG (OUTPUT)	12	Interlock ON/OFF (INPUT)
5	Total pressure (TP) set-point output ON/OFF (OUTPUT)	13	INPUT COM (INPUT)
6	Partial pressure abnormal output ON/OFF (OUTPUT)	14	
7	Partial pressure alarm output ON/OFF (OUTPUT)	15	
8	OUTPUT-COM (OUTPUT)		

- Digital output common is pin 8.
- Digital input common is pin 13.
- ☐ in the signal identification shows that the signal is LOW (short, negative logic).
- Total pressure set-point output, partial pressure abnormal output and partial pressure alarm output of terminals 5-7 are effective only when software is connected.
- START input of terminal 11 is effective only in the local mode.
- To connect another recorder or device in parallel with the RGA's analogue input, use a resistor (input impedance) of about 100 kΩ in series with the RGA analogue input line (terminal numbers: 1 and 2). Analogue input impedance of the RGA is about 50kΩ when power is on. When the power supply is switched to OFF, the input impedance is undefined (several Ω) because power is not supplied to the input operational amplifier. If another recorder is connected in parallel with the RGA's analogue input, the input voltage to that recorder may fluctuate due to this undefined impedance.

3.4 DIP switch

The DIP switch configures the sensor unit. Switches 2 and 4 can be changed with the power on, after making other changes, reset the sensor unit power supply for those changes to take effect.



As viewed from the connector panel front.

The figure indicates the factory setting of the model with a SEM such as LEYSPEC view100S or LEYSPEC ultra 300S.

Fig. 3.4 DIP switch setting

Item		Description
Initial setting DIP switch (CONFIG)	1	To change IP address between "Fixed IP address" or "Automatic IP address". ON = automatic OFF = fixed
	2	Can be changed with power on and measurement stopped. To select between secondary electron multiplier (SEM) or Faraday Cup (FC). ON = SEM OFF = FC
	3	Not used.
	4	Can be changed with power on and measurement stopped. To set local and remote operation. ON = Local mode (control panel operation only) OFF = Remote mode (PC operation)
	5	To set the sensor address for this RGA unit. See the table below for switch settings.
	6	
	7	
	8	

Address	S5	S6	S7	S8	Address	S5	S6	S7	S8
1	0	0	0	1	9	1	0	0	1
2	0	0	1	0	10	1	0	1	0
3	0	0	1	1	11	1	0	1	1
4	0	1	0	0	12	1	1	0	0
5	0	1	0	1	13	1	1	0	1
6	0	1	1	0	14	1	1	1	0
7	0	1	1	1	15	1	1	1	1
8	1	0	0	0	16	0	0	0	0

(0: OFF, 1: ON)

The following tables show the factory default switch settings (multiple sensor unit option excluded).

Buttons and connections

With SEM

S1	S2	S3	S4	S5	S6	S7	S8	S7	S8
OFF	ON	OFF	OFF	OFF	OFF	OFF	ON	0	1

Without SEM

S1	S2	S3	S4	S5	S6	S7	S8	S7	S8
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Operation mode	: REMOTE
Address	: 1
IP address	: Fixed

Fixed IP address of sensor unit

Sensor 1	: 192.168.250.11	Sensor 9	: 192.168.250.19
Sensor 2	: 192.168.250.12	Sensor 10	: 192.168.250.20
Sensor 3	: 192.168.250.13	Sensor 11	: 192.168.250.21
Sensor 4	: 192.168.250.14	Sensor 12	: 192.168.250.22
Sensor 5	: 192.168.250.15	Sensor 13	: 192.168.250.23
Sensor 6	: 192.168.250.16	Sensor 14	: 192.168.250.24
Sensor 7	: 192.168.250.17	Sensor 15	: 192.168.250.25
Sensor 8	: 192.168.250.18	Sensor 16	: 192.168.250.26

4 Installation

4.1 Preparation

1. Make sure power is off.
2. Unpack the product and check quantities.
3. Check for damage.

4.2 Installation

4.2.1 Install the analyzer tube

1. Measuring position
   - This product measures pressure by measuring the static pressure in the position where the analyzer tube is connected. Take care in selecting the measuring position because the measurement value is affected if there is a flow in the vacuum system, source of out-gas or source of high intensity electrons or ions.
   - The correct pressure measurement cannot be made or the analyzer tube may fail if the analyzer tube is subject to vibration, heat radiation, high intensity electromagnetic field or high intensity radiation.
   - The RGA must be connected to power supplies or instruments that conform to the requirements of a grounded protective extra-low voltage (SELV-E according to EN 61010).
   - Keep enough room around the unit as to not cover panel vents and allow for sufficient heat dissipation.
2. Installing the analyzer tube
   - Install the analyzer tube so that the aperture plane of the analyzer tube is installed in parallel to the flow of gas. Especially, see to it that gas is not introduced into the analyzer tube in a beam form. Also make sure that foreign objects cannot fall into the analyzer tube by installing a mesh if the aperture faces up.
   - If you touch the gasket with bare hands or use a contaminated gasket it can cause measurement errors. Use a new gasket and, before use, wipe it with a clean cloth wetted with alcohol. To avoid leaks, never reuse gaskets.
   - If the filament is subjected to strong lateral impact or vibration when it is hot, it may break or contact the grid electrode.
   - If the analyzer tube is connected at the end of a long or thin pipe, the pressure in the analyzer tube will increase because of the reduced conductance. This can cause measurement errors or filament burnout.
   - As indicated in *Front panel buttons and displays* on page 17, fix the analytical tube after paying attention to the orientation of the operation panel

on the sensor unit. To assist you, a "DisplaySide" label is attached to the flange of the analyzer tube.

CAUTION:

After fixing the analysis tube, do not attempt to twist it in order to change the orientation of the sensor unit. This can cause the sensor unit to malfunction.

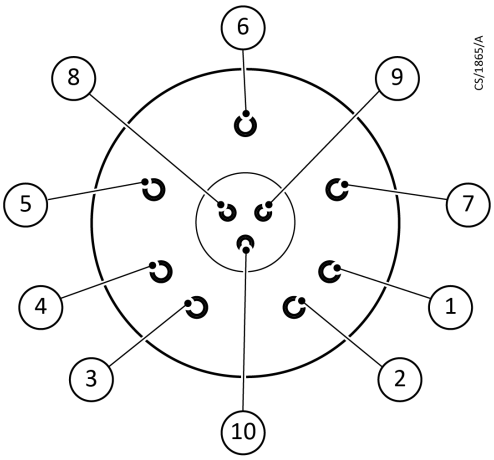


Fig. 4.1 Pin assignment as viewed from atmospheric side (LEYSPEC view)

	LEYSPEC view
1	FIL1
2	Grid
3	FIL2
4	FIL.C
5	RF
6	HV
7	RF
8	IC (SEM/FC)
9	IC (FC) LEYSPEC view
10	TP

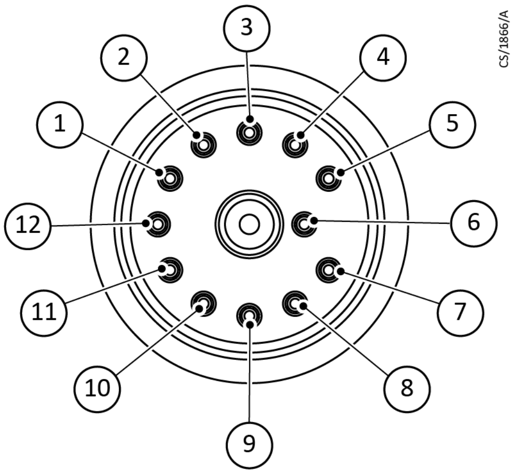


Fig. 4.2 Pin assignment as viewed from atmospheric side (LEYSPEC ultra)

	LEYSPEC ultra
1	N.C.
2	FIL.C
3	RF2
4	FOCUS
5	N.C.
6	HV
7	FIL2
8	FIL1
9	TP
10	N.C.
11	GRID
12	RF1

3. Check for continuity and insulation

Check the insulation and continuity between each terminal of the analyzer tube and between the terminals and earth. *Fig. 4.1* on page 23 shows the pin assignment of the analyzer tube connector for LEYSPEC view models, and *Fig. 4.2* on page 24 shows the assignment for LEYSPEC ultra models.

For LEYSPEC view and LEYSPEC ultra models:

Check the insulation between terminals, except the HV terminal, and earth.

When the analyzer tube is equipped with a secondary electron multiplier (SEM), the resistance between the HV terminal and earth is 19 MΩ.

Check filament continuity from FIL1 to FIL.C and from FIL2 to FIL.C.

Measure the resistance. If the filaments are intact, the resistance is about 1Ω. If the filament is broken, the resistance is infinite (open circuit).

4.2.2 Install the sensor unit

CAUTION:

Ensure the sensor unit does not strike other structures.

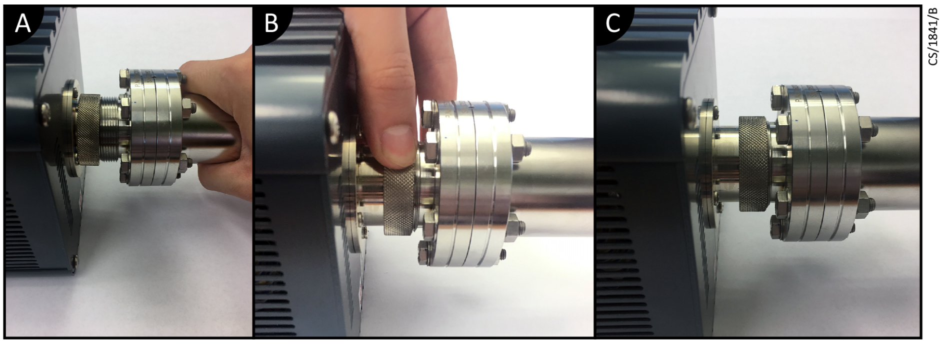
CAUTION:

Attach or detach the sensor unit from the analyzer tube using the knurled ring. Do not rotate the sensor unit, this can break the connector or the wiring.

CAUTION:

Only ever tighten the knurled ring by hand. If you use tools, there is a risk of making it impossible to detach, breaking the connector, or damaging the internal wiring.

1. Attach the sensor unit and the analyzer tube and tighten the knurled ring by hand.



4.2.3 Install the power connector

CAUTION:

Make connections to the correct pins when wiring the power connector. If you apply power to the incorrect pins internal damage could result.

1. Wire the power connector as follows:
   - Power +24 V
     Pin that supplies 24 V d.c. power.
   - Power GND
     GND when +24 V d.c. power is supplied.

- Frame GND
  Frame ground. Connect it to the instrument frame.
  Connect the earth connection to Class A ground to prevent leakage currents.

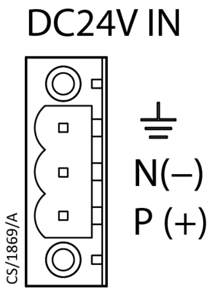


Fig. 4.3 Pin assignment on power connector

CAUTION:

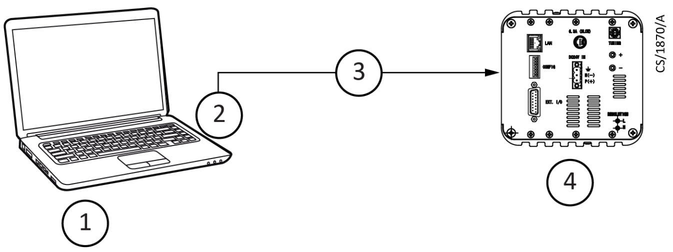
To prevent damage to the unit, make sure the power is off before making connections.

2. Plug in the power connector and tighten the screws securely so that the power connector cannot detach.

4.2.4 Connect to a single sensor to the PC

For one sensor unit, connect the Ethernet LAN cable directly to the PC.

Route the LAN and EXT I/O cables away from power lines and other sources of electrical interference. Otherwise, their performance can be affected by noise.

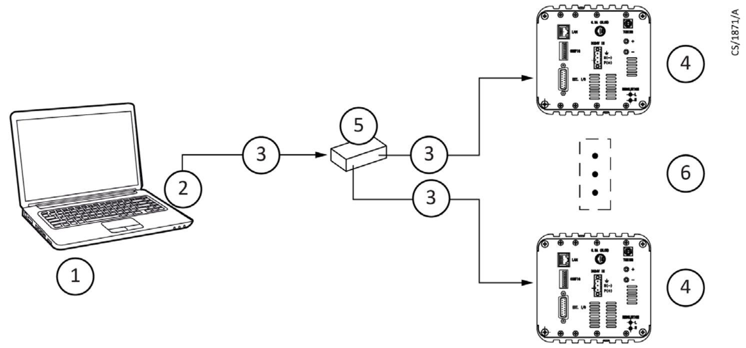


1. PC
2. LAN connector
3. LAN cable
4. Sensor unit

Fig. 4.4 Single connection with Windows PC

4.2.5 Connect multiple sensors to the PC

To connect more than one sensor unit, use a switching hub. For each sensor unit set a separate sensor number (individual IP address) by referring to *DIP switch* on page 20.



PC
LAN connector
LAN cable
Sensor unit
Switching hub
Sensor unit (maximum 16 units)

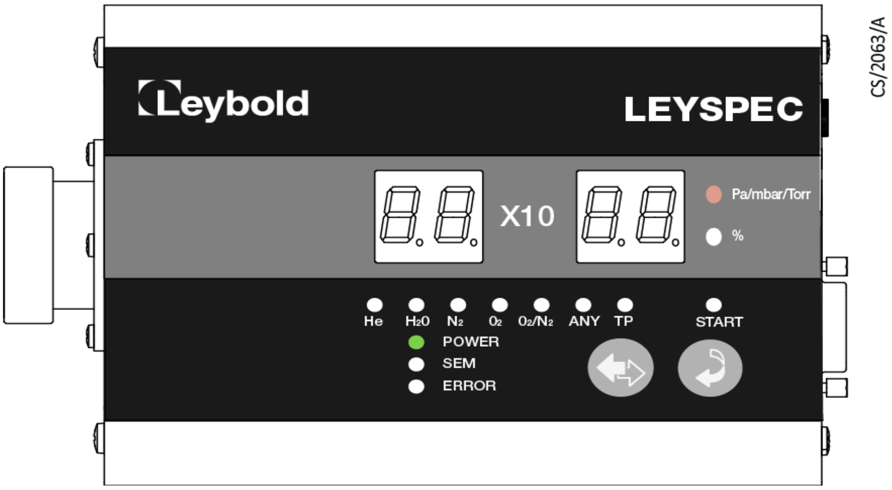
Fig. 4.5 Connection between PC and multiple sensor units

5 Turning on (supplying power)

CAUTION:

Before pressing START, use an ion gauge or other instrument to make sure that the pressure is within the operating pressure range. Always use under a pressure of 1 x 10-2 Pa or less. If the pressure is higher than 1 x 10-2 Pa, the filament will burn out and the life of secondary electron multiplier (SEM) will be extremely short and the RF power supply will fail.

For stable measurement, start measurement after the unit has been on for more than 30 minutes.



After turning on, one of the below indicators will show depending on operation in remote or local mode and setup is completed.

POW - 1

- Remote Mode (Default)

The "POWER" LED lights up.

No indication on the display.

- Local Mode

The "POWER" and "Pa" LED lights up.

0.0 x 10^{-0} is shown on the display as “0.0” and “-0”.

6 Operation

Your RGA can either measure using a computer (PC) running the dedicated gas analysis software, or it can measure in local mode after you press the START button.

6.1 Measurement with software (remote)

Refer to the Appendix for PC network setting and refer to the software manual for operating instructions.

1. Install the gas analysis software on your PC.

2. Connect the LAN port of your PC to the sensor unit using a LAN cable.

3. With measurement stopped, set DIP switch 4 to OFF.

4. Switch on the power to the sensor unit.

5. If this is the first time you have connected the RGA to this PC, temporarily disable Windows Firewall. See *Disable the firewall* on page 87.

6. Start the software on the PC.

7. Enter the sensor unit number and sensor type in the sensor type dialog and click OK.

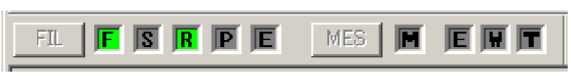
8. When communication between the PC and the RGA is established, the software loads the default recipe or the recipe used last time

CAUTION:

Before pressing START, use an ion gauge or other instrument to make sure that the pressure is within the operating pressure range. Always use under a pressure of 1 x 10-2 Pa or less. If the pressure is higher than 1 x 10-2 Pa, the filament will burn out and the life of secondary electron multiplier (SEM) will be extremely short and the RF power supply will fail.

9. Check the operating pressure on an ionization gauge or other to make sure it is sufficiently low.

10. Click the "FIL" button to turn on the filament of the analyzer tube. The "F" and "R" lights come on.



CS/1875/A

- If filament is turned on soon after pumping down, the self-protection against high pressure might activate because of gas emitted by the filament. Confirm that the operating pressure is sufficiently low and turn the filament on several times until the emitted gas reduces.

11. Click measure MES to start gas analysis. The S and M lights come on. (Whether the F, R and S lights are on or off depends on the settings on the control panel.)

12. To terminate gas analysis, click MES again.

13. Click FIL to turn off the analyzer tube filament.

14. Exit the software when measurement is completed.

15. Re-enable Windows Firewall and add an exception for the RGA program. See *Add firewall rules to allow RGA communications* on page 88.

6.2 Measurement with the sensor unit (Local mode)

With measurement stopped, set DIP switch 4 to ON.

