

Precision Gas Dilutor



USER MANUAL



G.A.S. Gesellschaft für
analytische Sensorsysteme mbH

Precision Gas Dilutor – User Manual

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CE-Marking according to:

International Standard EN ISO 17050-1:2004

Directive 2014/35/EU (Low voltage directive);

Directive 2014/30/EU (Electromagnetic compatibility);

Directive 2011/65/EU (RoHS);

Directive 2012/19/EU on waste disposal (Waste Electrical and Electronic Equipment – WEEE)

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1 General Information

1.1 Information about the Manual

This manual describes a safe and adequate handling of the device. Following the instructions of the indicated safety aspects and instructions as well as the national and/or local rules and general safety regulations concerning the prevention of accidents are absolutely imperative.

Before starting the work with the device read the manual completely and thoroughly particularly the chapter security and respective safety references. Assure that you/the operator comprehend the terms described.

The manual is part of the device. It must be stored together with and next to the device at any time.



INFORMATION!

The graphics in this user manual are schematic and may differ from the actual conditions. The firmware and PC software screenshots in this user manual may differ from the actual conditions.

1.2 Explanation of Symbols

Important and safety-relevant references in this manual are characterized by symbols. These indications which are in-line with industrial safety must be respected and followed at any time.



INFORMATION

This symbol calls information, which are to be considered for efficient and perfect handling of the equipment.



WARNING

This symbol indicates references, which can lead to damages, malfunctioning and/or loss of the device.



DANGER

This symbol marks references, which can lead to health impairments, injuries, lasting body damages or to death due to electric current.

1.3 Notation for Dialogs, Elements and References

Example Dialog:

System › **Connections** › **LAN File Transfer** › **Settings...** › **Test Connection**

Example Elements:

Gas Out, **Sample gas in**

Example: References

Advanced User Manual, **Chapter 5.1 Installation Requirements**

Example: Information

keep the transport box

1.4 Scope of Supply

Assure that you have received the full scope of supply. If there is any part missing, please contact the GAS-hotline immediately.

Standard Scope of Supply



Precision Gas Dilutor (1 piece)



Power plug (1 piece)

Part Number: 100002455



Power Supply (1 piece)

Part Number: 100001817

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USB Connector (1 piece)

Part Number: 100003092



Zero Gas Connector (1 piece)

Part Number: 100001102



Test Gas Connector (1 piece)



Gas Mix Out Connector (1 piece)

Part Number: 100003102



Purge Connector (1 piece)

Part Number: 100003104



Blind Plug with Red Cap (3 piece)

Part Number: 100003141

Located on the device at position 4, 5 and 7
(see chapter 5.3)



Blind Plug (1 piece)

Part Number: 100000934

Located on the device at position 3
(see chapter 5.3)



Trigger Connector (1 piece)

Part Number: 100001547



USB-Stick (1 piece)



INFORMATION!

It is recommended to **keep the transport box** for a safety return transport.

1.5 Liability and Guarantee

This user manual describes the safe and proper handling of the device.

All data and reference within this manual are compiled under the valid regulations, the state-of-the-art as well as G.A.S. experiences of several years.

This user manual must be stored together with and close to the device at any time and accessible to all persons, who operate or handle the device at any time.

This user manual must be read carefully before starting to work with the device. G.A.S. does not assume any liability for damage and disturbances, resulting from disregard of the instructions contained in this user manual. All claims of any kind related to damage from a not intended use of the device will be rejected.

G.A.S. reserves the right to realize technical changes of the product due to improvements without explicitly mentioning them.

1.6 Copyright

The manual is confidential. It is beyond doubt exclusively made and also meant for the personnel directly dealing with the equipment. All data, texts, designs, pictures and other representations within this manual are protected in the sense of the copyright law and are subject to further commercial patent rights. Each abusive is punishable by law.

Passing it on to third persons as well as duplications in any kind and form - also in part - as well as the use and/or report of contents are not permitted without written agreement of the manufacturer. Offences lead to payment of damages. We reserve ourselves all rights of the practice of commercial patent rights.

1.7 Return and Disposal

For an adequate disposal, the device or/and its equipment must be returned to the G.A.S. or to a third party authorized by the G.A.S.! For questions please contact G.A.S.

1.8 Customer Service

For questions concerning G.A.S. products a customer service is available:

G.A.S. Gesellschaft für analytische Sensorsysteme mbH

Otto-Hahn-Straße 15

44227 Dortmund

Germany

Phone: +49 (0) 231 / 97 42 - 65 50

Fax: +49 (0) 231 / 97 42 - 65 55

support@gas-dortmund.de

The telephone hotline is available from monday to friday from 9:00 to 16:00 hours. In urgent cases or if you use fax or email please provide a telephone number for callbacks.

2 Safety

2.1 Intended Use Only



WARNING!

Usage other than described in this manual may damage the device and/or harm persons involved.

Do not use the device for other purposes. Damages due to misuse are not covered by the guarantee. Such damage claims will be rejected.

The device and its equipment are not certified for the employment in areas with explosive gas air mixtures.

Do not introduce corrosive gases and/or liquids into the device.

Do not introduce or mix explosive gases.

When working with toxic or hazardous gases the whole set-up (incl. customer parts: supply pipes, analyzer, etc) has to be checked for gas leakage by the customer!

All claims or requirements of any kind against the manufacturer and/or its authorized persons that arise due to damages from a not intended use of the device will be rejected. All damages that arise from a not intended use are of the operator's responsibility.

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The intended use of the equipment and its correct handling according are described in the operating instructions of this manual. Other parts than the parts belonging to the scope of supply, may only be used after G.A.S. approval.

2.2 Responsibility of Operator

The device may only be operated in a perfect technical condition. Before putting the device into operation the condition of the device and its equipment must be checked. The information and instructions provided in this manual have to be followed at any time.

Besides the instructions provided in this manual the local rules for the prevention of accidents, general safety regulations - valid for the area of application of the device - as well as the valid environmental-protection regulations must be considered and respected.

The responsible technicians and operators have to make sure a failure-free use of the device. Responsibilities among the involved persons regarding installation, operation, maintenance and cleaning must be made clear.

2.3 Requirements of Personnel

Only authorized and trained technical personnel may work with the instruments. The operator must have received an instruction over existing and all possible dangers and should be regularly instructed in safety procedures and environmental protection and that the personnel is fully aware of the complete operating instructions and particularly the safety notes. Personnel that might be under the influence of drugs or alcohol are to be kept off the device at any time.

Technical personnel in this context are defined as skilled employees who are knowledgeable due to their educational background. In case the foreseen personnel do not have the necessary qualifications to operate the instrument, it must be trained. Further to that non-authorized personnel should not operate the device.

The competencies for the work on and with the device must be specified and kept undoubtedly at any time so that with respect to security issues no unclear situation might come up.

Any changes of the equipment, which impair security of the personnel, must immediately be reported to the operator and every person dealing with it.

2.4 Dangers

The device and its equipment is subject to an endangerment analysis. The construction and execution of the device corresponds to the today's state-of-the-art. The device is reliable in service when operated according to its intended use.



DANGER

Exercise great care in handling current-carrying parts like the power supply cord. Do not get directly in touch with current-carrying parts. Do not open the housing. Do not use damaged parts.



INFORMATION!

If the housing of the device is damaged, the device must not be used anymore and must be returned to the G.A.S. by using the original transportation case.



INFORMATION!