Conduct gas analysis referring to *Front panel operation* on page 31.

7 Front panel operation

7.1 Operating and error states

CAUTION:

Before pressing START, use an ion gauge or other instrument to make sure that the pressure is within the operating pressure range. Always use under a pressure of 1 x 10-2 Pa or less. If the pressure is higher than 1 x 10-2 Pa, the filament will burn out and the life of secondary electron multiplier (SEM) will be extremely short and the RF power supply will fail.

MESU - 1

A press of the START button sets up the filament measurement state (FIL, RF, and secondary electron multiplier (SEM) (if present). A second press stops measurement.

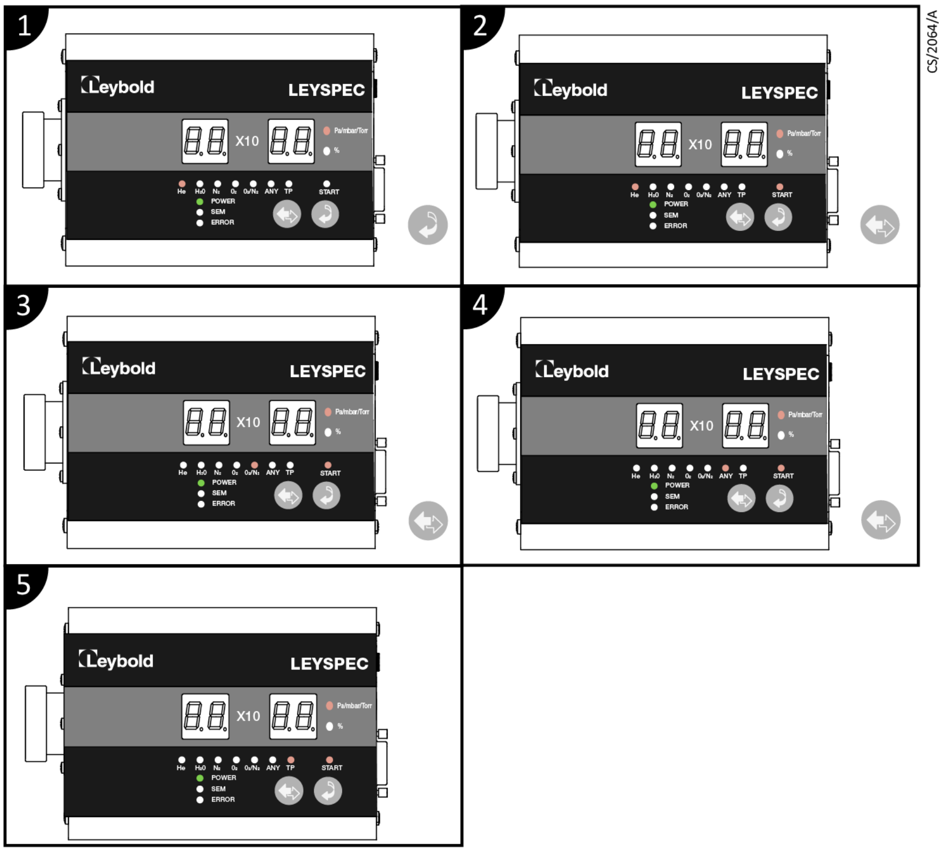


Fig. 7.1 Front panel operation

MESU - 2

Partial pressure is shown in the display during measurement.

Pressing the CH button changes over the measurement gas species from He to H_2O, N_2, O_2, O_2/N_2 ration (%), ANY and TP.

MESU - 3

When O_2/N_2 is selected, the unit is changed over from Pascals (Pa) to %, displaying the ratio between O_2 and N_2.

MESU - 4

When ANY is selected, the partial pressure of the preset measurement gas species is displayed.

- M/z is set to 44 (CO_2) before shipment from the factory. To change the setting, use the dedicated software.

MESU - 5

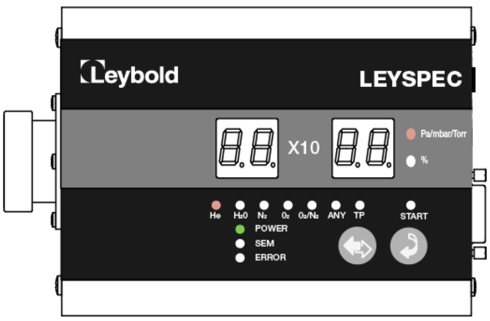
When TP is selected, total pressure is displayed.

- Models with a total pressure measuring function only. Other models show [0.00 - 0].

7.2 If pressure is lower than measurement range

UNDR - 1

With measurement started (START = ON) and the partial pressure and total pressure are below the measurable lower limit, [0.00 - 13] is shown.



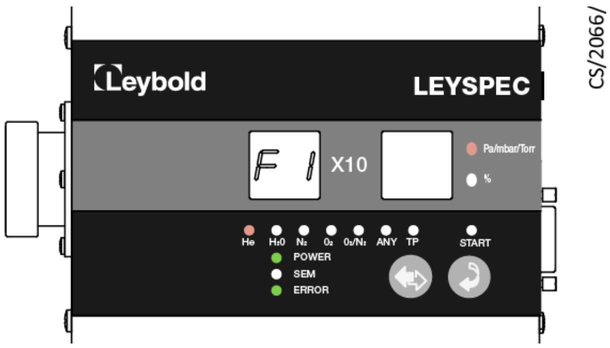
7.3 If filament fault has occurred

Err. - 1

If any fault occurs with filament 1 when the START button is ON, the sign "F1" is shown.

("F2" is shown for filament 2 where present).

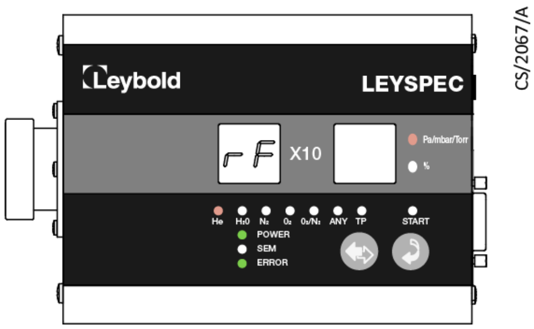
Front panel operation



7.4 If RF fault has occurred

Err. - 2

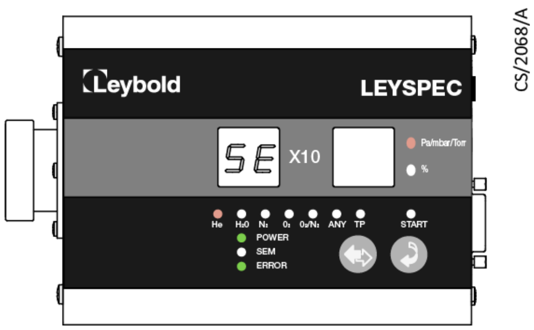
If any fault occurs in RF when the START button is ON, the sign "rF" is shown on the display.



7.5 If secondary electron multiplier (SEM) fault has occurred

Err. - 3

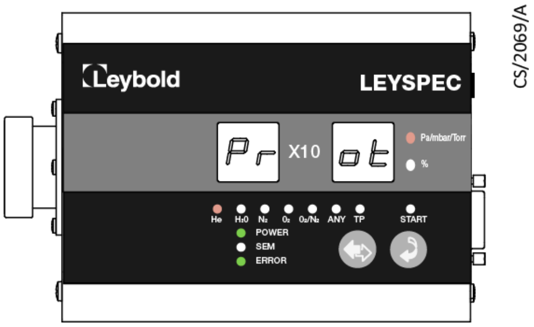
If any fault occurs in SEM when the START button is ON, the sign "SE" is shown on the display.



7.6 If interlock signal is input and total pressure interlock in on

Err. - 4

If the interlock signal is input when the START button is ON, the sign "Prot" is shown on the display.



The sign "Prot" could be also shown even when instantaneous pressure rise immediately after filament turns on.

8 External inputs and outputs (I/O)

External interface signals connect to the EXT-I/O connector on the rear panel.

8.1 Pressure and error outputs

The outputs for total pressure set-point, partial pressure fault, partial pressure warning, and error output are provided as digital signals (negative logic).

The output format is open collector with a common emitter. The capacity of the transistor is maximum 24 V between the collector and emitter, the maximum current of the collector is 50 mA, and the rated loss power is 1 V.

The error output is set high when there is any error with the filament, secondary electron multiplier (SEM) and RF and set low in the normal state.

NOTICE:

The total pressure set-point output, partial pressure abnormal output and partial pressure warning output are effective only when the dedicated gas analysis software is connected.

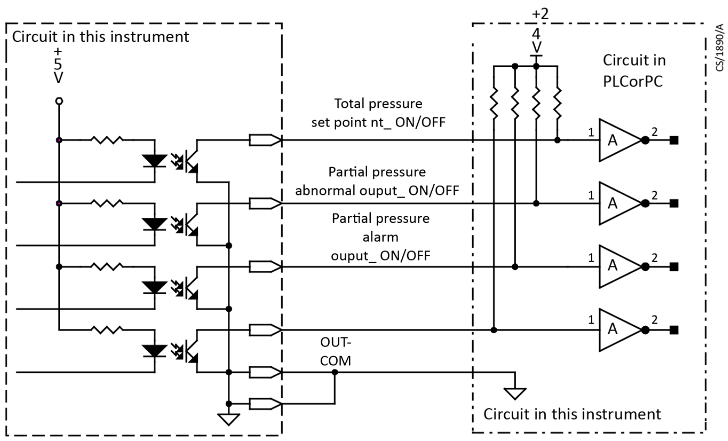


Fig. 8.1 Digital output internal circuit diagram

8.2 Interlock input

The interlock input is used to protect the filament, secondary electron multiplier (SEM) and RF power supply using an external signal.

Ground the interlock input terminal (pin 12) and INPUT-COM terminal (pin 13) with the relay contact or open collector. The maximum permissible leakage current from the external unit is 0.1 mA or less. Maximum saturation voltage between emitter and collector is 0.4 V.

NOTICE:

When the unit is in its error state, the error LED lights red. The unit keeps its interlock error state until the error is confirmed by the dedicated gas analysis software. This means that even when the interlock signal is not active, the interlock may be displayed as an error.

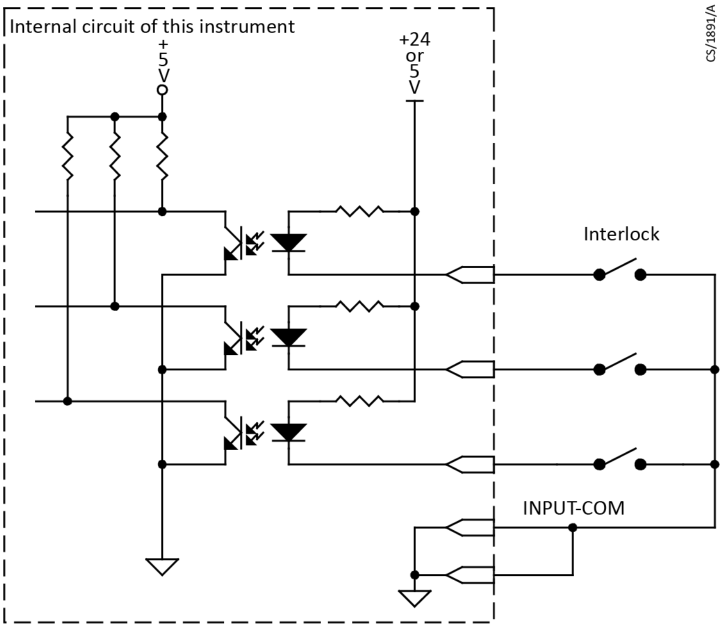


Fig. 8.2 Interlock signal circuit

8.3 Analogue input

CAUTION:

Observe operating conditions. The product could be damaged if a voltage of 10 V or more is applied.

Used when loading the pressure on the pressure gauge or temperature from outside.

Input a voltage of 0 to 10 V to the analogue input terminal (pins 1 and 2) and A-GND (pins 9 and 10).

The analogue input specifications are as follows.

Insulation	: Not insulated
Input range	: 0 to 10 V
Input impedance	: 50 kΩ
Input form	: Differential
Resolution	: 0.01 V

NOTICE:

To connect more than one recorder or device in parallel on the RGA's analogue input, use a resistor (input impedance) of about 100 k? in series with the RGA analogue input line (terminal numbers: 1 and 2). Analogue input impedance of the RGA is about 50k? when power is on. When the power supply is switched to OFF, the input impedance is undefined (several ?) because power is not supplied to the input operational amplifier. If another recorder is connected in parallel with the RGA's analogue input, the input voltage to that recorder may fluctuate due to this undefined impedance.

9 Cautions in operation

9.1 Operating pressure range

CAUTION:

Always use under a pressure of 1 x 10-2 Pa or less. If the pressure is higher than 1 x 10-2 Pa, the filament will burn out and the life of secondary electron multiplier (SEM) will be extremely short.

9.2 Degassing

WARNING:

Risk of burns. Be aware of high temperatures.

CAUTION:

Conduct degassing at a pressure of 1 x 10-4 Pa or less. If it is conducted in a higher pressure region, the sensor head will be contaminated.

The degassing mode uses an electron bombardment system for degassing. Electron bombardment is the method of applying high voltage (300 V: LEYSPEC view models 330 V: LEYSPEC ultra models) to the grid electrode and releasing the gas adhering to the grid by strongly colliding thermoelectrons from the filament towards the grid surface.

Naturally, the electrode struck by thermoelectrons will be heated corresponding to its energy, and there will also be outgassing inside the electrode.

Pressure is not measured during degassing. Ensure that the pressure does not rise during degassing because filament protection from pressure rise is not activated. We recommend you monitor pressure using another vacuum gauge and, if the pressure exceeds the measurement range, input an interlock signal.

Note that the intermediate piping can become hot during degassing.

9.3 Secondary electron multiplier (SEM) tube

CAUTION:

Observe operating conditions.

Ions that have passed through the quadrupole are incident on the SEM. Ions are incident on the metal surface on the 1st stage through the ion entrance port in the SEM, and secondary electrons are discharged. The secondary electrons are accelerated by electric field, impinge upon the diode in the next stage, and generate new secondary electron groups. As this step is repeated many times, the number of electrons increases from one to about 100 million when it reaches the dynode of the last stage. Electrons that reached the last stage are measured by the sensor unit as current.

Fig. 9.1 Secondary electron multiplier tube (for LEYSPEC view100S/LEYSPEC view200S)

Take the following care in using the secondary electron multiplier (SEM):

- Decrease the SEM voltage between -1 and -1.2 kV because gas has been adsorbed to the dynode surface immediately after pumping down.

- If the SEM voltage is increased excessively more than needed, the multiplying factor may increase, accelerating deterioration, increasing output drift, and producing noise. These effects lower linearity.

- If you are using an analyzer tube that has been vented to atmospheric pressure, the SEM sensitivity may rise, but this not a problem because it is due to the SEM surface being cleaned.

- The amplification factor of the SEM lowers with operation. It varies with operating hours, operating atmosphere (gas species, contamination) and others. The life will be short if the SEM voltage is high and the measuring ion current value is high.

- If you find that you need to measure at the maximum applied voltage, but the sensitivity is lower than expected and affects the measurement, it is time to replace the SEM. You can calculate the SEM amplification factor to decide when to replace the SEM as follows:

SEM amplification factor calculation:

1. In the measurement recipe of the software, decide the mass number to calculate the SEM amplification factor (for example, use m/z = 18, 28, and so forth, whose peak is high. If N_2 is available use m/z = 28).

2. In the software control panel, set the detector to SEM and measure the ion current value of the desired mass number.

3. Perform the same measurement as in (2) by switching detector to FC.

4. Calculate the ratio of (2) to (3), that is "(2)/(3)", to give the amplification factor of SEM and check the condition of deterioration.

For example:

Measurement value of SEM = 9.71e-5A, measurement value of FC = 6.12e-11A

9.71×10^{-6} A / 6.12×10^{-11} A = 1.59×10^{5}

The multiplication factor of SEM is 159000 times.

9.4 Baking

CAUTION:

Conduct baking at a pressure of 1 x 10-4 Pa or less. If it is conducted in a higher pressure region, the sensor head will be contaminated.

If the analyzer tube is left under atmospheric pressure for an extended time and contaminated, carry out baking (heating) to remove contamination and reduce the out-gassing of the Residual Gas Analyzer (background).

The LEYSPEC view models can be heated up to 120 °C with the sensor unit connected, up to 250 °C without the sensor unit connected.

The LEYSPEC ultra models can be heated up to 250 °C with the sensor unit connected, up to 300 °C without the sensor unit connected.

9.4.1 Baking procedure (with removal of sensor unit)

1. Make sure that there are no leaks and check that the pressure is 1×10^{-4} Pa or less before baking.

2. Turn off the sensor unit’s power and remove the sensor unit.

CAUTION:

Risk of damage to the sensor unit. Do not connect or disconnect the cable with the power turned on.

---

3. LEYSPEC ultra p the analyzer tube with aluminium foil to improve heat conduction.

4. Wind the baking heater around the analyzer tube.

5. Wind aluminium foil around the baking heater.

6. The temperature and time of baking depend on conditions. As a guide, bake at around 150 °C for 12 hours. Always control the temperature using a thermocouple or similar so that the analyzer tube will not be damaged by excessive temperature rises.

7. To avoid burns, take precautions including clear signs that read "Warning - High Temperature" in a noticeable position near the analyzer tube.

WARNING:

Risk of burns. Beware of high temperatures.