The housing must not be opened by the customer. Otherwise, all claims under guarantee, claim for defects and warranty claims are expired.

3 Transport, Packing and Storage

3.1 Inspection after Transport

Check the supply immediately after delivery concerning its completeness and/or transport damages. If you detect externally visible transport damage, do not receive the supply, or only under reservation. State the extent of the damage on the provided delivery note and/or the transportation documents of the feeder. Generate a complaint. Lodge a complaint of covered defect immediately after recognizing, as claims due to transport damages can only be made valid within the complaint periods (usually 7 days).

3.2 Packing

If no return agreement regarding the packing was agreed upon dispose the packaging material always in an environmentally friendly way and according to valid local regulations. If necessary, ask a recycling company.



INFORMATION!

It is recommended to **keep the transport box** for a safety return transport.

3.3 Storage and Transport

Store the device only under the following conditions:

- **When not in use store the equipment in the supplied casing**
- **Prevent unauthorized access**
- **Do not store outside**
- **Protect the equipment from moisture and dust**
- **Put protective caps on all gas sockets**
- **Avoid mechanical vibrations**
- **Do not expose the equipment to aggressive substances**
- **Protect the equipment from direct sun light**
- **Storage temperature: 5 to 35 °C**
- **Relative Air Humidity: non condensing**
- **Instrument's position: Horizontal**

The equipment should be moved only within the provided carrying case. By this means, transport damages can be avoided. The above mentioned values are considered for an instrument transported in its original new packing.



WARNING!

Protective caps should be put on gas sockets in case the device is stored or transported.

4 Cleaning and Maintenance

Natural aging and the wear of certain components of the equipment require a regular cleaning and maintenance.

4.1 Cleaning

Clean the device only with a dry or easily damp cloth.



WARNING!

Do not use cleaning agents, which contain solvents, acids or bases.

4.2 Maintenance



INFORMATION!

Maintenance of the device should only be carried out at G.A.S. or through specially trained and by G.A.S. authorized personnel.

5 Description of the Precision Gas Dilutor (PGD) unit

5.1 Purpose of the Device

The purpose of the PGD is dilution and/or mixing of gases:

- Gas quality: 5.0 and higher
- Non-corrosive gases
- Non-condensing conditions

This system is engineered to be easy to install, requires only little annual maintenance and can be used in laboratories and/or light industrial environments.



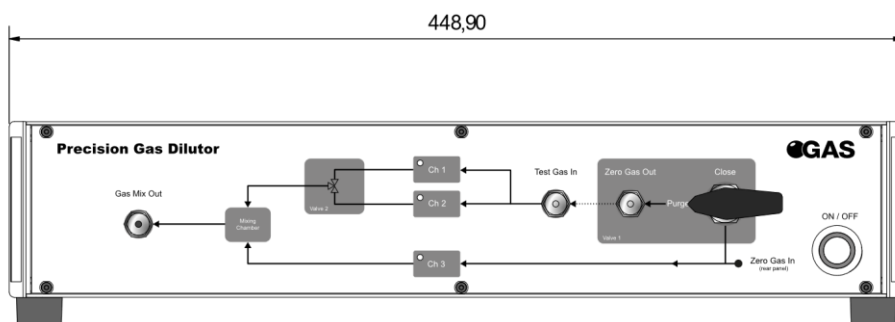
INFORMATION

Any use of the device, that differs from the intended purpose will be regarded as “out of purpose”. Any claims of any kind against G.A.S. or her associates that are related to damages from use not covered by the aforesaid will be rejected.

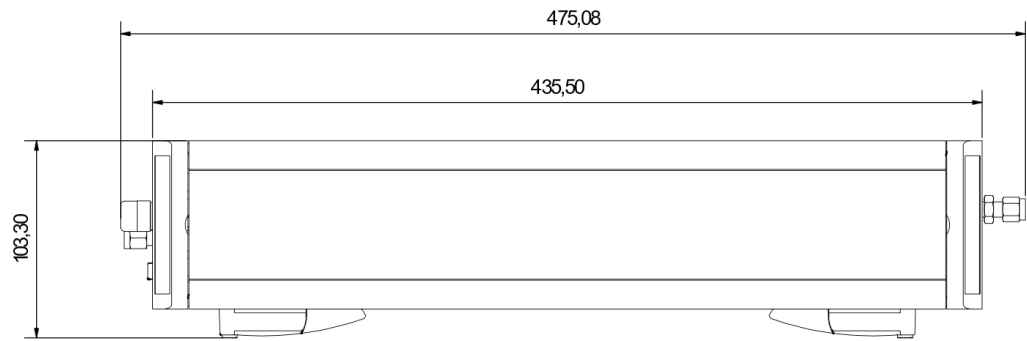
5.2 Dimensions

Model	Net weight (kg)	Gross weight (kg)
Precision Gas Dilutor	8	12

PGD Dimensions Front View:



PGD Dimensions Side View:



5.3 Overview of the Appliance

Front view

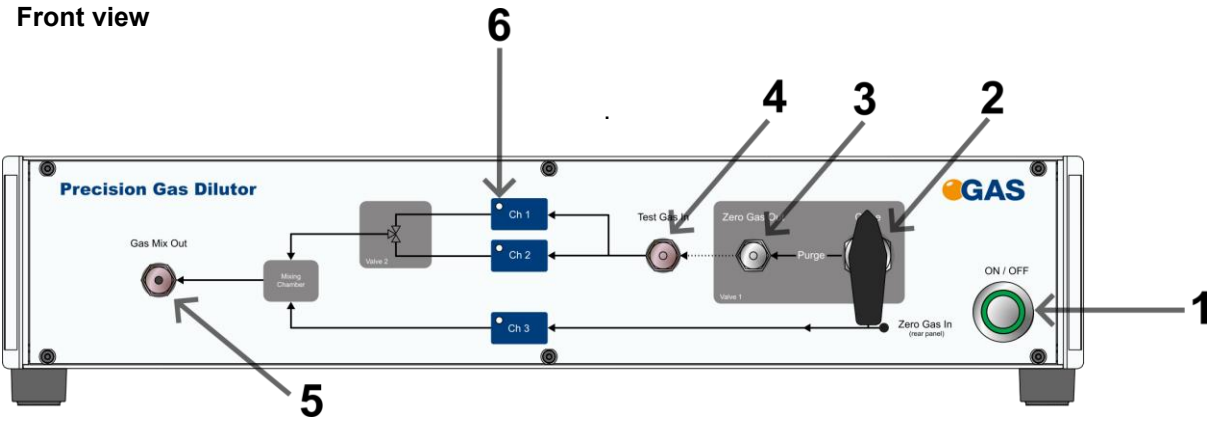


Figure 1

#	Description
1	ON/OFF Button Status LED
2	Valve 1
3	Zero Gas In
4	Test Gas In
5	Gas Mix Out
6	Channel status LED

Precision Gas Dilutor – User Manual

Back view

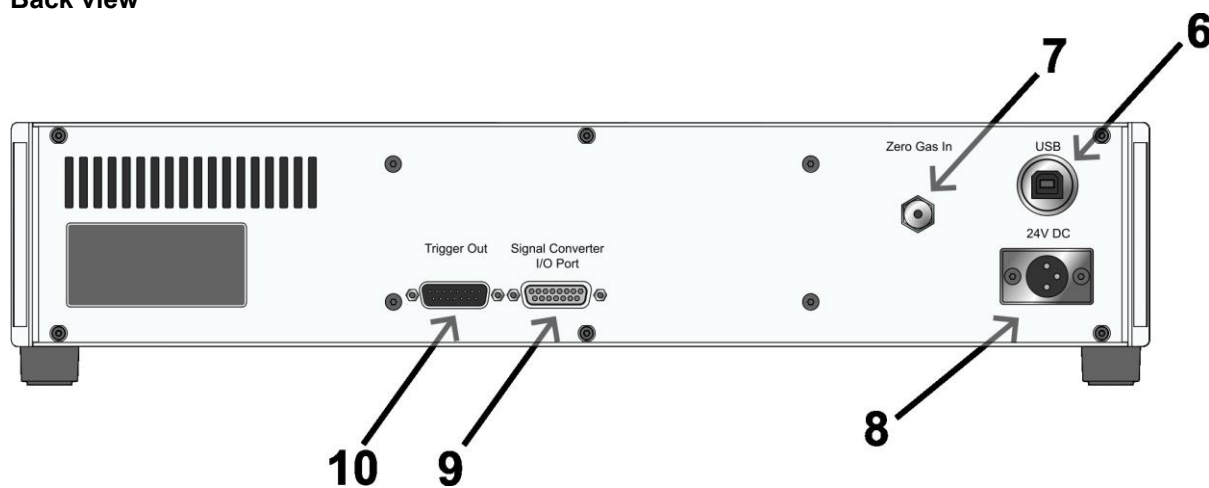


Figure 2

#	Description
6	USB Jack
7	Zero Gas In
8	Power Supply Jack
9	I/O Port
10	Trigger Out Jack

5.4 Installation and Operation Requirements



INFORMATION!

- The Device should be positioned on a flat surface that is not exposed to vibrations and able to withstand a weight greater than 12 kg
- For highest accuracy use **two** stage pressure regulators



WARNING!

- Do not position the device near flames or other heat sources
- Always leave sufficient clearance for the circulation of air around the appliance (about 10 cm), above all at the rear (about 20 cm), where the ventilation air intake is located (as shown in the picture below).
- Do not use the device in a sealed environment or without suitable ventilation
- Do not use the appliance in temperature and humidity conditions outside of the limits specified for operation



DANGER

- Make sure that the characteristics of the mains power supply are adequate for the power ratings indicated in the table of technical specifications
- Power to the appliance must be turned on only after installation work has been completed
- The power line should be fitted upstream with a suitable device to protect against short-circuits and earth leakage and isolate the appliance from other equipment
- Use cables with double insulation, in accordance with the standards in force in the country concerned
- The appliance must be earthed.



INFORMATION!

The manufacturer is not liable for any damage caused by failure to earth the appliance.

6 Commissioning

6.1 Starting the Operation the First Time



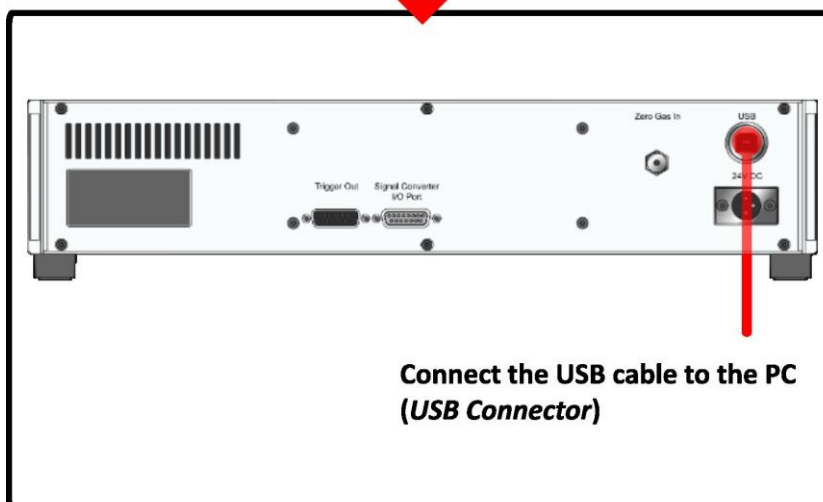
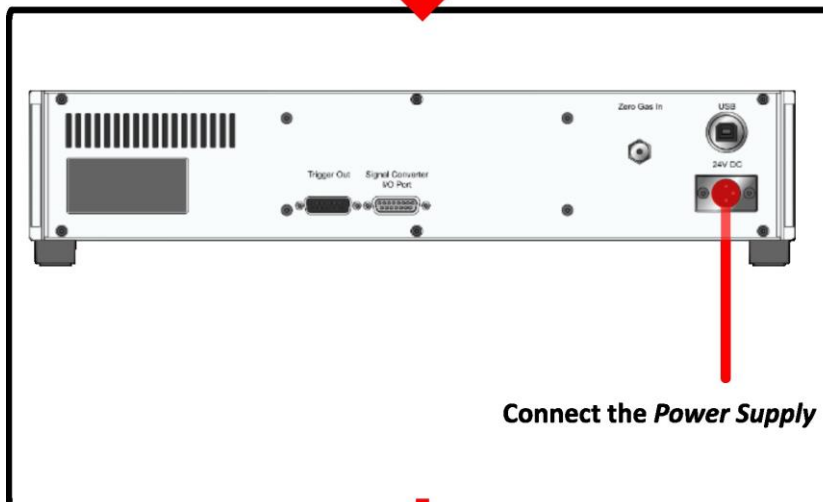
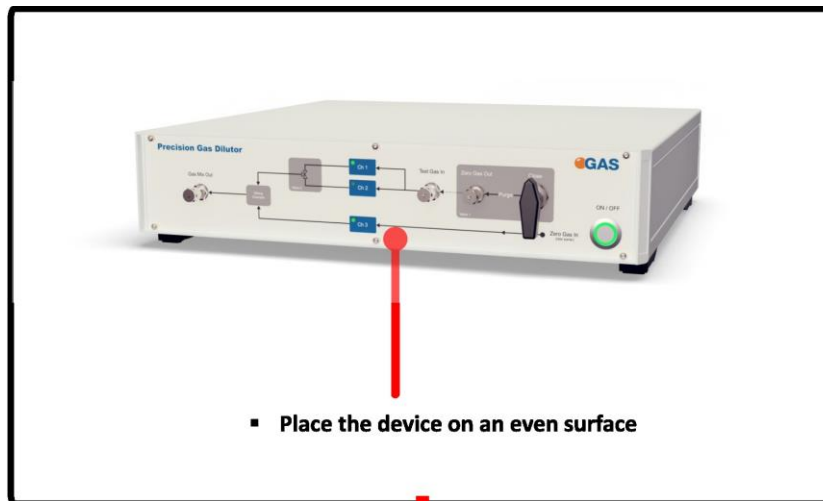
INFORMATION!