---

8. Turn the heater on to start baking.

9. Upon completion of baking and after the analyzer tube has cooled down to room temperature, install the sensor unit.

10. Confirm by measuring the water content (m/z=17, 18) and hydrocarbon type gases (m/z=27, 29, 39, 41, 43, 55, 56, 57, and so forth) have decreased as compared with before baking.

11. When the temperature and humidity of the controller changes, the resolution changes and the position of the mass numbers also shift. Adjust the resolution and mass number calibration while temperature and humidity are constant.

9.5 Calibration

For accurate measurement, it is necessary to calibrate mass number and sensitivity.

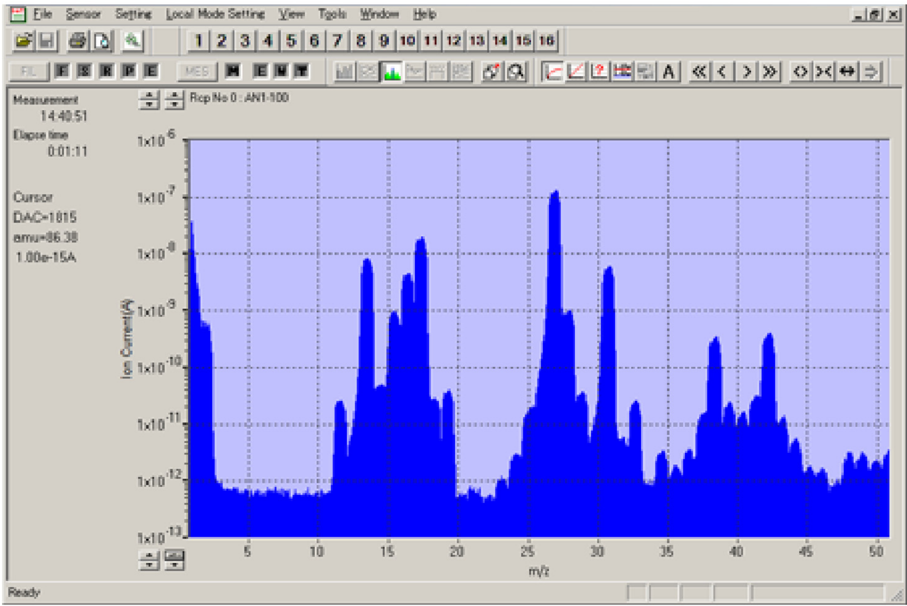
9.5.1 Mass number calibration

Mass numbers are calibrated before shipping, but can change in your measurement environment. Mass numbers also shift if the analyzer tube is contaminated.

For the relationship between mass numbers and ions, refer to Appendix "Peaks of Major Residual Gases".

In the dedicated gas analysis software, use the analogue mode recipe to perform mass number calibration. Refer to the software instructions for further details.

Cautions in operation



CS/1893/A

Fig. 9.2 Mass number calibration screen

9.5.2 SEM sensitivity calibration

The sensitivity of the mass spectrometer is determined factors such as the intrinsic sensitivity of the ion source, transmittance of the quadrupole, and applied voltage to the secondary electron multiplier (SEM). But the sensitivity of the SEM may decrease due to the usage history of the analyzer tube. In order to maintain sensitivity, you can calibrate by adjusting the voltage applied to the SEM.

You will need:

- A pumping system with exhaust performance that can be used with the analyzer
- A vacuum gauge for measuring pressure
- Gas for maintaining a constant pressure (N_2 and general gas such as Argon)
- A pressure adjustment mechanism (e.g. variable leak valve, mass flow controller)

In the dedicated gas analysis software, use the "calibration mode for sensitivity calibration mode" recipe.

For example, a recipe which tunes the SEM voltage to measure an ion current of 2.5 x 10^{-6} A when N_2 gas is introduced up to 5.0 x 10^{-4} Pa would give a sensitivity of 5.0 x 10^{-3} A/Pa (=2.5 x 10^{-6} A / 5 x 10^{-4} Pa).

The Residual Gas Analyzer/process gas monitor measure ion currents in the order of 0.1 µA to 0.1 pA. If the insulation resistance between the grid electrode (150 V) and the ion collector electrode (0 V) is 200 MΩ, the insulation may be held acceptable in normal sense, but in a micro-current measurement such as by an ionization gauge, a leakage current of 0.75 µA would flow from the grid electrode.

Furthermore, ion current cannot be detected unless it is 1 uA or more because the direction of leakage is the reverse of ion current.

9.5.3 Faraday Cup sensitivity calibration

Faraday Cup (FC), sensitivity is specified by inputting the ion current of the specified gas type measured under constant pressure condition and the pressure value at that time. For details, refer to "FC sensitivity calibration" in the software instruction manual.

9.5.4 Operating environment temperature and humidity

Resolution varies depending on operating environment temperature and humidity. If the resolution changes, adjust it while the temperature and humidity are constant.

Mass numbers shift depending on operating temperature and humidity. In that event, calibrate the mass number while temperature and humidity are constant.

9.6 Converting to partial pressure

Peaks of mass numbers that are measured by a mass spectrometer are detected as ion current values (A). You can use various methods to convert them into partial pressure measurements.

The software includes the following methods:

1. Using the correlation between the ion current set in the sensitivity calibration mode and the pressure

For example, if sensitivity is calibrated when the vacuum gauge for the equipment to measure under measurement indicates 1×10^{-1} Pa and the ion current is set at 5×10^{-7} A, the partial pressure conversion factor will be:

1×10^{-1} (Pa) / 5×10^{-7} (A) = 2×10^{5} (Pa/A)

Convert ion current values (A) to a partial pressures (Pa) by multiplying the ion current value by this partial pressure conversion factor.

2. Using the total pressure measuring function

Given that PT (Pa) is the value measured by the total pressure measuring function and IN (A) is the ion current value of each mass number and partial pressure is PN (Pa), pressure is converted to partial pressure (Pa) by this formula.

$P_N = (I_N / \Sigma I_N) \times P_T$

The numerical value obtained by this formula is recorded as partial pressure (Pa).

In the software, to apply this conversion select "total pressure" as the specified value of the partial pressure conversion reference value. However, if the main gas component is removed with the recipe setting of the software in the atmosphere to be measured, deviation may occur in the partial pressure calculation result.

With a pumping system which can reach 1×10^{-5} Pa or less, select method 1) or 3) because the total pressure measurement range of LEYSPEC view models is from 1×10^{-2} to 1×10^{-5} Pa.

3. Using a vacuum gauge equipped with measured equipment

The value of the vacuum gauge for the measured system can be connected to the analogue input of the sensor unit where it can be converted into the partial pressure (Pa) by the same calculation as above in 2).

NOTICE:

This calculation does not take into consideration the difference in the sensitivity factor between gas species, gas ionization effects, or the presence of isotopes.

9.7 Storage

If the instrument is not used for an extended time, store the analyzer tube in an inert gas atmosphere like nitrogen. If the analyzer tube is stored in a high humidity atmosphere, the SEM may deteriorate.

10 Options

10.1 AC adaptor

10.1.1 Standard specification

Model	SPU61A-108
Input voltage	90 - 264 Va.c.
Input current	1.45 A at 100 Va.c. maximum
Efficiency	88% at rated load
Frequency	47 - 63 Hz
Output voltage	24 V d.c.
Output current	2.5 A
Power requirement	60 W
Output variation	±3%
Ripple and noise (Vp-p)	240 mVp-p
Protection	Over-voltage, short-circuit protection, overload protection
Hold up time	< 10 msec under maximum load, 110 Va.c.
Dimension	L 118 x W 47 x H 30 mm
Weight	0.34 Kg
Operating temperature	0 - 70 °C
Operating humidity	0 - 95% (non-condensing)
Storage temperature	-40 - 85 °C
Storage humidity	0 - 95% (non-condensing)
Reliability	MTBF 100,000 hours minimum at maximum load, 25 °C
Applicable standard	Safety standard: UL/c-UL (UL 60950-1: 2nd Edition), TUV/GS (EN 60950-1: 2nd Edition), EMI: FCC class B, EN 55022 and EN55024 class B, CE

10.1.2 Dimensional drawings

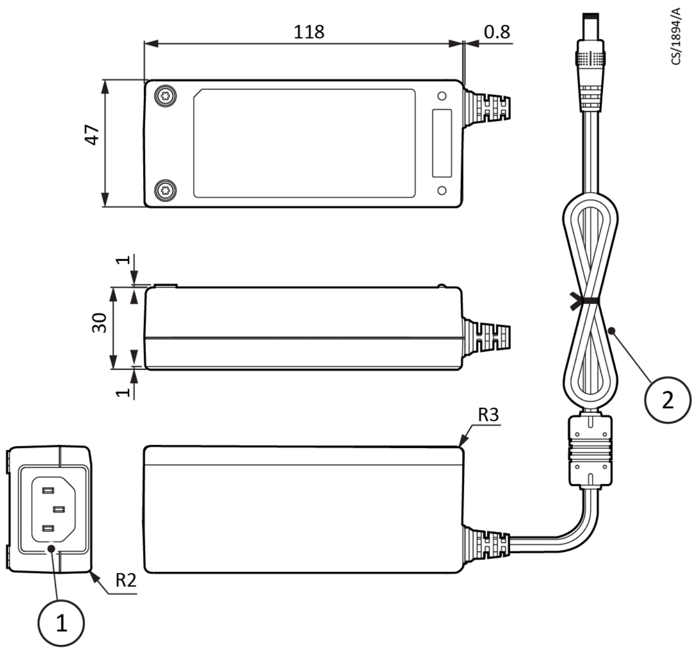


Fig. 10.1 Dimensional drawing

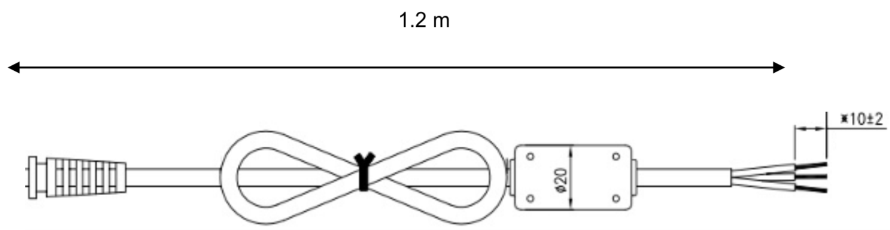


Fig. 10.2 DC output cable dimensions

White	+V
Black	-V
Green	F.G.

10.1.3 Installation

1. Unpack the carton and check quantities.
2. Make sure that the AC adaptor has not been damaged in transit.

CAUTION:

Make connections to the correct pins when wiring the power connector. If you apply power to the incorrect pins internal damage could result.

3. Fit the connector.

The pin assignment is shown in the dimensional drawing.

CAUTION:

To prevent damage to the unit, make sure the power is off before making connections.

4. Plug in the power connector and tighten the screws securely so that the power connector cannot detach.

5. Plug in the power supply. Always connect it to Class A ground.

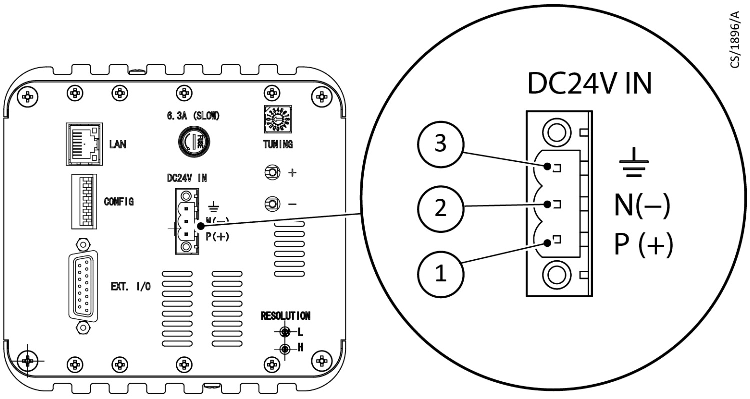


Fig. 10.3 Sensor unit power supply connectors

1.	+V (P (+))	Positive polarity 24 V d.c. - white cable
2.	-V (N (-))	Negative polarity of 24 V d.c. - black cable
3.	Frame GND ( )	Frame ground - green cable

10.1.4 Troubleshooting

CAUTION:

Make sure the power is off.

For troubleshooting, refer to the following. Make sure the power is off before troubleshooting.

Error	Cause	Remedy
POWER LED on the sensor unit does not come on when power is turned on	Power connector is disconnected	Check the power inlet connector.
	Power cable has a break in continuity	Check the wires of the power cable for continuity and insulation using a circuit tester or other.
	Input power voltage is below the specified range	Check the input power voltage using a circuit tester or other
	The AC adaptor has failed	Check the output voltage using a circuit tester or other

10.2 USB 3.0 wired LAN adaptor

If you do not have a spare LAN connector for the RGA, connect a wired LAN adaptor to a USB port for communication with the unit.

10.3 Switching hub

When connecting multiple sensor units to a PC, use switching hub. You can connect up to 16 sensor units. Example products:

The suggested examples below have 8 or 16 Ethernet ports on the front panel to which RJ45 100 Ω impedance twisted pair cable can be connected. The data transmission speed is 10/100 Mbps. Each port has an auto-cross function which means you can use straight (1:1) or crossover cables.

We recommended you use shielded LAN cables.

CAUTION:

The maximum length of the LAN cable used for connection between sensor unit and PC is 100 m.

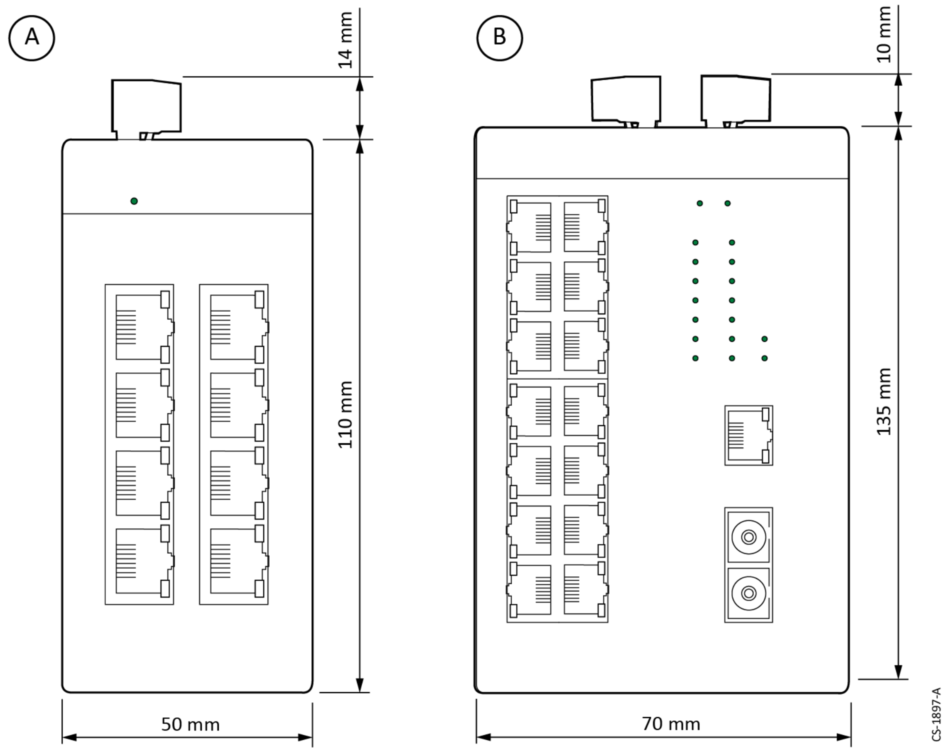
10.3.1 8-port hub

Model	FL SWITCH SFNB 8TX
Function	IEEE802.3 standard
LAN transmitted speed	100/10 Mbps
Dimension (mm)	50 x 110 x 70
Weight (g)	291
Power connection	Screw type connector
Rated voltage	24 V d.c.
Current consumption	138 mA at 24 V d.c.
Interface	RJ45 female connector 8 pieces
Maximum transmission distance	100 m
Install	Can be mounted on universal DIN rail

10.3.2 16-port hub

Model	FL SWITCH SFN 16TX
Function	IEEE802.3 standard
LAN Transmitted speed	100/10 Mbps
Dimension (mm)	70 x 135 x 110
Weight (g)	870
Power connection	Screw type connector
Rated voltage	24 V d.c.
Current consumption	275 mA at 24 V d.c.
Interface	RJ45 female connector, 16 pieces
Maximum transmission distance	100 m
Install	Can be mounted on universal DIN rail

10.3.3 How to use the hubs



A. 8-Port type
B. 16-Port type

This unit can be fixed to a DIN rail.

1. Install the switch from above the DIN rail. Hook the upper holding key groove to the upper side of the DIN rail.
2. Push the switch from the front of the mounting surface.
3. Make sure it is securely fixed on the DIN rail.
4. Wire the power connector as follows:

8-port power connector wiring

- Connect the 24 V d.c. power supply to the power supply connector of this unit

Be sure to turn off the main power supply when connecting the power supply.

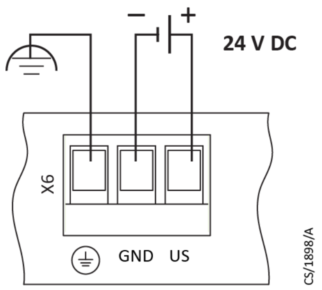


Fig. 10.4 8-Port type power connection

16-port power connector wiring

The suggested 16 port hub supports power supply redundancy.

- Connect the 24 V d.c. power supply to the power supply connector of this unit.