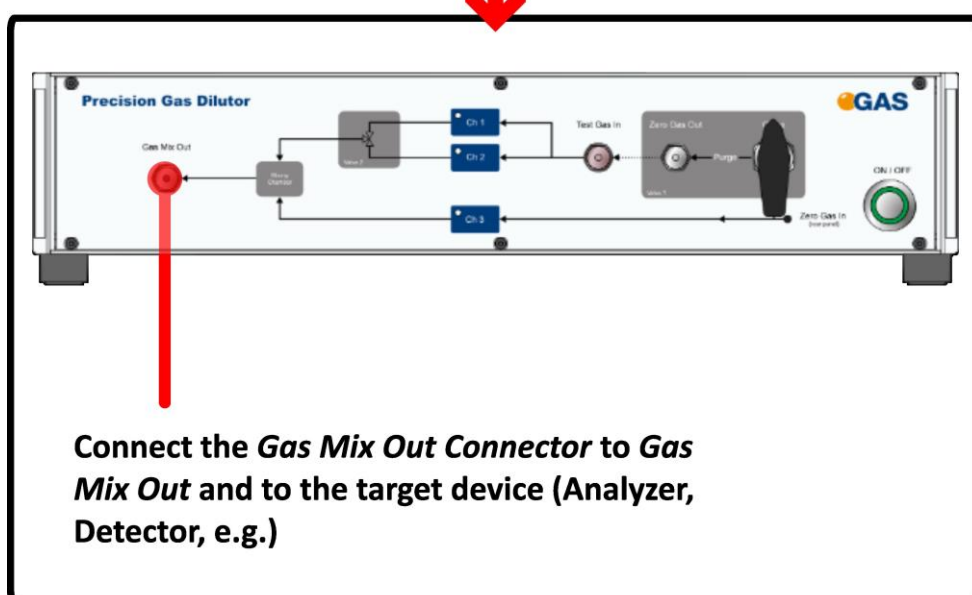
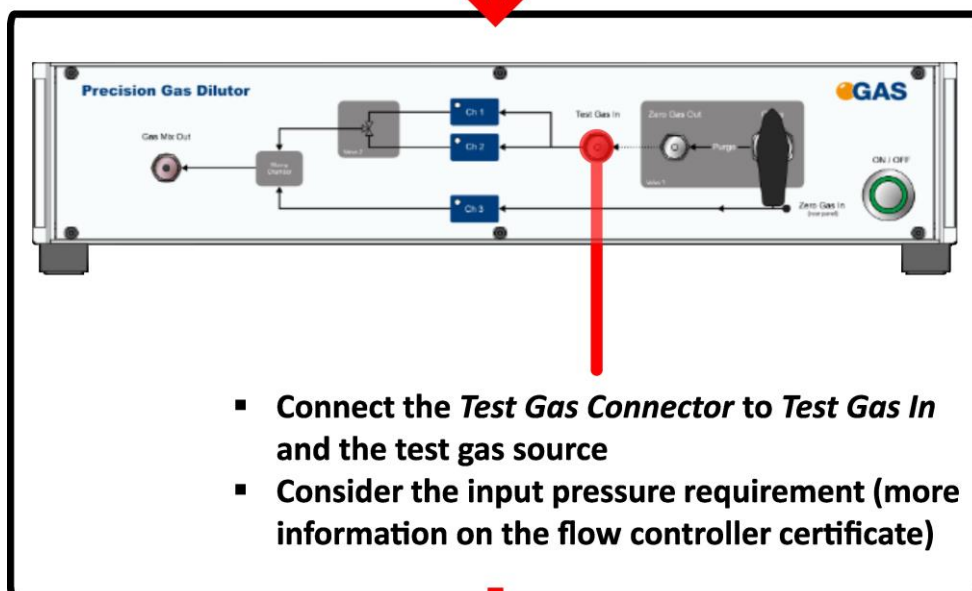
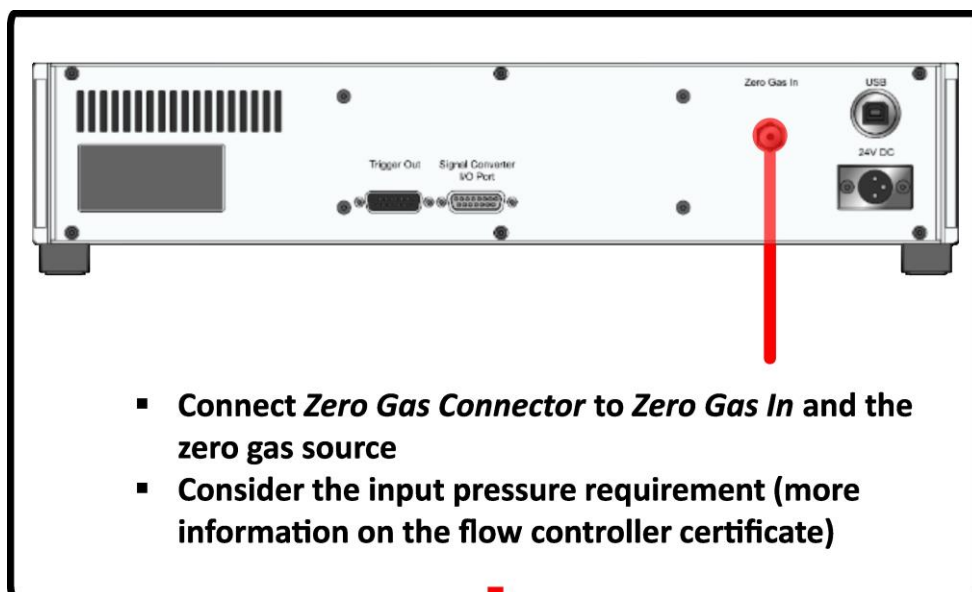
Before operating the Precision Gas Dilutor for the first time, proceed as follows:

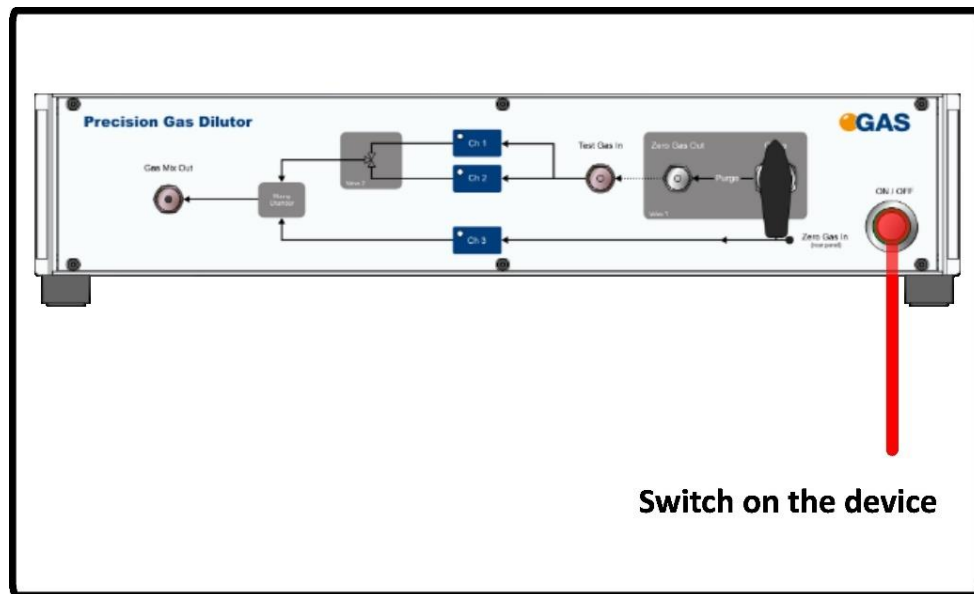
- Remove all caps on the gas sockets **(3,4,5,7)**