Be sure to turn off the main power supply when connecting the power supply.

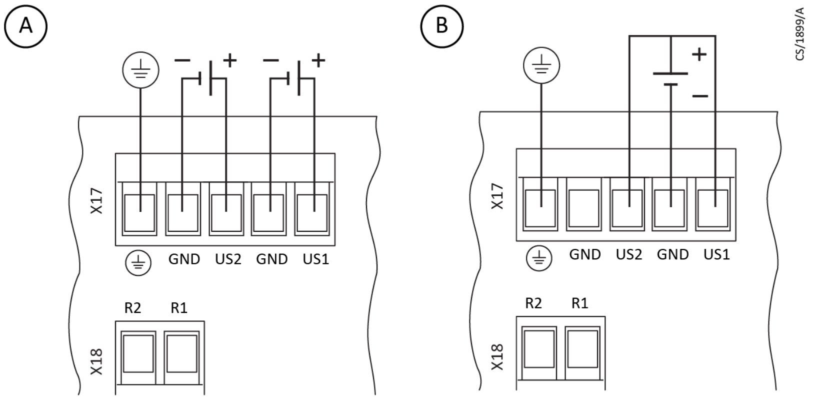


Fig. 10.5 16-Port type power connection

A. Connection as a redundant power supply
B. Connection as single power supply

5. Connect the Ethernet cables.

CAUTION:

Make sure the power is off.

---

6. Plug in the power connector.
7. Plug in the power supply.

11 Maintenance

NOTICE:

Before maintaining the instrument, remove the sensor unit and install a protective cap to protect the analyzer tube flange.

11.1 Life expectancy of the ion source

Expect to replace the ion source according to the following operating hours.

Emission current (μA)	Measurement pressure (Pa)	Expected lifetime
400	1.0	700 hours (approximately 30 days)
400	0.1	7000 hours (approximately 300 days)
100	1.0	2800 hours (approximately 120 days)

NOTICE:

The life expectancy is based on the length of time that the ion source is exposed to and varies with the measurement atmosphere. The times given do not imply a warranted lifetime.

11.2 Replace consumable components

WARNING:

Risk of burns. Before touching the ion source or filament, wait for 30 minutes after turning off the filament. Parts around the ion source are heated to a high temperature immediately after the filament is turned off and you may get burned on contact with the heated part.

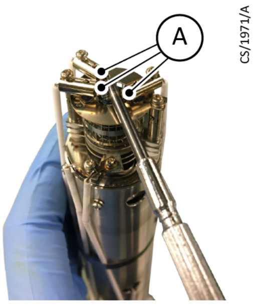
CAUTION:

If a foreign object like a metal or combustible object is admitted into the sensor unit, make sure to remove it. Continuing to use the product with a foreign object inside it can cause it to fail.

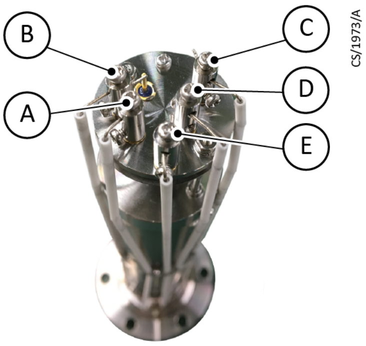
If "Filament Fault" occurs, filament burnout or contamination of the ion source is suspected. If FIL1 has burnt out in a model having two filaments, change over the filament to FIL2. If both filaments have burnt out or if the ion source is severely contaminated, it is necessary to replace the ion source. Contact your local Leybold representative.

11.2.1 Replace the Ion Source (LEYSPEC view models)

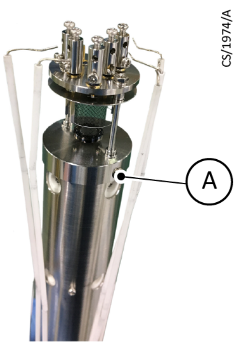
1. Loosen the M2 screw to remove the wiring clamp band of the Q-pole.



2. Loosen the M2 screw on top of the ion source to remove the FIL1, FIL2, FIL C, GAUGE and GRID wiring.



3. Loosen the M2 screw to remove the ion source.



4. Install a new ion source and fix it to the Q pole using the M2 screw.
5. Fix the FIL 1, FIL 2, FIL C, GAUGE and GRID wiring with M2 screw.
6. Fix the wiring using the wiring fixing band.

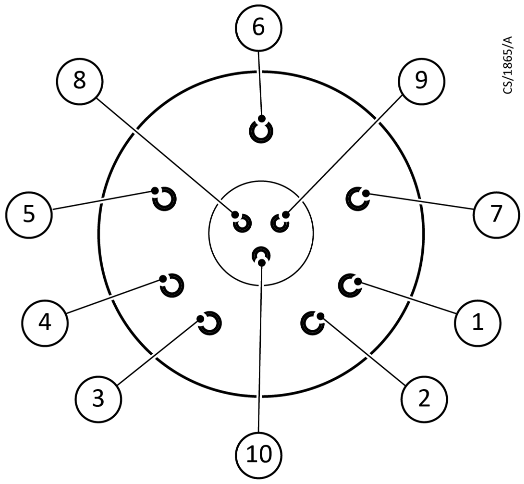


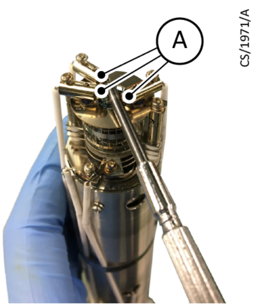
Fig. 11.1 Pin assignment as viewed from atmospheric side (LEYSPEC view)

	LEYSPEC view
1	FIL1
2	Grid
3	FIL2
4	FIL.C
5	RF
6	HV
7	RF
8	IC (SEM/FC)
9	IC (FC) LEYSPEC view
10	TP

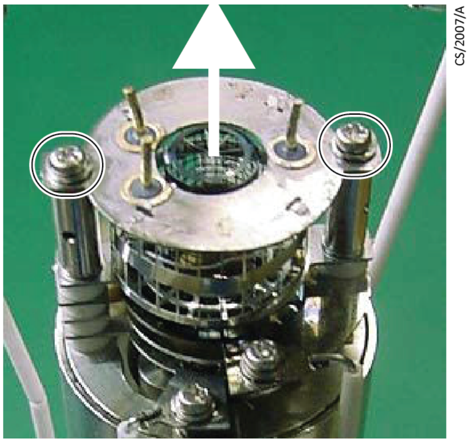
7. Check continuity and insulation according to *Install the analyzer tube* on page 22.

11.2.2 Replace the filament (LEYSPEC ultra models)

1. Loosen the M2 screws (A) of the FIL1, FIL2 and FIL.C joints using a small screwdriver and remove the terminals from the hermetic seal.



2. Remove the two M2 screws (circled) from the ion source post using a small screwdriver.



3. Remove the filament unit from the ion source.

4. Set a new filament and fix it to the ion source using the M2 screws.

5. Reattach FIL1, FIL2 and FIL.C to the terminals and reattach to the hermetic seal.

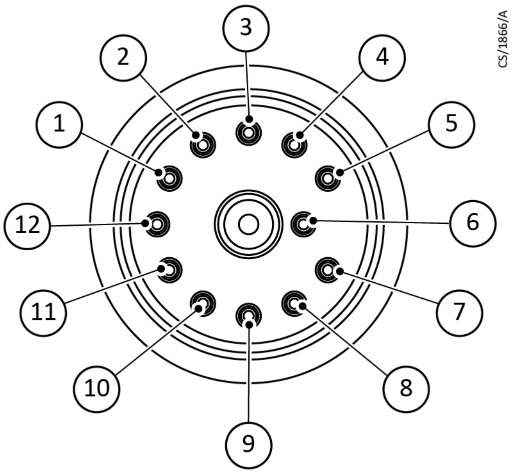


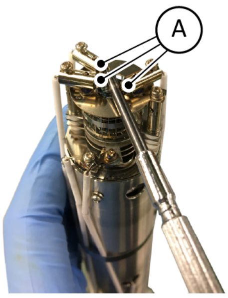
Fig. 11.2 Pin assign of atmospheric side view

	LEYSPEC ultra
1	N.C.
2	FIL.C
3	RF2
4	FOCUS
5	N.C.
6	HV
7	FIL2
8	FIL1
9	TP
10	N.C.
11	GRID
12	RF1

6. Check continuity and insulation according to *Install the analyzer tube* on page 22.

11.2.3 Replace the ion source (LEYSPEC ultra models)

1. Loosen the M2 screws (A) of the FIL1, FIL2 and FIL.C joints.



CS/1971/A

2. Loosen the M2 screws (circled) to remove the GRID, FOCUS and GAUGE wiring from the ion source.

CS/2008/A

3. Remove two M2 screws to remove the ion source. See Figures (3) and (4).

4. Install a new ion source and fix it to the Q pole with the M2 screw (A).

5. Fix the FIL 1, FIL 2, FIL C, GRID, FOCUS and GAUGE wiring with M2 screws.

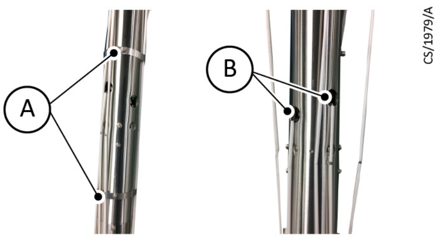
6. Check continuity and insulation according to *Install the analyzer tube* on page 22.

11.2.4 Replace the secondary electron multiplier (SEM) (LEYSPEC ultra models)

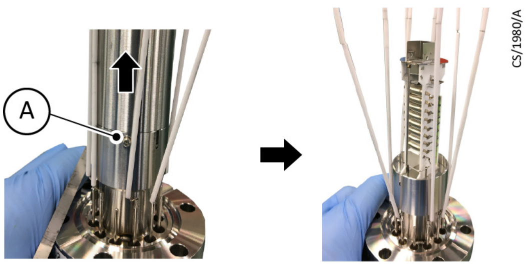
1. Loosen the M2 screw to remove the FIL1, FIL2, FIL.C, GRID, FOCUS and GAUGE wiring from the ion source.

2. Loosen the M2 screw to loosen the two bands.

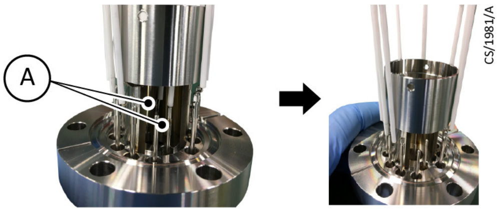
3. Remove the wiring of RF 1 (A) and 2 (B) which fix the Q-pole inside the cylinder (Fig. (2)). Take care not to drop the M2 screw into the cylinder when you remove the wiring.



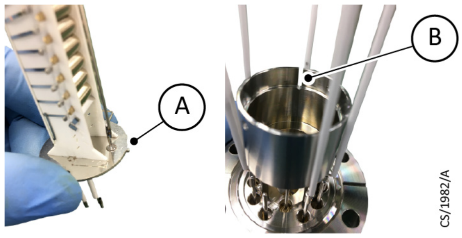
4. Remove the four M2 screws at the bottom of the cylinder. Pull the cylinder straight upward to remove it. When removing the cylinder, the mounting condition of the SEM will be confirmed.



5. Remove the sockets connected to pins "l" and "m" from the analyzer tube base flange (A). Removing this pin separates the SEM from the base flange. The pin may break if a force is applied to the pin horizontally.



6. Install a new SEM. Put the socket onto pins "l" and "m" (A).



7. Set the cylinder (A) in the original position. Fix it with four M2 screws (B).

8. Set the wiring of RF1 and RF2 to Q-Pole in the original position. Fix it with two M2 screws.

9. Install the FIL1, FIL2, FIL.C, GRID, FOCUS and GAUGE wiring to the ion source.

10. Bind the two bands and fix them with M2 screws.

11. Check continuity and insulation referring to *Refer to these lists when disposing or recycling.* on page 72.

11.3 Calibrate

To operate the RGA in normal condition, periodical calibration or tuning is needed. We recommend that you calibrate at fixed intervals.

11.3.1 Tuning RF matching

Purpose:	To output the RF voltage efficiently, RF matching between the control and the sensor is needed. RF matching shifts according to ambient conditions or if the sensor is contaminated. If the shift becomes large, an RF error can occur.
Cycle:	Tune when you exchange the sensor, or if ambient conditions (temperature, humidity) change.

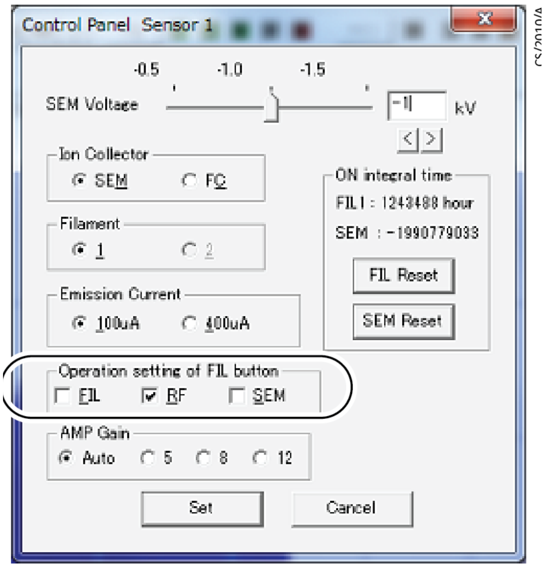
Procedure:

1. Check that the pressure is less than 1 x 10^{-2} Pa.

2. Connect a circuit tester to the TUNING socket on the back of the unit and set the tester to DC voltage mode.

3. Create a recipe in the software as follows:
Mode: Analogue
First and largest mass number: maximum specification
LEYSPEC view100/100S: 100
LEYSPEC view200/200s or LEYSPEC ultra 200S: 200
LEYSPEC ultra 300S: 300

4. Open the control panel from the Sensor menu.
In Operation setting of FIL button, remove all the check marks except "RF".



5. Start measurement and confirm that you see a DC voltage on the circuit tester.

6. Turn the Resolution adjustment potentiometers on the sensor rear-panel to minimize the DC voltage.

7. Stop measurement.

Maintenance

11.3.2 Resolution

Purpose: Resolution represents the degree of separation of neighbouring peaks of mass numbers. With the RGA series, M/e = M and M+1 can be discriminated because ΔM = 1 (10% P. H.).

M/ΔM = M/(b/a)

= M(10% P.H.)

ΔM = b/a = 1

This procedure adjusts the width of the peaks. The width also changes according to ambient conditions or if the sensor is contaminated. If the peaks are too broad the existence of some peaks will be masked. On the other hand, if the peaks are too narrow, data would be unstable.

Cycle: Please adjust resolution if a large deviation between the measured and the reference spectrum is confirmed.

Procedure:

1. Create a recipe in the software as follows:

Mode: Analogue

First Mass: m/z=1

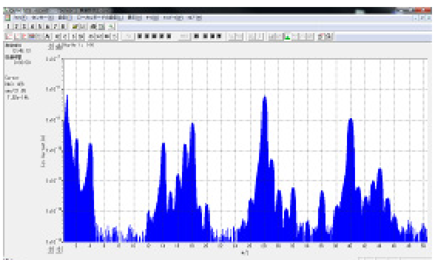
Last Mass: maximum of specification

LEYSPEC view100/100S: m/z= 1 - 100

LEYSPEC view200/200S or LEYSPEC ultra 200S: m/z= 1 - 200

LEYSPEC ultra 300S: m/z= 1 - 300

2. Turn on the filament and start measurement.
If no peaks appear, turn on some gas flow, or increase the SEM voltage.



3. Compare the measured spectrum with reference spectrum described (below) to see if adjustment is required.

4. Turn the Resolution adjustment potentiometers on the sensor rear-panel to adjust the resolution while confirming spectra.
(L) Adjust low mass side

(H) Adjust high mass side

Anticlockwise:
Resolution will be better
(Peaks will be narrow)
Clockwise:
Resolution will be worse.
(Peaks will be broad)

NOTICE:

There is time lag of about 10 seconds between each adjustment and a change to the spectrum. We recommend you rotate the about half turn each time and wait for the spectrum to change.
Since there is no clear boundary between (L) volume and (H) volume, there are characteristics that mutually influence both. While you adjust the potentiometers keep track of the direction of rotation and number of rotations at all times.

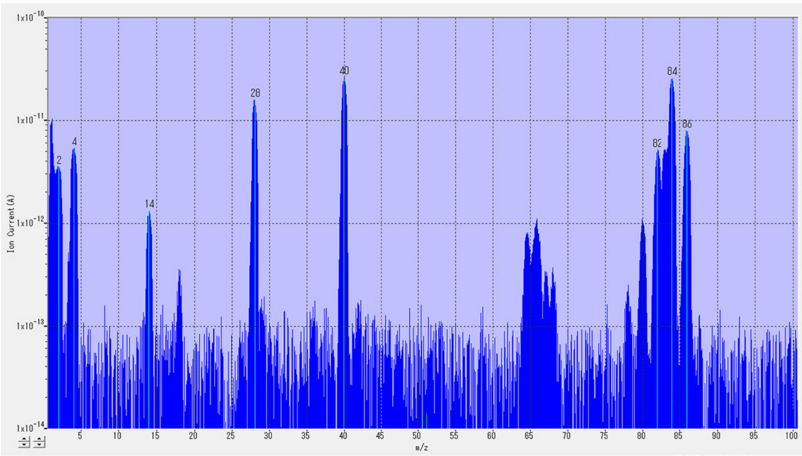


Fig. 11.3 Reference spectrum (LEYSPEC view100)

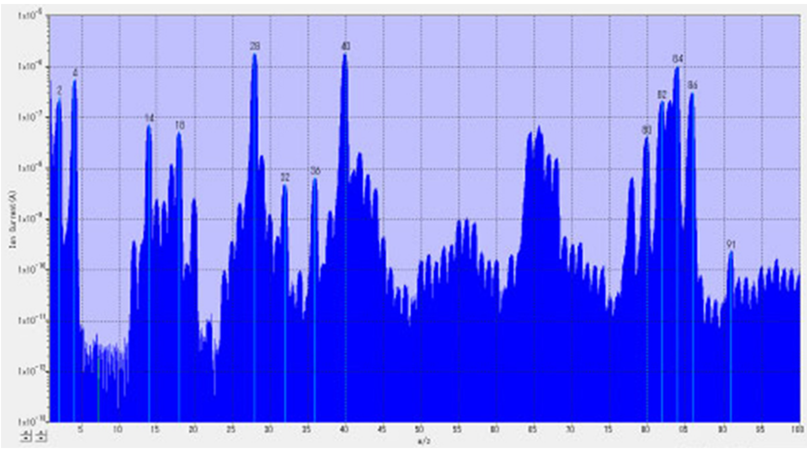


Fig. 11.4 Reference spectrum (LEYSPEC view100S)

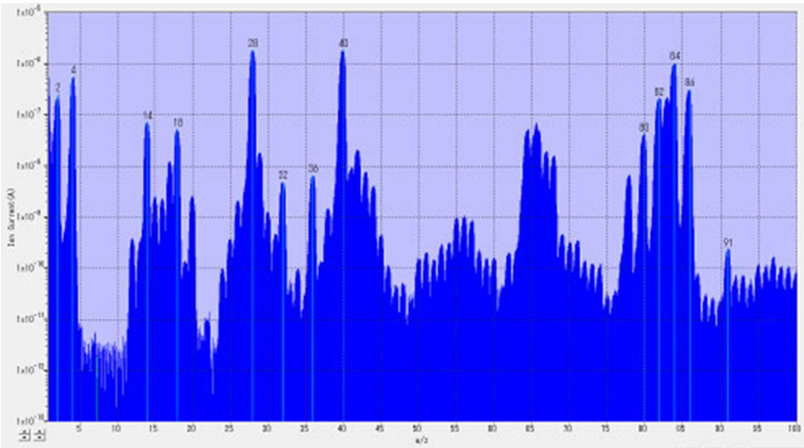


Fig. 11.5 Reference spectrum (LEYSPEC view200/200S or LEYSPEC ultra 200S) m/z=1-10

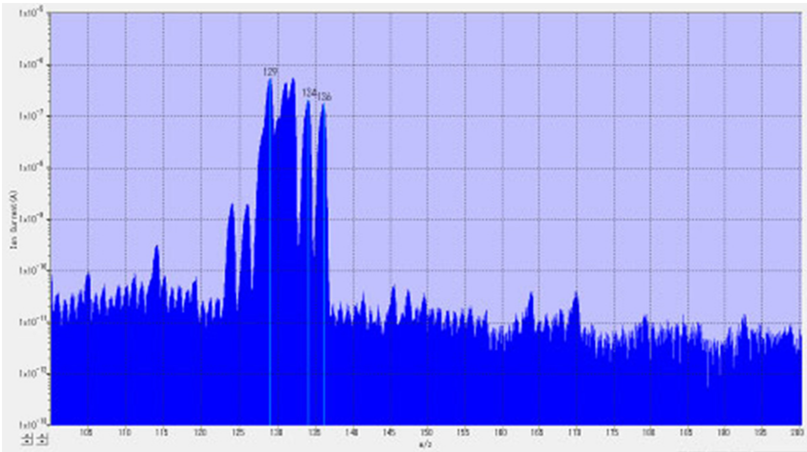


Fig. 11.6   Reference spectrum (LEYSPEC view200/200S or LEYSPEC ultra 200S) m/z=101-200

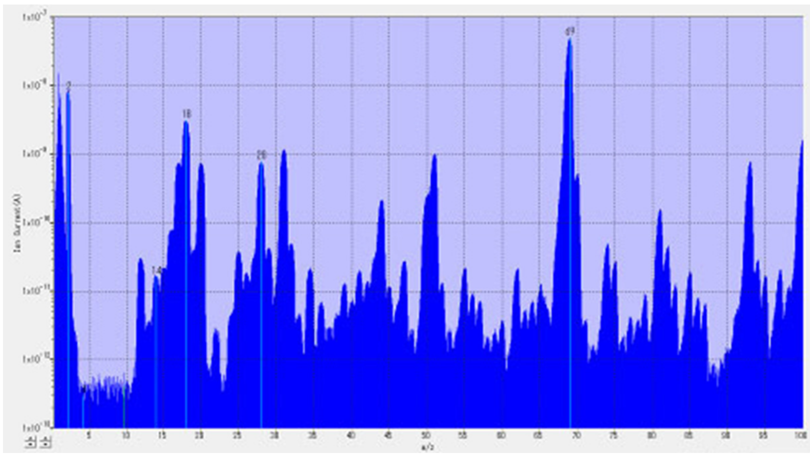


Fig. 11.7 Reference spectrum (LEYSPEC ultra 300S) m/z=1-100

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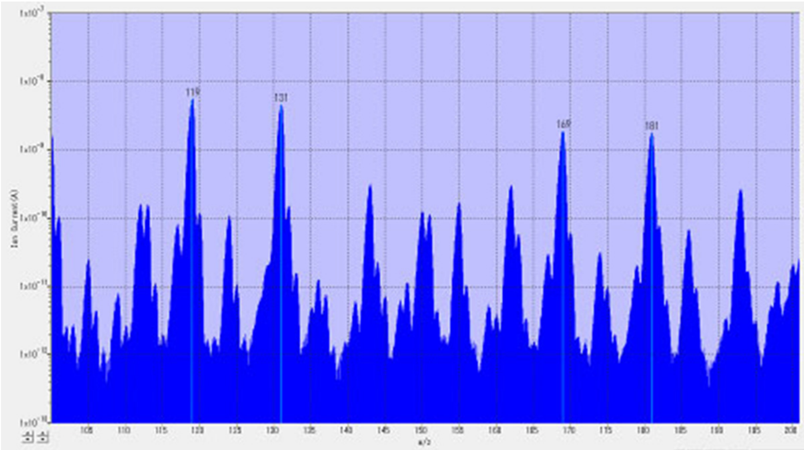


Fig. 11.8 Reference spectrum (LEYSPEC ultra 300S) m/z=101-200

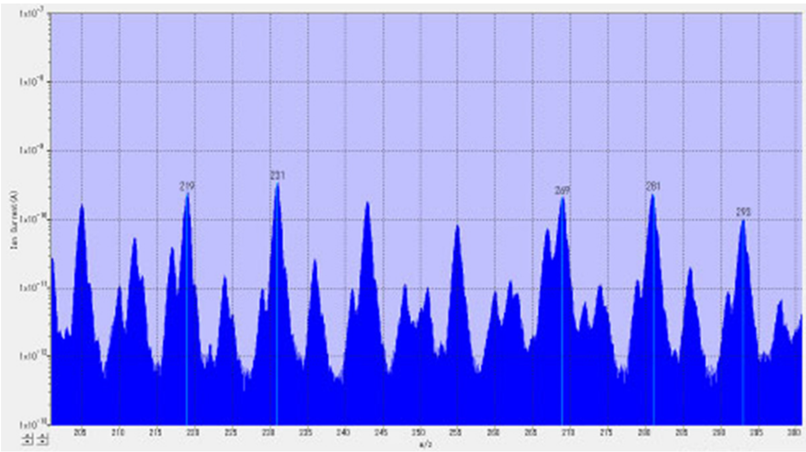


Fig. 11.9 Reference spectrum (LEYSPEC ultra 300S) m/z=201-300

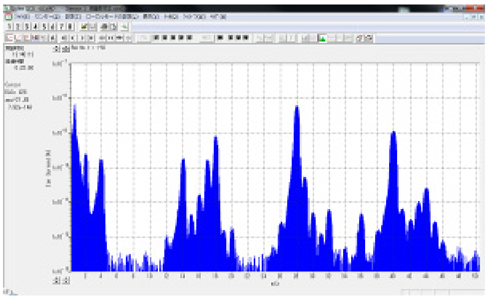
11.3.3 Mass number calibration

Purpose:	Calibrate the horizontal axis of the mass spectrum. The horizontal axis can fluctuate according to ambient conditions or if the sensor is contaminated. If the fluctuations becomes large, the data can become unstable.
Cycle:	Calibrate when you exchange the sensor or the ion source, or if the ambient conditions (temperature, humidity) change, or during a confirmation of sensitivity.

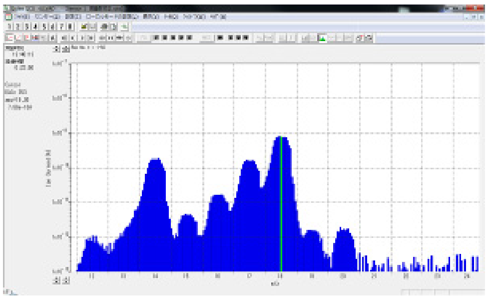
Procedure:

1. Set a recipe for analogue mode and measure the mass spectrum.

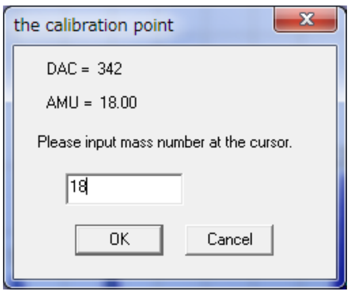
(If peaks are not clear, improve the situation by adding gas flow or increasing the SEM voltage.)



2. Move the cursor to the centre of the main peak and right-click.

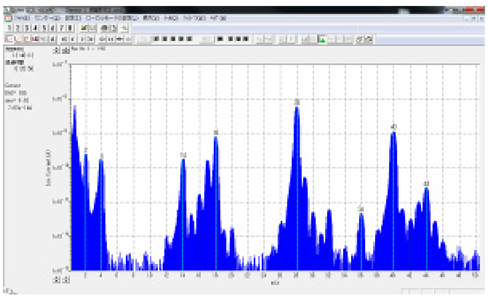


3. Type the correct mass number in calibration point window and click OK.

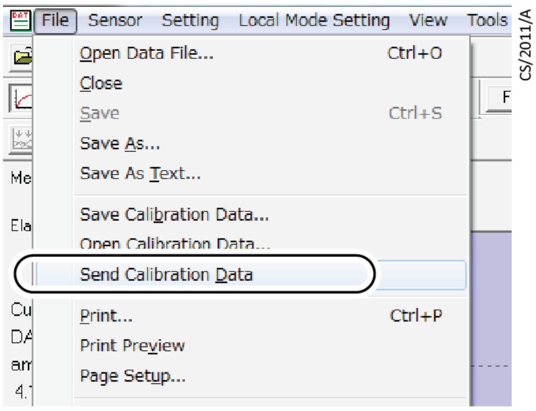


4. Set calibration points for several main peaks (m/z = 2, 18, 28, 32, 40, 44…). At least three points are required to calibrate.

Mass numbers for points that you do not enter are estimated from extrapolation and interpolation.



5. From the File menu, select Send Calibration Data.

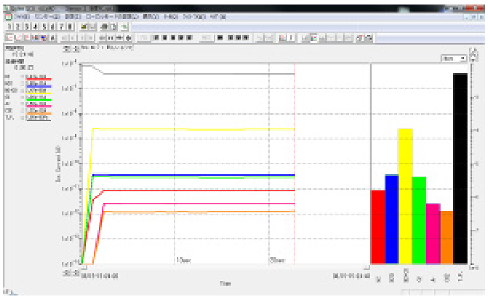


11.3.4 Confirm the sensitivity (Faraday Cup)

Purpose: Sensitivity of the ion source reduces during continuous operation. When the sensitivity is reduced, it becomes difficult to detect small fluctuations in partial pressure.

Cycle: The rate of reduction depends on the operating conditions (gas species, pressure). We recommend that you confirm the sensitivity and its reduction about once a month.

1. Procedure: Set a Gas flow into the sensor of between 1 x 10^{-4} Pa and 1 x 10^{-3} Pa (LEYSPEC view and LEYSPEC ultra models).
We recommend Nitrogen or Argon gas.



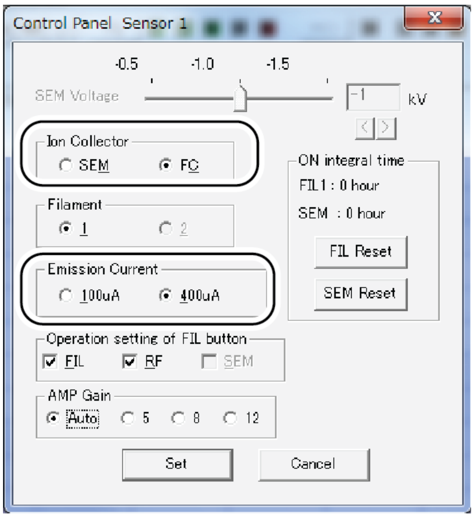
Example: Introduce Nitrogen gas up to 5 x 10^{-3} Pa

2. Recipe settings:
Mode: Trend
Ionization Voltage (WR only): 70 eV.
Unit of Y axis: [A] (Current)
Measurement mass number: Flowing gas (such as N_2 gas m/z = 28)

3. Control settings

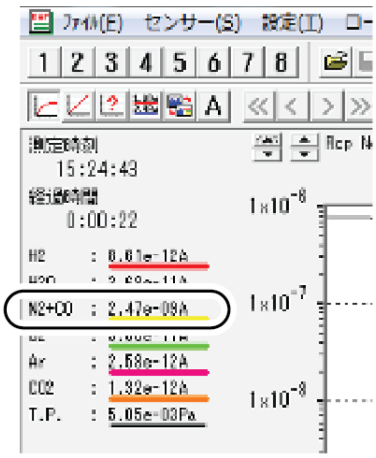
From the Sensor menu, open Control Panel and make these settings:
Ion collector = FC
Emission current =
500 µA LEYSPEC view models (fixed value)
500 µA LEYSPEC ultra models

Maintenance



CS/2012/A

4. Start measurement and confirm the ion current generated by the flowing gas.



CS/2013/A

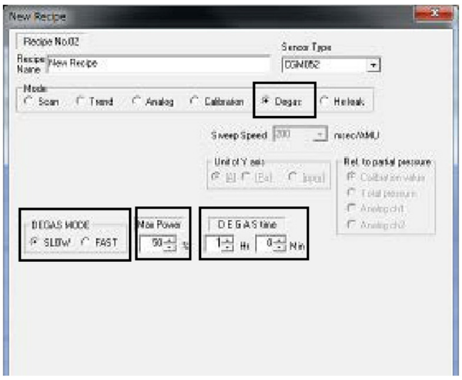
5. Estimate the sensitivity as follows:
The standard sensitivity is 1 - 7A/Pa (for example, an N_2 gas inlet pressure of 5 x 10^{-4} Pa gives an ion current of 5 x 10^{-11} A).
If the sensitivity is lower than the specification, try degassing.
(Degas is cleaning function which removes deposition from surface of electrode by colliding high energy thermal electrons.) If the sensitivity is not improved after degassing, consider exchanging the ion source.

$$Sensitivity(A/Pa) = \frac{IonCurrent(A)}{GasPressure(Pa)}$$

6. Degas

When using the degas function, the pressure at sensor should be as low as possible.
(Under 1 x 10^{-4} Pa recommended)

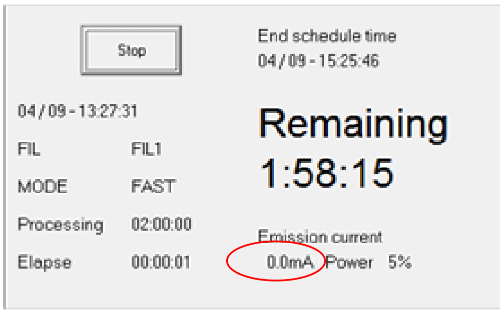
Create degas recipe and operate it.
Mode = Slow
Output = 50%
Time = 1 Hour



CS/2005/A

NOTICE:

During a normal degassing operation, 100% of the degas power corresponds to 5.0 mA of emission current, 50% to 2.5 mA, and 10% to 0.5 mA. However, if there are many deposits then the thermal electron stream will be unstable and stop and the emission current will indicate 0.0 mA as shown below in the figure. In this case, the PC will not give an error message, and the remaining time progresses as with a normal operation. Repeat the degassing operation to fully degas the ion source.



7. Check the sensitivity again after degassing. If after degassing, the ion current is below 1 x 10^{-7} A/Pa by more than one order of magnitude, consider degassing for a longer time with a greater current or consider replacing the ion source.

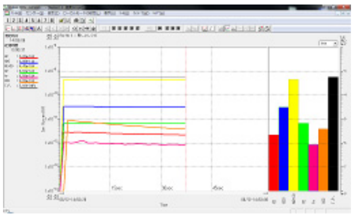
11.3.5 Calibrate total pressure measurement

Purpose: Correct the total pressure measurement by calculating a correction coefficient using the chamber vacuum gauge.