6.2 Hardware Installation and Handling – Step-by-Step

6.2.1 Connections

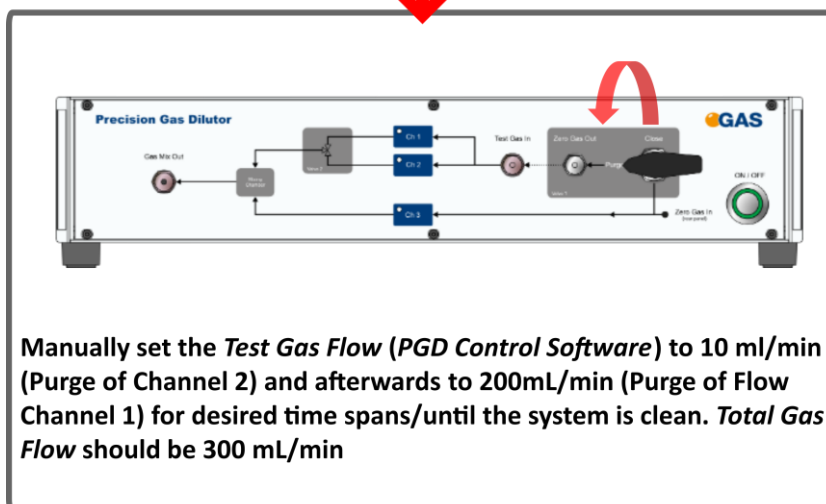
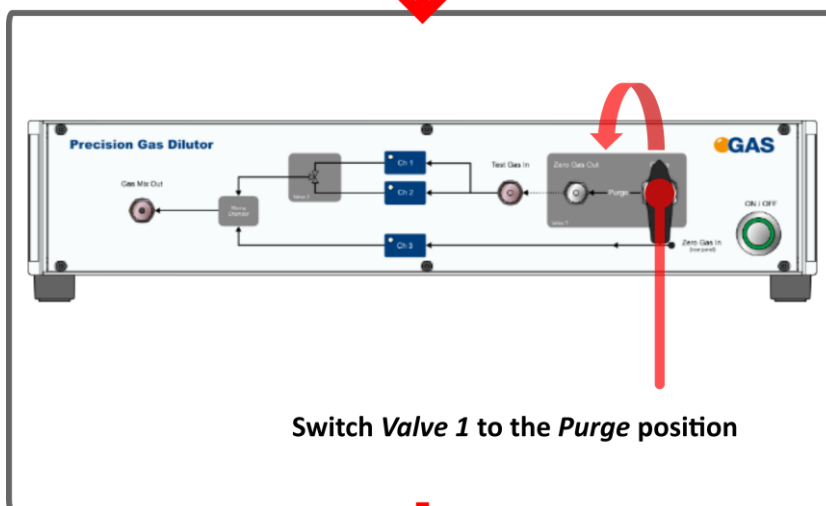
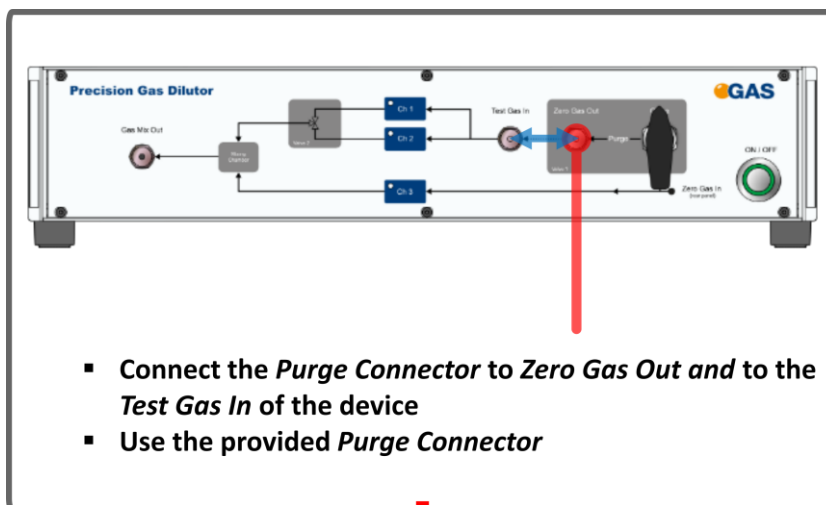


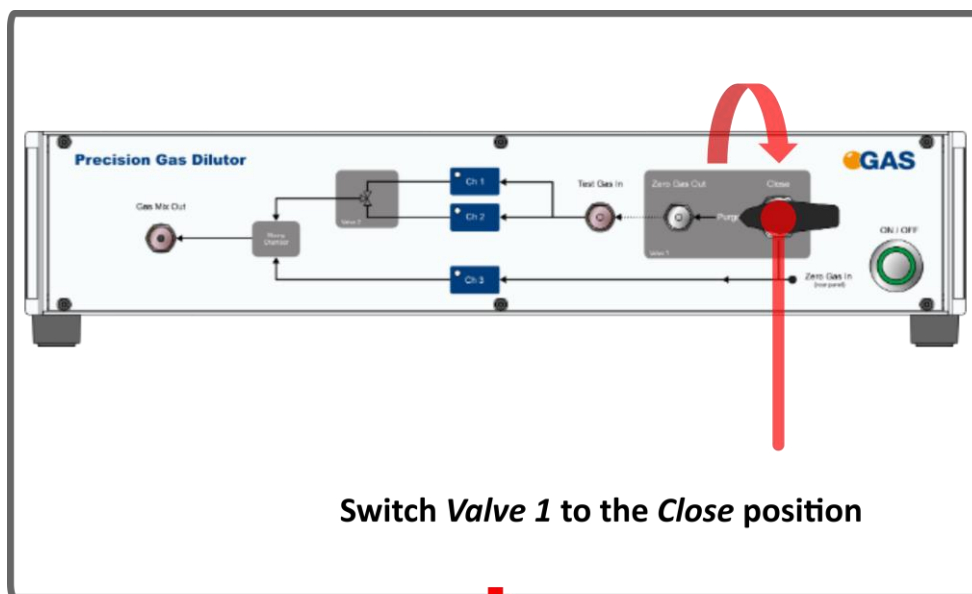




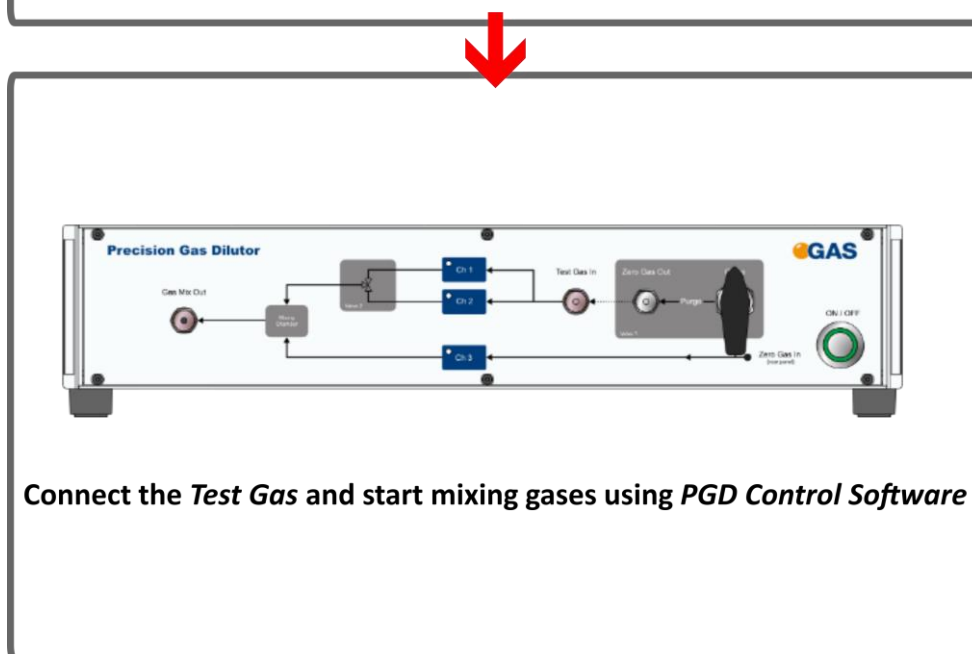
Precision Gas Dilutor – User Manual

6.2.2 Purge procedure





Switch *Valve 1* to the *Close* position



Connect the *Test Gas* and start mixing gases using *PGD Control Software*

6.3 Shutting Down



INFORMATION!

List of operations to be performed before powering off the PGD at the power switch:

- Disconnect the test gas source.
- Perform the Purge Procedure (Chapter 6.2.2)
- Depressurize the device by closing all connected pressure reducers (from test gas source and/or zero gas source), while the flows of Channel 1 and 3 are still running (vent)
- Afterwards the device can be switched off (1)

6.4 Returning the Appliance for Service and/or Repairs



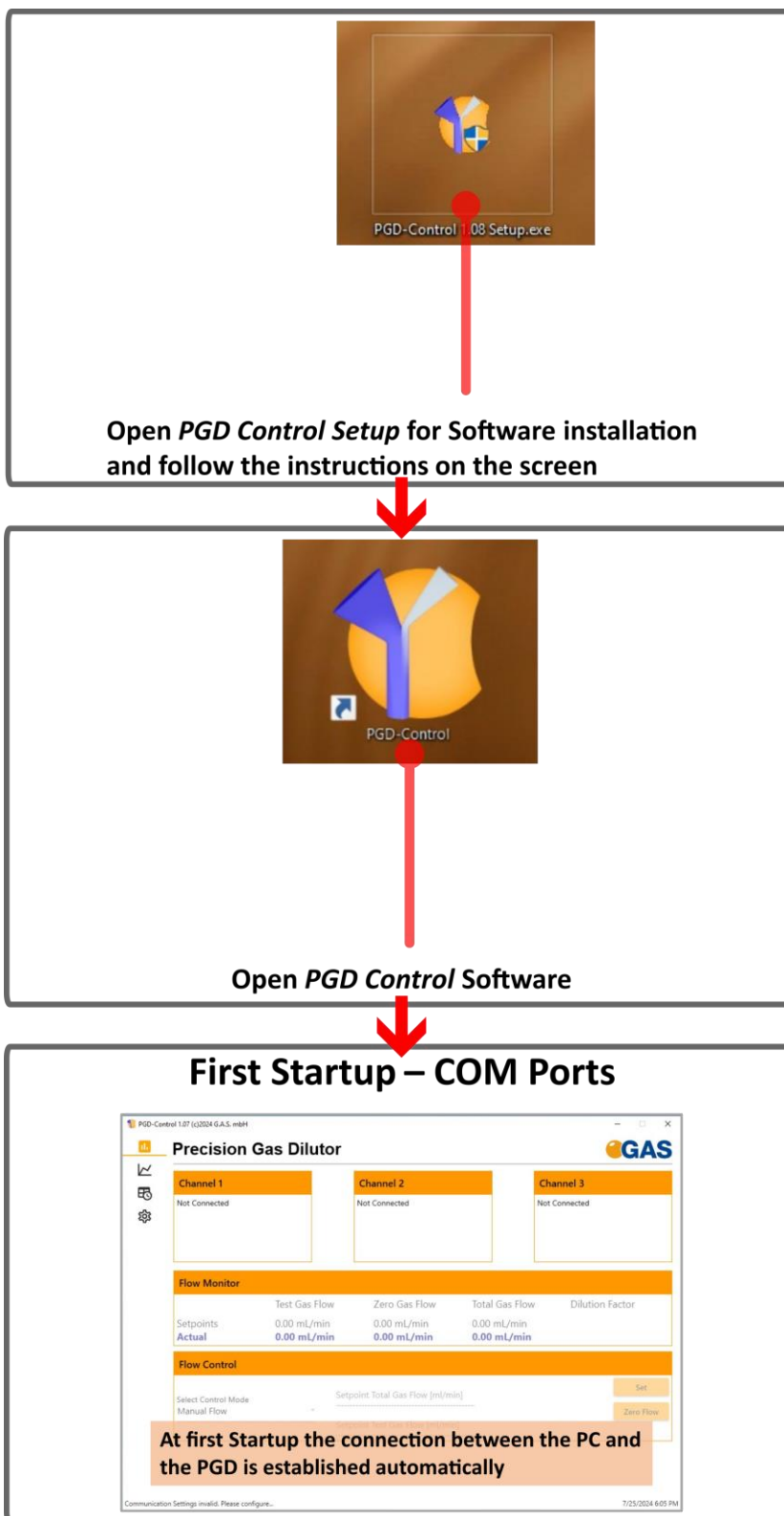
INFORMATION!

List of operations to be performed before packaging the appliance and sending it to service:

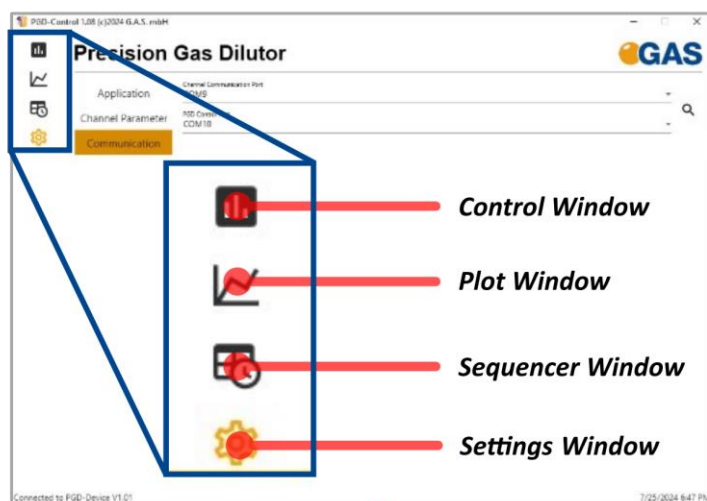
- In addition to the Shutting down procedure (Chapter 6.3):
- Perform the Purge Procedure (Chapter 6.2.2) thoroughly
- Make sure that Ch1, Ch2, Ch3 are purged and no test gas is left in the device (minimum 60 min each channel)
- Afterwards load the Flow Protocol *PGD Purge Fast Switching* (file located on the provided USB-Stick) and start the protocol. Within this Flow Protocol Ch1 and Ch2 are switched every few seconds while Ch3 is purged the whole time.
- There **must not** be any hazardous compounds within the PGD before return (if needed check via adequate detection systems)