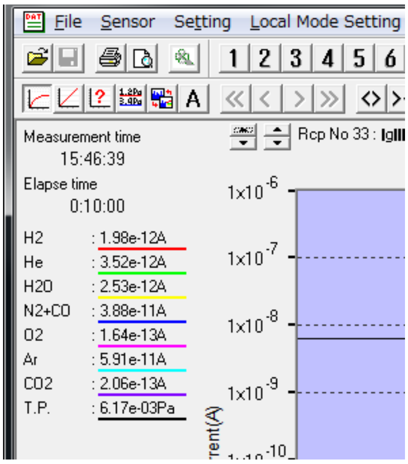
Cycle: Whenever you exchange ion source or sensor.

Procedure:

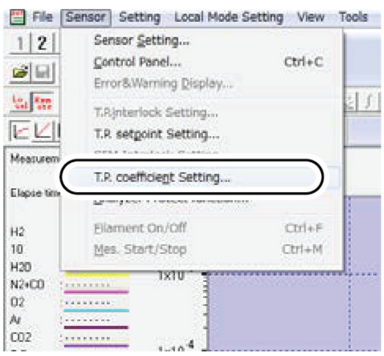
1. Flow gas into the sensor until target pressure. After that, start measurement and confirm total pressure.



2. Calculate the coefficient.
Coefficient = vacuum gauge [Pa] / total pressure of the RGA [Pa]

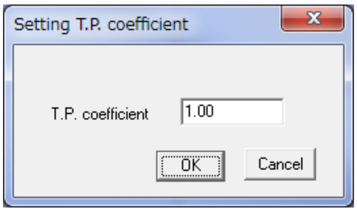


3. From the Sensor menu, select TP coefficient setting.



CS/2016/A

4. Type the coefficient in the dialog and click OK.
Measure the total pressure again to confirm the calibration.

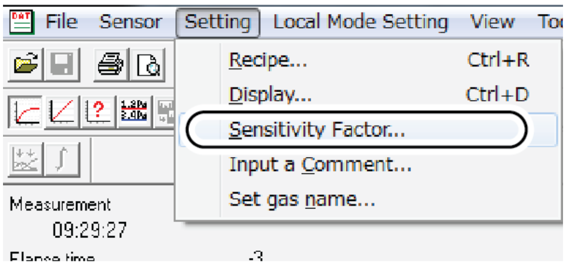


11.3.6 Calibrate Faraday Cup sensitivity

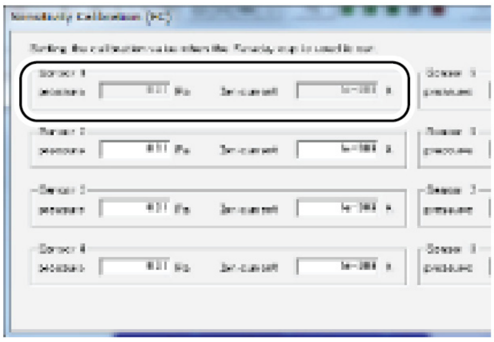
Purpose:	Set conversion coefficient to convert the ion current to partial pressure. If you convert it by ratio you do not need to carry out this calibration.
Cycle:	After confirming sensitivity.

Procedure:

1. From the Setting menu, select Sensitivity factor.



2. Enter the pressure and ion current you confirmed during confirmation of sensitivity and click OK.


CS/2018/A

11.3.7 Calibrate sensitivity of the SEM

Purpose: Calibrate secondary electron multiplier (SEM) sensitivity to measure with constant sensitivity. The SEM amplifies small ion currents using a cascade of secondary electrons which are generated by accelerated those secondary electrons. The amplification rate of the secondary electrons is in inverse proportion to the measurement current intensity and the number of hours operated. You can restore the amplification rate by raising the voltage supplied to the SEM. Perform the calibration in high pressure to avoid the possibility of shortening the life of the SEM or causing fluctuating readings from electrical discharge.

Cycle: The cycle depends on frequency of use. If you use the RGA only in FC mode, you do not need to make this calibration.

Procedure:

1. Introduce the gas so that the pressure at the place where the RGA is installed will be between 1 x 10^{-4} Pa and 1 x 10^{-3} Pa. We recommended using N_2 or Argon gas.

2. Decide your required operating sensitivity for the SEM.

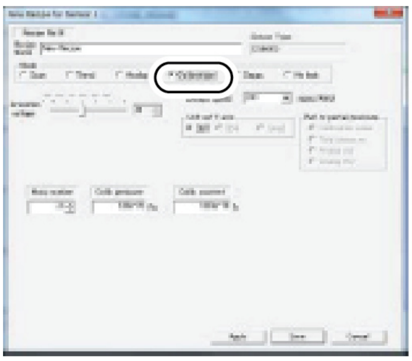
If you set a high sensitivity, the SEM can detect small fluctuation, but its life shortened.

The standard sensitivity for each model is as follows:
LEYSPEC view: 5 x 10^{-3} A/Pa
LEYSPEC ultra : 12.5 x 10^{-3} A/Pa

3. Calculate the calibration current in Amps [A] from sensitivity [A/Pa] and pressure in Pascals [Pa].
Calibration Current [A]
= Sensitivity [A/Pa] × Calibration Pressure [Pa]

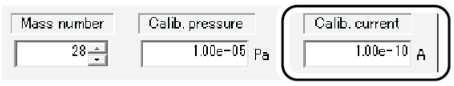
For example: If the sensitivity is 5 x 10^{-3} A/Pa and the calibration pressure is 5 x 10^{-4} Pa, then calibration current is 2.5 x 10^{-6} A

4. Create a “calibration mode” recipe.



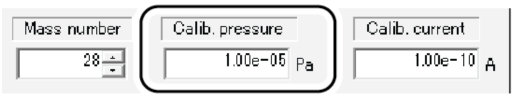
CS/2019/A

5. Enter the setting current on the recipe. The shipping standards are as follows:
LEYSPEC view: 2.5 x 10^{-6} A at 5 x 10^{-4} Pa
LEYSPEC ultra : 6.25 x 10^{-6} A at 5 x 10^{-4} Pa



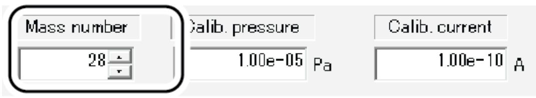
CS/2020/A

6. Enter flowing gas pressure on recipe. The shipping standards are as follows.
Please refer to it.
LEYSPEC view: 5 x 10^{-4} Pa
LEYSPEC ultra : 5 x10^{-4} Pa



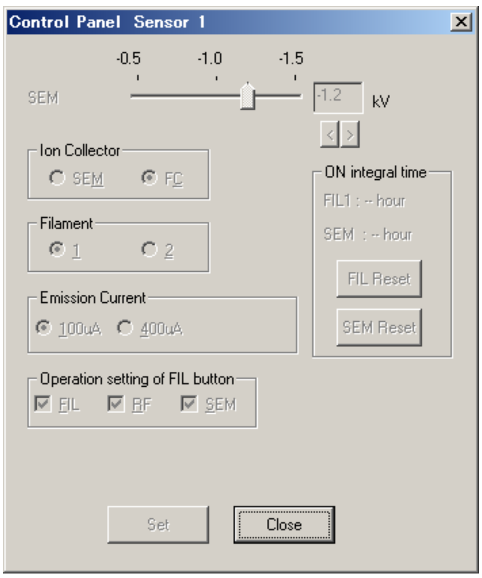
CS/2021/A

7. Enter the m/z mass number of the flowing gas on the recipe.
28 for N_2 gas
40 for Ar gas
After completing the above inputs, click Set Now.
The software enters sensitivity calibration mode.



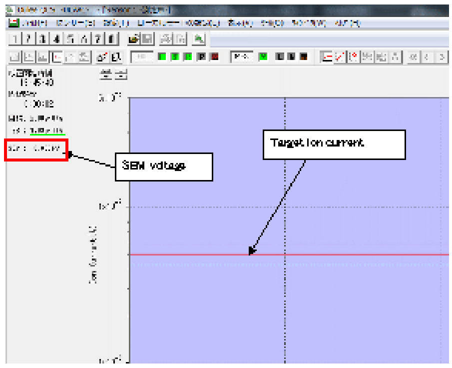
CS/2022/A

8. Set the Control Panel as shown.
SEM: as follows
Ion collector: SEM
Filament: 1 or 2
Emission current: 500 uA (LEYSPEC ultra)
Operation setting of FIL: all



9. Start the calibration. Click FIL and MES.

10.The SEM voltage adjusts automatically until ion current reaches the target. If the target current is a long way from the actual current, it can take a long time to calibrate. If calibration is taking a long time, stop the measurement and manually increase SEM voltage.



When the current reaches the target value, a dialog box appears.

11.To check the display value in local mode, change the DIP switch setting and perform the operation in the local mode.

11.4 Replacing the secondary electron multiplier (SEM)

For replacement of the SEM tube, contact your local service representative.

11.5 Consumable parts list

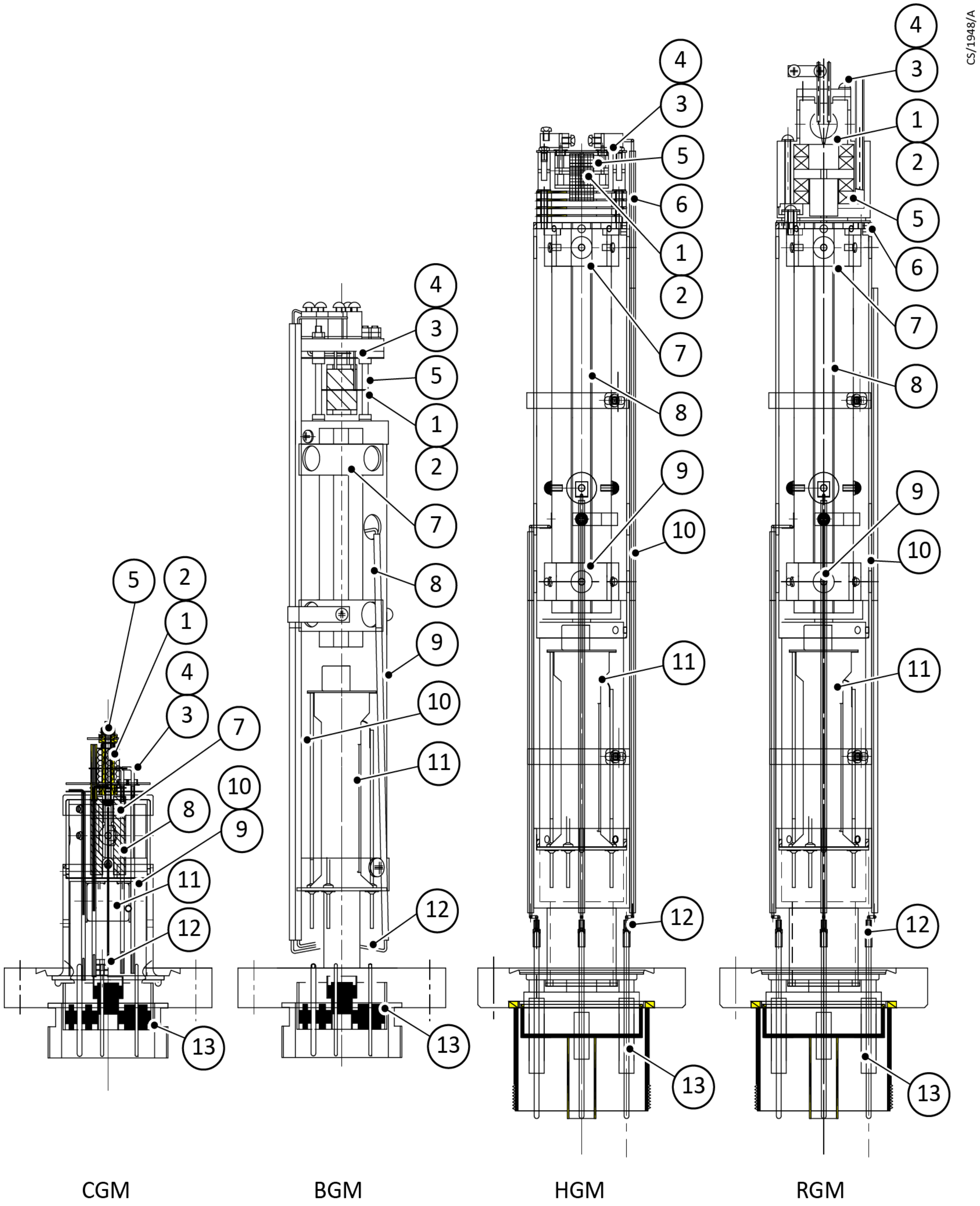
Item	Ordering No.	Applicable model	Timing of replacement
Ion source	D05001013	LEYSPEC view100	Filament burnout, ion source contamination or sensitivity decrease.
		LEYSPEC view100S	
		LEYSPEC view200	
		LEYSPEC view200S	
Analyzer tube	D05001016	LEYSPEC view100	Analyzer tube contamination, sensitivity decrease or abnormal waveform.
		LEYSPEC view200	
Analyzer tube	D05001015	LEYSPEC view100S	Analyzer tube contamination, sensitivity decrease or abnormal waveform.
		LEYSPEC view200S	
Filament	D05002014	LEYSPEC ultra 200	Filament burnout.
		LEYSPEC ultra 300S	
Ion source	D05002013	LEYSPEC ultra 200	Filament burnout, ion source contamination or sensitivity decrease.
		LEYSPEC ultra 300S	
Analyzer tube	D05002015	LEYSPEC ultra 200	Analyzer tube contamination, sensitivity decrease or abnormal waveform.
		LEYSPEC ultra 300S	
Secondary electron multiplier (SEM)	D05002013	LEYSPEC view-S	Sensitivity decrease.
		LEYSPEC ultra -S	

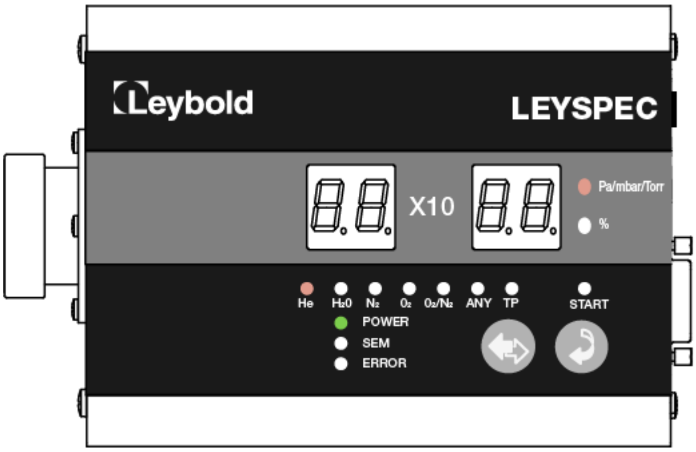
11.6 List of Materials

Refer to these lists when disposing or recycling.

		Material	
No.	**Parts**	**LEYSPEC view**	**LEYSPEC ultra**
1	Filament	Ir (Iridium)	
2	Filament	Y_2O_3 (Yttrium oxide) Coating	
3	Hermetic seal	Borosilicate glasses	
4	Pin	Fe-Ni-Co (Kovar)	
5	Grid	Mo (Molybdenum)	
6	Insulation	Al_2O_3 (Alumina)	
7	Quadrupole	SUS304	SUS303
8	Pole holder	Machinable Glass/Ceramic	
9	Line	Ni (Nickel)/Al_2O_3 (Alumina)	
10	Filament line	Ni (Nickel)/Al_2O_3 (Alumina)	Cu (Copper)/Al_2O_3 (Alumina)
11	Secondary electron multiplier	Al_2O_3 (Alumina)/Al (Aluminum)	
12	Socket	Cu (Copper)	SUS304
13	10/13-Pin electrode	Al_2O_3 (Alumina)/Fe-Ni-Co (Kovar)	
	Other	SUS304	

Maintenance





CS/2065/A

		Material	
No.	**Parts**	**LEYSPEC view**	**LEYSPEC ultra**
1	Housing	Al (Aluminium)	
2	Connector	Brass/Teflon	SUS303/POM (Polyacetal)
3	Panel sticker	PET (Polyethylene terephthalate)	
4	Screw	SUS304	
	Other	Electricity board	

12 Troubleshooting

CAUTION:

Make sure the power is off.

Refer to the following tables for troubleshooting.

Make sure the power is off before troubleshooting.

Error	Cause	Remedy
POWER LED on the sensor unit does not come on when power is turned on	Power connector is disconnected	Check the power inlet connector.
	Power cable is broken.	Check the power cord lines for continuity and insulation using a circuit tester or other.
	Line voltage is out of specification.	Check line voltage using a circuit tester or other (line voltage: 24 V d.c. ± 10%).
	Fuse in the rear panel is open.	Turn the fuse box with a screwdriver, take out the fuse and check continuity using a circuit tester. If the fuse has blown out and its cause is a momentary over-current, replacement of the fuse will resolve the problem, but if other cause is responsible for the over-current, the fuse will burn out again. Locate the real cause from other items.
	The power line in the sensor unit is disconnected.	Power line in the sensor unit (inline filter, wiring, power switch, transformer, switching power supply, and so forth) is disconnected or short-circuit. See your closest service representative for repair and inspection.
Measurement does not start when you press the START button (FIL error lights up)	Filament was burned out.	Check continuity between filament electrodes using a circuit tester or other. If the filament is burned out, change it over to the other one using the included software. However, if the filament is burned out due to operation above the measurement pressure range for an extended time, the analyzer tube interior could have been contaminated. In this case, the emission current may not be normal even if the other filament has continuity. In that case, replace the ion source.
	Poor insulation between electrodes of the analyzer tube.	Remove the sensor unit, check the pin assignment inside the analyzer tube, and then check the insulation between the electrodes of the analyzer tube and the outer wall using a circuit tester and so forth. If there is poor insulation, ship the analyzer tube back for repair.
	Pressure is high.	Check pressure by a vacuum gauge.
	Insufficient power capacity.	Use 24 V d.c., 2 A power or more.
	Contamination of the analyzer tube or filament worn out.	Replace the analyzer tube using the spare part listed in the consumable parts table.
Measurement does not start by pressing the START button (SEM error lights up)	Secondary electron multiplier (SEM) is in contact with earth or other electrode.	Check continuity between electrodes using a circuit tester or other. If there is continuity, remove the analyzer tube and eliminate the cause of contact.
	Insufficient power capacity.	Use 24 V d.c., 2 A power or more.