7 PGD Control Software

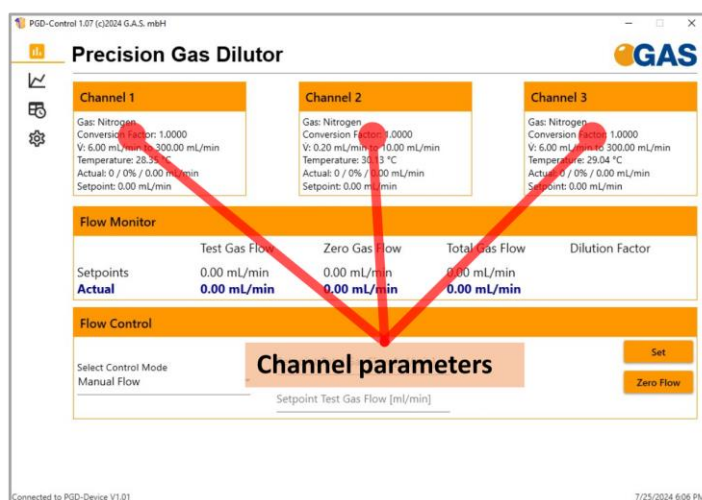
7.1 Step-by-Step Guide



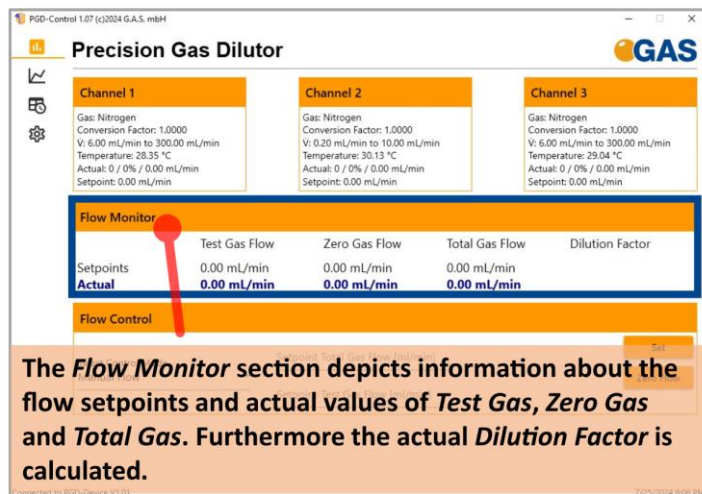
PGD Control Software - Windows



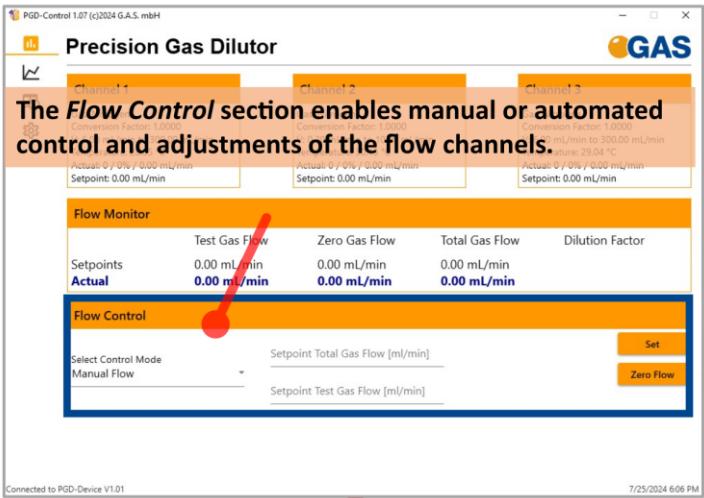
Control Window



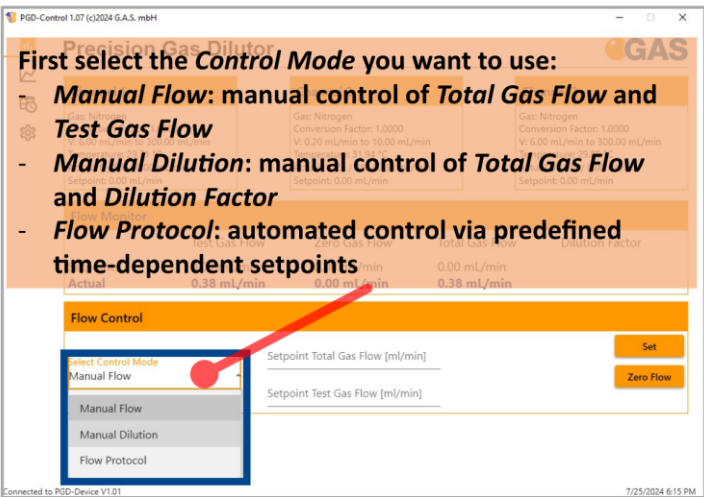
Control Window



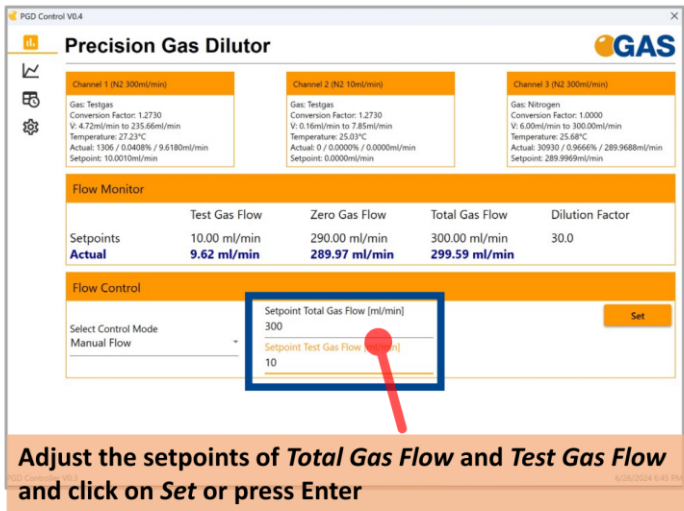
Control Window



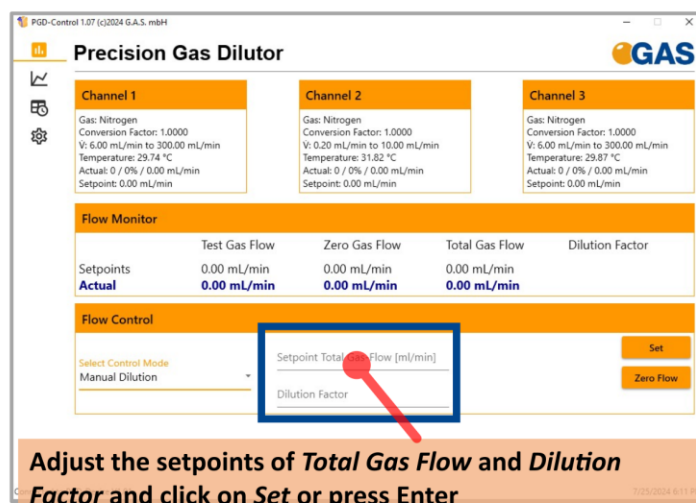
Control Window



Manual Flow Control Mode

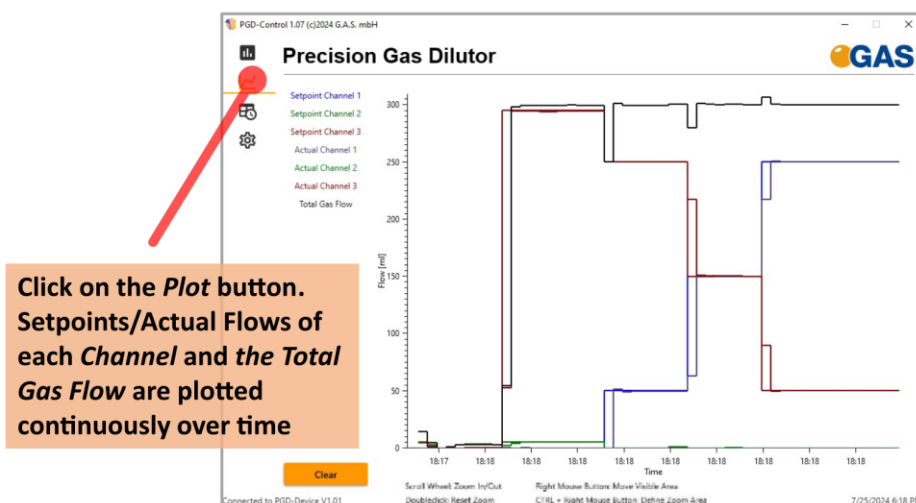


Manual Dilution Control Mode



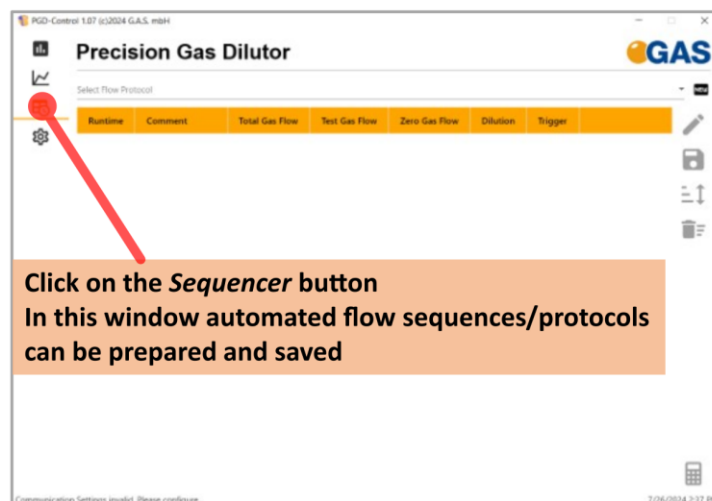
Adjust the setpoints of Total Gas Flow and Dilution Factor and click on Set or press Enter

Plot Window



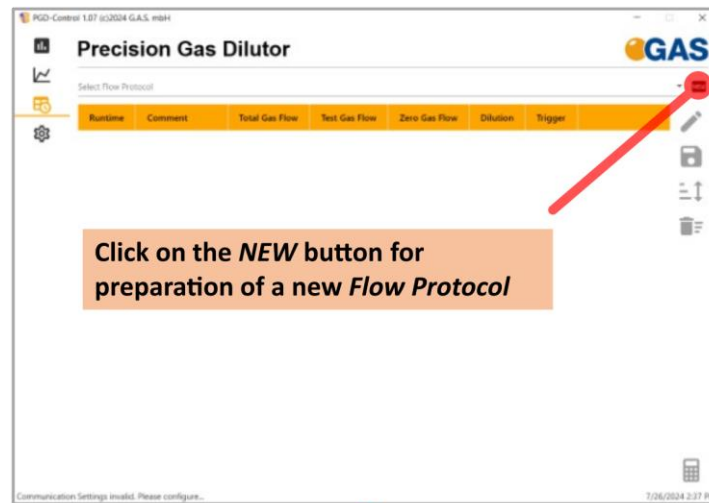
Click on the Plot button. Setpoints/Actual Flows of each Channel and the Total Gas Flow are plotted continuously over time

Sequencer Window



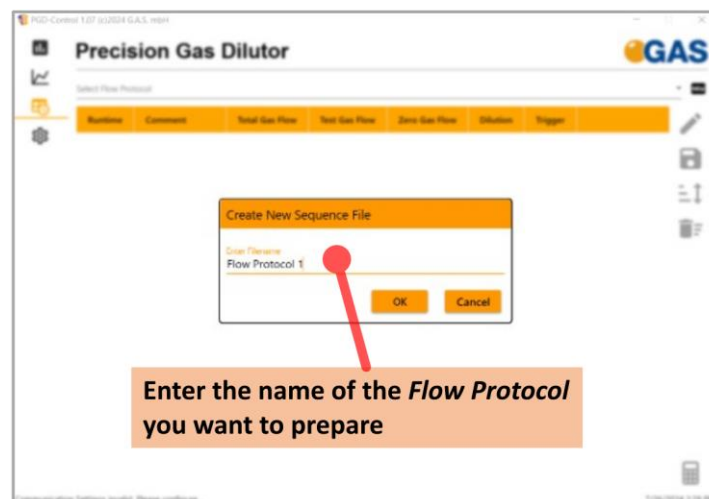
Click on the Sequencer button. In this window automated flow sequences/protocols can be prepared and saved

Sequencer Window



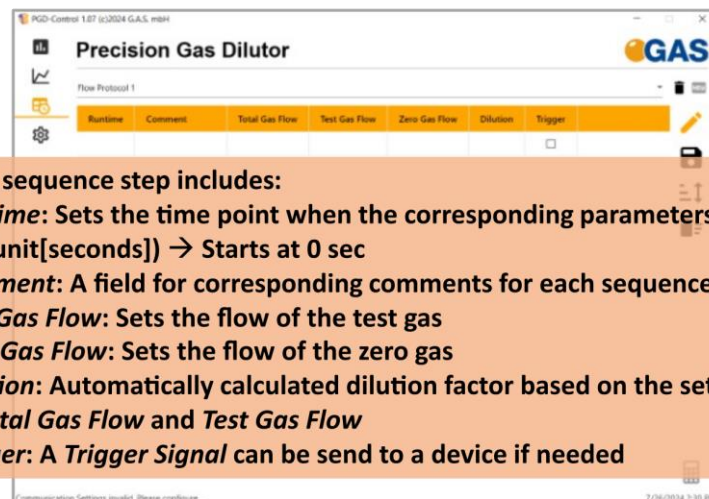
Click on the **NEW** button for preparation of a new *Flow Protocol*

Sequencer Window



Enter the name of the *Flow Protocol* you want to prepare

Sequencer Window



Each sequence step includes:

Runtime: Sets the time point when the corresponding parameters are set (unit[seconds]) → Starts at 0 sec

Comment: A field for corresponding comments for each sequence step