Error	**Cause**	**Remedy**
Measurement does not start by pressing the START button (RF error lights up)	RF is in contact with earth or other electrode. RF terminal is disconnected.	Check continuity between electrodes using a circuit tester or other. If there is continuity, remove the analyzer tube and eliminate the cause of contact.
	RF voltage tuning is out of alignment.	Regulate RF voltage tuning.
	Insufficient power capacity.	Use power of 24 V d.c., 2 A or more.
Any value is not shown in the display after pressing the START button	Secondary electron multiplier (SEM) voltage is too low.	Increase SEM voltage using the included software.
	Mass number is not calibrated correctly.	Calibrate mass again using the included software.
	Protected by external interlock	Reset the interlock.
	Insufficient power capacity.	Use 24 V d.c., 2 A power or more.
Sensitivity is low	Sensitivity is not correctly calibrated.	Calibrate sensitivity using the included software.
	Secondary electron multiplier (SEM) voltage is too low.	Increase SEM voltage using the included software.
	Amplification gain of SEM has lowered.	Replace SEM.
	Ion source is contaminated.	Remove the analyzer tube and check if the ion source is contaminated. If it is severely contaminated, replace it.
No LAN communication to the PC	Incorrect connection of cable.	Reconnect cables correctly.
	Parameters (conditions) are not set correctly.	Check if setting of IP-address and REMOTE/LOCAL is correct.
	Communication setting of PC is not correct.	Check the setting of network communication of PC and Windows.
		Check the setting of firewall of PC and Windows.
		Reset your PC and check again.

Troubleshooting

Error	Cause	Remedy
Measurement value fluctuates	Contaminated analyzer tube or extremely low sensitivity.	Change the analyzer tube with another one and check symptom. If OK with another one, the problem is in the sensor head.
	Line voltage is fluctuating.	Check line voltage using a circuit tester or other (line voltage: 24 V d.c. ± 10%).
	Ground potential is fluctuating.	Check the sensor unit ground and the ground where the analyzer tube is connected using a circuit tester or an oscilloscope.
		Strengthen the ground wiring or take measures such as installing either sensor unit or analyzer tube with a floating ground.
	Leakage current is generated because of poor insulation between electrodes of the analyzer tube.	Check insulation between the electrodes and the outside wall using a circuit tester. (Indication should be infinite or more.)
		If there is poor insulation, ship the analyzer tube back for repair.
	Operating environment temperature is varying.	Measure at a constant temperature.
	RF voltage tuning is out of alignment.	Regulate RF voltage tuning.
	High intensity magnetic field is generated by surrounding equipments.	The orbit of thermions generated from the filament is affected by intense magnetic field around the ion source, causing the emission current to fluctuate. Eliminate the intense magnetic field environment.
	Mass number calibration is not correct.	Recalibrate mass number using the included software.
No set-point signal output	In the LOCAL mode, set-point is not output.	Actuate the set-point with the included software.
	Erroneous wiring or open circuit of EXT-I/O connector.	Correct the wiring and check continuity using a circuit tester or other.
	Failure of output circuit.	See your closest Leybold representative for repair and inspection.
No interlock signal output	Erroneous wiring or disconnection of EXT I/O connector.	Correct the wiring and check continuity using a circuit tester or other.
	Photocoupler current is too low or cannot be fed.	Current of 10 mA is fed to the photocoupler inside.When an external power supply is used, check if the current capacity is sufficient and if the wiring resistance of the wiring is high. When it is turned on and off with a relay, make sure that the minimum actuating current of the relay is 10 mA or less.
	Failure of input circuit.	See your closest Leybold representative for repair and inspection.
Value on the sensor unit differs from that in the software	Sensitivity is not calibrated correctly.	Recalibrate mass number using the software.
	Recipe setting is not correct in the included software.	Refer to *Front panel operation* on page 31.

13 Appendix

13.1 Theory of operation

The analyzer tube of the quadrupole spectrometer consists of the ion source section, filter section, and detector section. The mass of ions generated by the ion source is analysed in the filter section and the ion current is measured by the detector section.

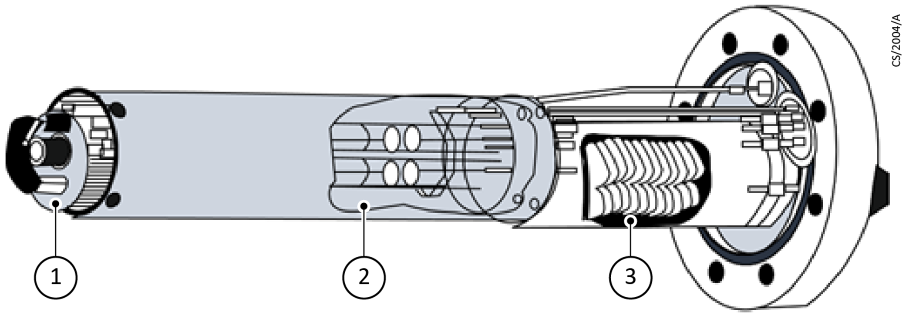


Fig. 13.1 Structure of quadrupole spectrometer analyzer tube

1. On source
2. Filter
3. Detector

The example spectrum below shows mass/electric charge ratios. A waveform with equal intervals is obtained for one mass. Gas composition is shown by the position of the peaks and gas amount is related to the peak height, for example, H2 in the position of mass number 2, H_2O in the position of 18, N_2 in the position of mass number 28 and Ar in the position of mass number 40.

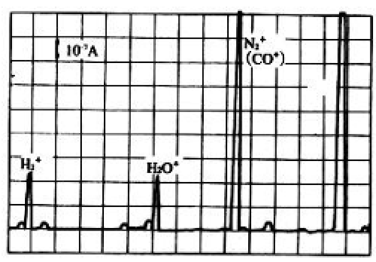


Fig. 13.2 Example spectrum from a quadrupole spectrometer

13.2 Principles of operation

13.2.1 Ion source section

The structure of the ion source is identical to that of the hot cathode type ionization vacuum gauge, in which thermions emitted from the filament are accelerated, and gas molecules are ionized. In the ionization vacuum gauge, ions are collected into the collector, but the quadrupole spectrometer uses an electric field to feed them to the filter section with an energy of about 10 eV.

13.2.2 Filter section (Q-pole)

In the filter section, four columnar electrodes are arranged parallel to each other. This is why the filter is called quadrupole and is referred to as mass filter.

As shown in on page 80, these opposing electrodes are connected with each other and d.c. and a.c. voltages of (U + Vcoswt) overlapped are applied with reverse polarity respectively. Here, the equation of motion of the ions incident on the filter section are expressed by equation (1) with respect to the x, y and z axis shown in on page 80.

$$m\frac{d^2x}{dt^2} + 2e(U + V\cos\omega t)\frac{x}{r_0^2} = 0$$

$$m\frac{d^2y}{dt^2} - 2e(U + V\cos\omega t)\frac{y}{r_0^2} = 0$$

$$m\frac{d^2z}{dt^2} = 0$$

As shown by equation (1), ions incident on the filter section are subjected to periodic force in the x-axis direction and y-axis direction and oscillate.

Substituting equation (1) as shown in equation (2), we obtain Maschew's differential equation, which is equation (3).

$$\omega t = 2\xi$$

$$a = \frac{8\mathrm{eU}}{mr_0^2\omega^2}$$

$$q = \frac{4eV}{mr_0^2\omega^2}$$

$$\frac{d^2x}{d\xi^2} + (a + 2q\cos 2\xi)x = 0$$

$$\frac{d^2y}{d\xi^2} + (a + 2q\cos 2\xi)y = 0$$

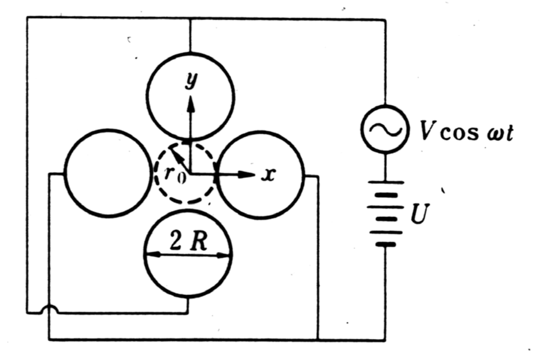


Fig. 13.3 Voltage applied to electrode

Equation (2) can be divided into stability analysis in which ions do not exceed a certain amplitude for an indefinite time and instability analysis in which amplitude increases with time. Whether Maschew's equation is stable or unstable is a function of a and q only, and it can be seen from equation (2) that the mass/charge ratio of ions with which stable oscillation can be performed for U and V voltage values.

When equation (3) is expressed on (U, V) plane as shown in on page 80, both the x axis and y axis show stable regions in which both axes x and y are stable, and only ions with a mass/charge ratio that falls in this area can pass through the filter section.

In order that the U/V ratio constant is constant, a/q is also constant from equation (2) and a straight line that passes through the origin can be drawn, as shown in on page 80. Under certain conditions of U/V, all ions of mass/charge ratio are arranged on this straight line in order of mass number, that is, they pass through the filter section. As the U/V ratio is increased further, the straight line comes close to the apex of the stability region and only ions of certain mass numbers can dwell in the stability region. In other words, the resolution of spectrum becomes high.

This can be summarized as follows: "Apply the voltage in *Fig. 13.2* on page 78 and sweep voltage while maintaining the U/V ratio at a ratio with which appropriate resolution can be obtained".

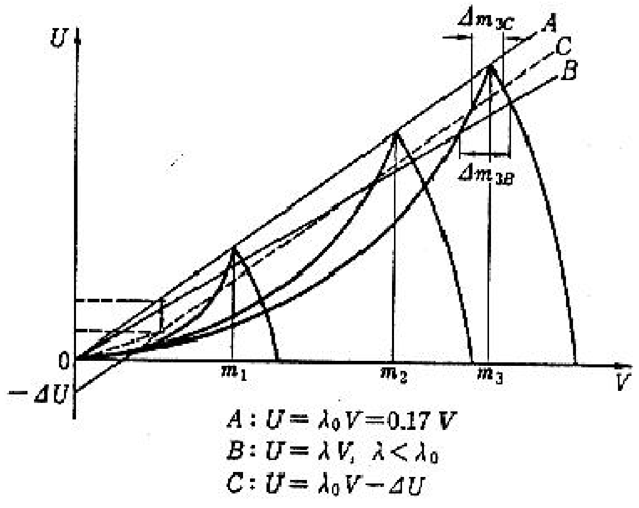


Fig. 13.4 Stability diagram of (U, V) plane and mass scan lines

13.2.3 Detector section

The detector section collects and amplifies the ions that have passed through the filter section. Some simplified analyzers can directly catch ions with the Faraday cup alone to measure the ion current value. Normally, a secondary electron multiplier tube, channeltron, ceratron, or other device is used to convert the incident ions into electrons, amplify them by a factor of 5 or 6, and send them to the DC amplifier of the controller.

For electronic amplification, a high voltage of about -2 kV is applied to the incident end of the amplifier. The detector unit is arranged in the OFF-AXIS position with respect to the centre axis of the filter section to inhibit incidence of soft X-rays generated from the ion source section and in the filter.

13.3 Handling of quadrupole spectrometer

13.3.1 Measurement pressure range

Normally, the operating range is 0.01 Pa or less. If the spectrometer is used at a higher pressure, the ion source filament is oxidized or burns out, causing deterioration of the secondary electron multiplier tube. In the 10^{-3} Pa range, linearity is lost and sensitivity may lower.

To measure a high pressure gas, pump the analyzer tube section differentially using a turbo-molecular pump, and make the measurement by feeding gas from the system to be measured while controlling it.

13.3.2 Deterioration

It is necessary to overhaul the analyzer tube if sensitivity has lowered by a factor of 3 or more as compared with the initial period or if the waveform becomes sharp and noise becomes noticeable. Normally, spare filaments are provided with the instrument, but it would be more effective to disassemble/clean or replace the ion source section rather than overhauling the analyzer tube.

If overhaul of the ion source section is not effective, replace the secondary electron multiplier tube. Since the amplification factor of this tube is subject to gradual decrease, it is desirable to measure sensitivity (amplification factor) periodically.

13.4 Interpretation of measurement value

Gas composition is judged from the mass number of the spectrum and is quantitatively decided with the ion current value of the peak top of the spectrum. Since the ion current value (A) cannot be converted directly to partial pressure (Pa), find the sensitivity
(A/Pa) by calibrating with an ionization gauge using nitrogen gas in order to obtain information about the pressure value.

13.4.1 Sensitivity factor

The sensitivity of a quadrupole spectrometer varies by gas species. The principal reasons for this are:

1. The ionization probability in the ion source varies with the type of gas as with the ionization gauge.

2. The higher the mass number, the lower the transmitting efficiency of the quadruple section.

3. The amplification factor of the secondary electron multiplier tube varies with the ion species.

To read the spectrum value of each gas as the amount of gas, feed mixture gas with a known volume ratio and find the sensitivity factor for each gas.

13.4.2 Cracking pattern

1. Ions dissociated in ionization

2. Divalent ion

3. Isotope, and so forth.

Cracking patterns appear when multiple spectra appear with one type of gas, and this occurs with most types of gases. The mass number of residual gas in an ordinary vacuum system is 50 or less and the number of cracking patterns is small, so that it is relatively easy to analyse them, but if organic gas is mixed, it is difficult to analyse the cracking pattern.

13.4.3 Overlapping peaks

Since a gas species is identified with mass number, it is difficult to separate gases with the same mass number. For example, N_2 and CO that are present as residual gas have cracking patterns at mass numbers 14 and 12 respectively, it is possible to judge them to some extent, but it is not easy to find the ratio and partial pressure accurately because the peaks overlap.

13.5 Peaks of major residual gases

m/z	Ion	Residual gas molecule	Remark
1	H+	H_2, vapour, Hydrocarbon	
2	H2+	H_2, vapour, Hydrocarbon	H dissociated from various molecules are recombined.
12	C+	CO, CO_2, Hydrocarbon	
14	N_2++, CO++ CH_2+	N_2, CO, Hydrocarbon	
15	CH_3+	Hydrocarbon having methyl base	
16	O_2++, O+ CH_4+	CH_4, O_2, oxygen compound	
17	OH+	H_2O	With H_2O ratio is 16 : 17 : 18=1 : 5 : 20
18	H_2O+	H_2O	
20	Ar++, (H_2O)	Ar, (H_2O)	H_2O (20) with O18 abundance ratio of about 0.2% is present.
22	CO_2++	CO_2	
27	C_2H_3+	Hydrocarbon	
28	CO+, N_2 C_2H_4++	CO, N_2, Hydrocarbon	Hydrocarbon (28) is 5 to 10 times hydrocarbon (27). When CO_2 (44) is high, CO (28) is also high.
29	C_2H_3+, (N_2+), (CO)+	Hydrocarbon, (N_2) (CO)	Abundance ratio of N13 is 0.3%. Abundance ratio of C13 is 1.1%.
30	NO+		Appears immediately after evacuation of a contaminated vacuum system.
32	O_2+	O_2	Air leak when 28:32 = 4:1.
35	Cl+	Halogen type detergent	Cl35: Cl37 = 3:1
37	(Cl)+	Halogen type detergent	
39	C_3H_3+	Hydrocarbon	
40	Ar+, C_3H_4+	Hydrocarbon, Ar	Abundance ratio of Ar in air is about 1%.
41	C_3H_5+	Hydrocarbon	C_3 type hydrocarbon appears at 36 to 44, especially much at 39, 41 and 43.
42	C_3H_6+	Hydrocarbon	
43	C_3H_7+	Hydrocarbon	
44	CO_2+	Hydrocarbon, CO_2	Some CO_2 peaks of C13 and O18 appear at 45 and 46.
50	C_4H_2+	Hydrocarbon especially aromatic groups	
51	C_4H_3+	Hydrocarbon, especially aromatic groups	

m/z	Ion	Residual gas molecule	Remark
55	C_4H_7+	Hydrocarbon	C_4 type hydrocarbon contains much 55 and 57.
56	C_4H_7+	Hydrocarbon	
57	C_4H_7+	Hydrocarbon	

13.6 Setting the IP address of the sensor unit

Make the following settings and connect the LAN cable to the RGA. Without this setting, communication with the RGA cannot be established.

There are two IP address options in the RGA sensor unit, pre-set (fixed IP address) and user's setting (variable IP address).

13.6.1 Fixed IP address settings

The fixed IP address set in advance is as follows.

Sensor 1	: 192.168.250.11	Sensor 9	: 192.168.250.19
Sensor 2	: 192.168.250.12	Sensor 10	: 192.168.250.20
Sensor 3	: 192.168.250.13	Sensor 11	: 192.168.250.21
Sensor 4	: 192.168.250.14	Sensor 12	: 192.168.250.22
Sensor 5	: 192.168.250.15	Sensor 13	: 192.168.250.23
Sensor 6	: 192.168.250.16	Sensor 14	: 192.168.250.24
Sensor 7	: 192.168.250.17	Sensor 15	: 192.168.250.25
Sensor 8	: 192.168.250.18	Sensor 16	: 192.168.250.26

To use the fixed IP addresses, switch sensor unit DIP switch no. 1 to OFF.

On the PC, set the above fixed IP address of the RGA. For details on how to set the IP address of the PC, see *Set up the RGA PC network* on page 86.

NOTICE:

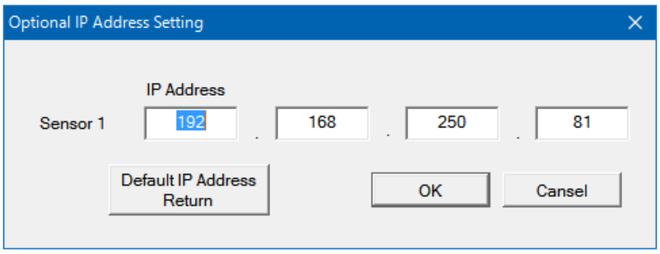
For communications to be possible, the PC must have a different IP address from the RGA.

13.6.2 Set up a variable IP address

A variable IP address is an IP address that can be set by the user. As for the RGA (fixed IP address) setting, communication is made between the PC and the RGA sensor unit.

1. In the software, from the Setting menu, select Optional IP address setting.

The first 3 fields must match those used by the PC, only the 4th can be different. If required, click Default IP address Return to reload the fixed IP address setting.



2. Enter the required values and click OK.

3. Exit the software.

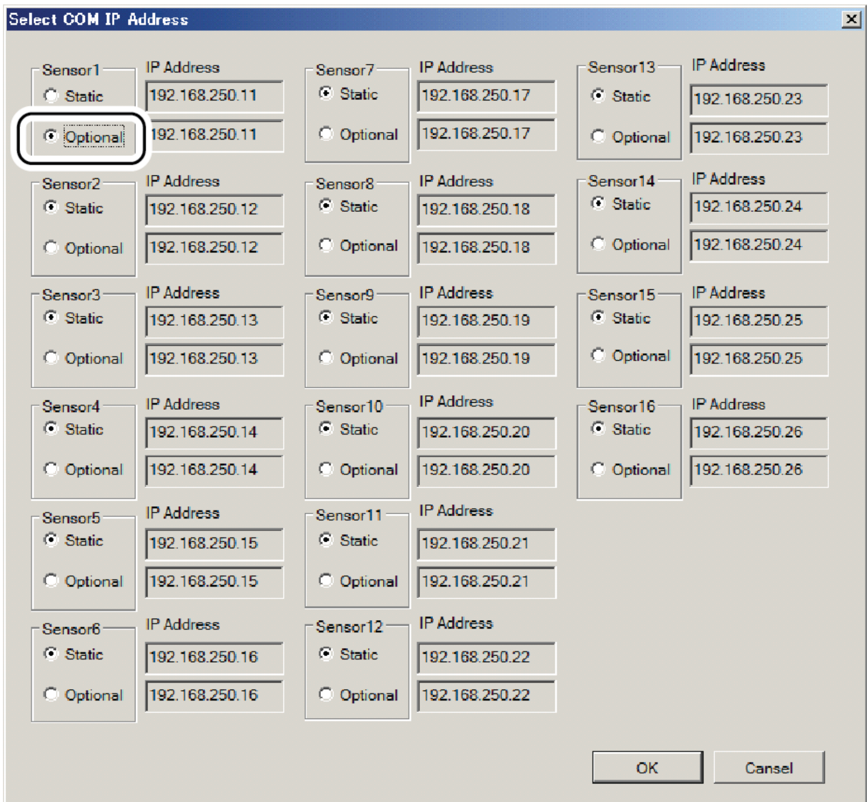
4. Set the IP address of the PC to be used referring to *Set up the RGA PC network* on page 86. Make sure that the first 3 fields match those you have set here.

5. Turn off power to the RGA, switch DIP switch No.1 to ON, and turn on the power to the RGA.

6. Launch the software and close the sensor type screen.

7. From the Setting menu, select Communication IP address setting and check "Optional" for the sensor to be connected.

The variable IP address you set is displayed.



CS/2038/A

8. Reopen the Sensor type dialog and connect it to the RGA unit.

13.7 Set up the RGA PC network

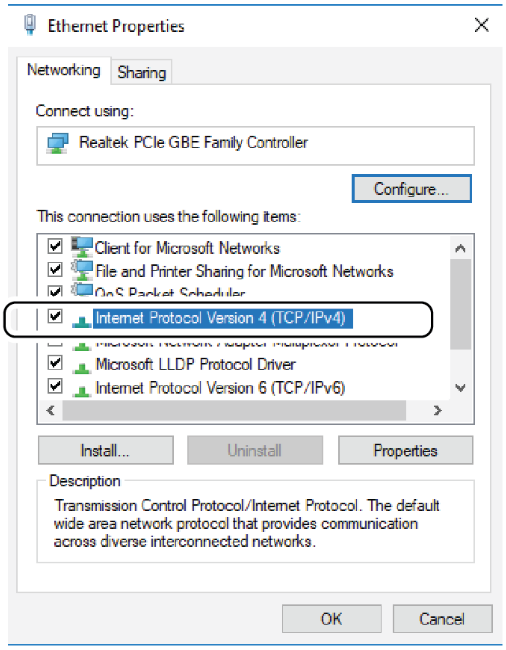
13.7.1 Set the PC IP address

Requires Administrator privilege (example OS: Windows10)

1. Select Start → Control panel → Device Manager

2. Expand Network adaptors and Right click the appropriate adaptor (network card) and select Properties

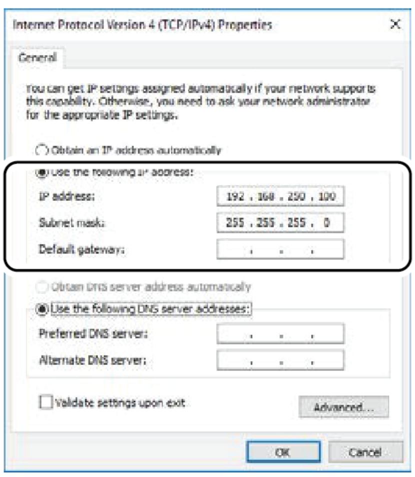
3. In the list, select Internet protocol version4, TCP/IPv4 and click Properties



CS/2023/A

4. Select Use the following IP address.

- Set the IP address for the PC.
- Set the Subnet Mask to 255.255.255.0



CS/2024/A

Appendix

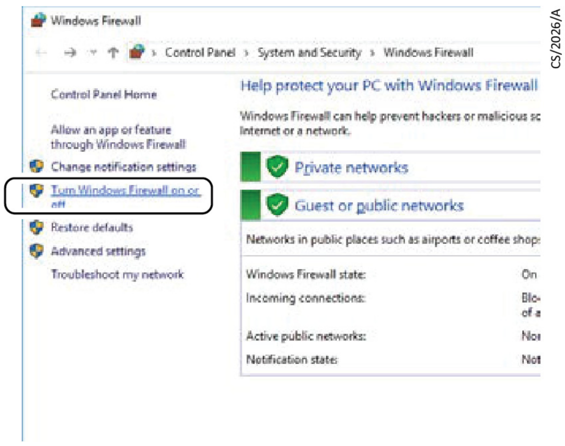
13.7.2 Disable the firewall

You can disable the Windows firewall to troubleshoot while you set up the network. Do not leave the firewall disabled. Leaving the firewall disabled leaves the PC vulnerable to cyber attacks.

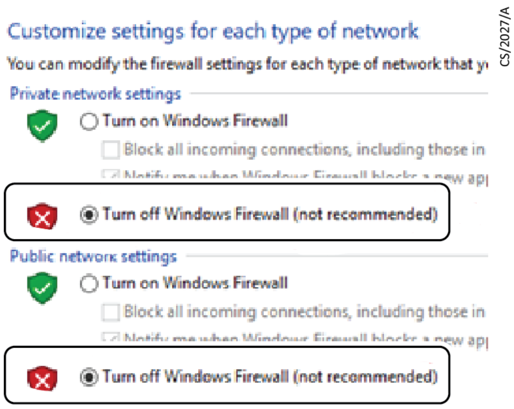
Requires Administrator privilege (example OS: Windows10)

- Control Panel ' Windows Firewall

- Turn Windows Firewall on or off



- Turn off Windows Firewall



13.7.3 Add firewall rules to allow RGA communications

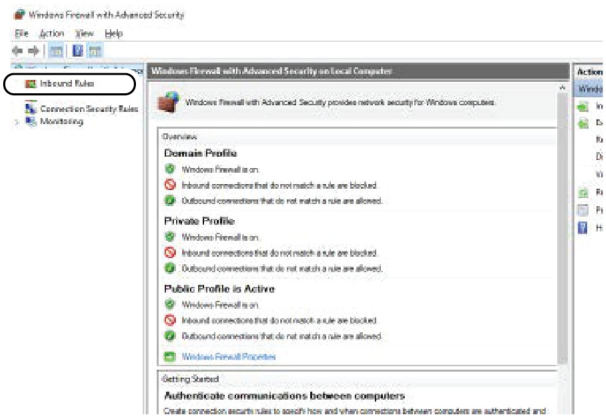
Requires Administrator privilege (example OS: Windows10)

- Exit the windows software

- From Control Panel select System and Security, Windows Defender Firewall and click Advanced Settings

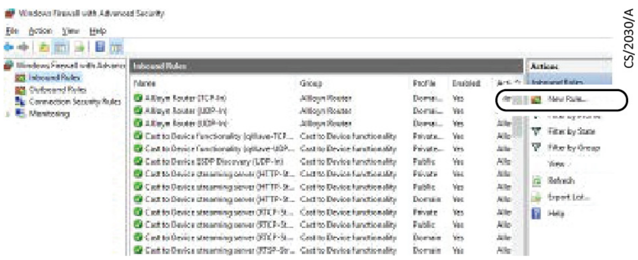
CS/2028/A

- Inbound Rules



CS/2029/A

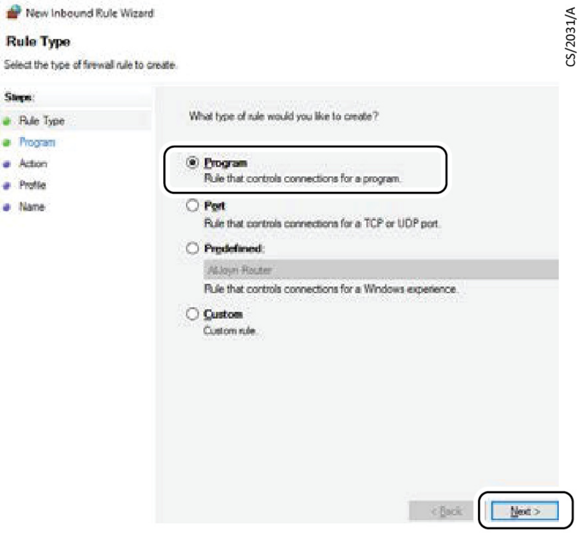
- New Rule



CS/2030/A

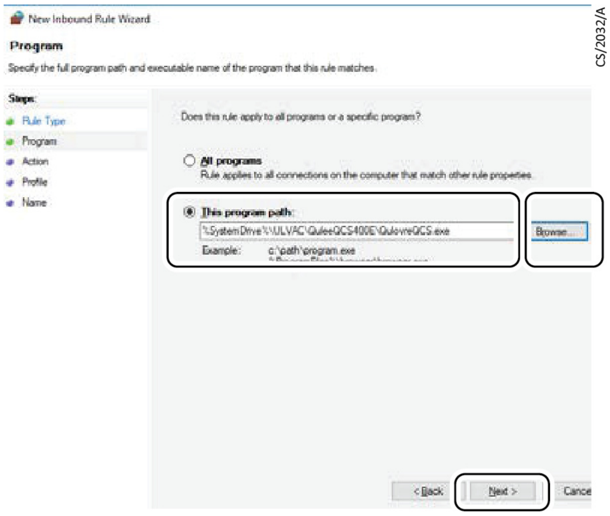
Appendix

- Program → Next



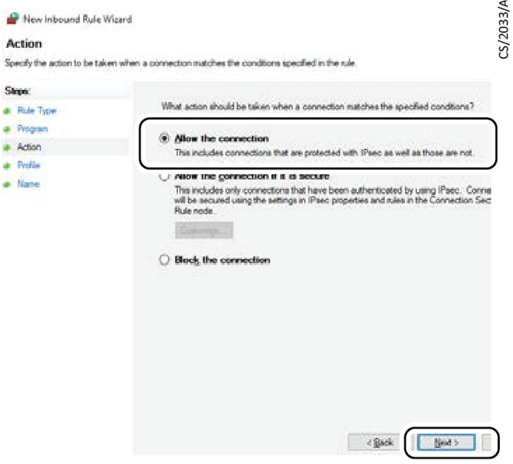
CS/2031/A

- In This program Path, click Browse and specify the RGA installation folder (by default it is installed in C:\Leybold or, C:\Program Files (x86)\Leybold
Click Next.



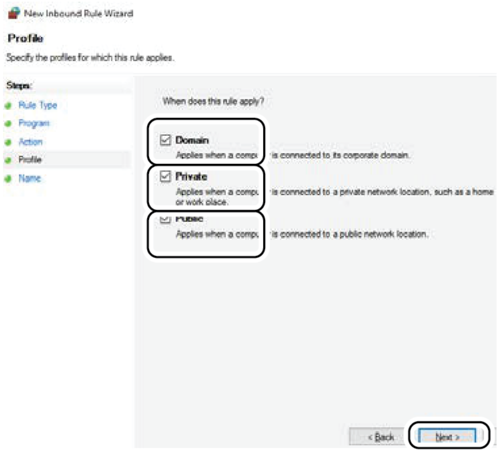
CS/2032/A

- Allow the connection → Next.



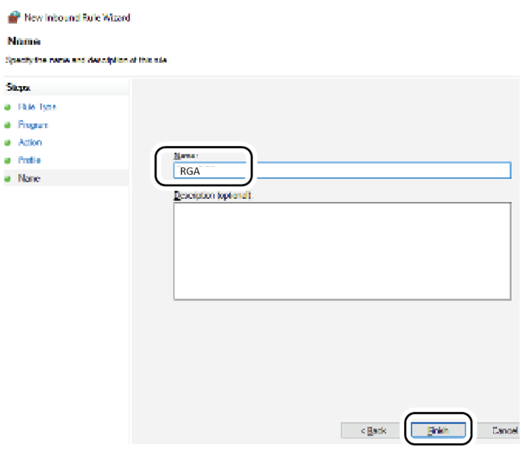
CS/2033/A

- Check "Domain", "Private", "Public" → Next.



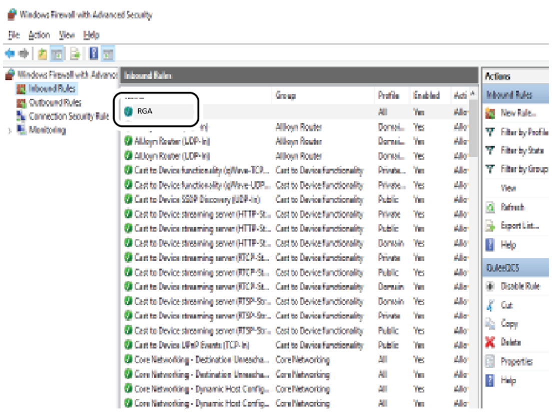
CS/2034/A

- Enter "RGA" and click "Finish".



CS/2035/A

- In Inbound Rules, make sure "RGA" has been added.



CS/2036/A

- Close the setting screen of Windows Firewall, start the software and check communication connection with the RGA sensor unit.

14 Return the equipment or components for service

Maintenance inside the device should only be performed by the manufacturer.If you send us a device, indicate whether the device is free of harmful substances or if it is contaminated. If it is contaminated, also indicate the type of hazard. Use the form prepared by us:

"Declaration of Contamination of Compressors, Vacuum Pumps and Components".

The form can be found on the Internet: www.leybold.com - Downloads - Download documents. Attach the form to the device or attach it in email.

This declaration of contamination is required to comply with legal requirements and protect our employees. Devices without explanation about contamination will be sent by Leybold back to the sender.

Leybold

CE

EU Declaration of Conformity

(Translation of original Declaration of Conformity)

The manufacturer:	Leybold GmbH Bonner Straße 498 D-50968 Köln Germany

herewith declares that the products specified and listed below which we have placed on the market, comply with the applicable EU Council Directives. This declaration becomes invalid if modifications are made to the product without agreement of Leybold GmbH.

Product designation: Residual Gas Analyzer

Type designation:	**Part numbers:**
LEYSPEC view 100	220010V01
LEYSPEC view 100S	220011V01
LEYSPEC view 200	220012V01
LEYSPEC view 200S	220013V01
LEYSPEC ultra 200S	220020V01
LEYSPEC ultra 300S	220021V01

The products comply with the following Directives:

Low Voltage Directive (2014/35/EU)

Electromagnetic Compatibility (2014/30/EU)

RoHS Directive (2011/65/EU)

The following harmonized standards have been applied:

EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use — EMC requirements — Part 1: General requirements Emissions: Group 1, Class A Immunity: Industrial electromagnetic environment

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