Test Gas Flow: Sets the flow of the test gas

Zero Gas Flow: Sets the flow of the zero gas

Dilution: Automatically calculated dilution factor based on the settings of *Total Gas Flow* and *Test Gas Flow*

Trigger: A *Trigger Signal* can be send to a device if needed

Sequencer Window

The screenshot shows the 'Precision Gas Dilutor' software interface. At the top, it says 'PGD-Control 1.08 (c)2024 G.A.S. mbH'. Below the title bar, there's a 'Flow Protocol 1' dropdown. A table with the following headers is visible: Runtime, Comment, Total Gas Flow, Test Gas Flow, Zero Gas Flow, Dilution, and Trigger. A red arrow points from the 'Test Gas Flow' header to a pencil icon in the top right corner of the table area. Another red arrow points from the pencil icon to a text box below.

Click on the *Pencil* Icon adds new rows to the sequence

Connected to PGD-Device V1.01 7/27/2024 12:37 PM

Sequencer Window

The screenshot shows the same software interface, but now the table has one row of data: 0, Step 1, 300, 0.2, 299.8, 1500, and an empty Trigger checkbox. A red arrow points from the 'Test Gas Flow' header to the pencil icon in the top right corner of the table area. Another red arrow points from the pencil icon to a text box below.

Now the desired values can be entered in each field...

Connected to PGD-Device V1.01 7/27/2024 12:38 PM

Sequencer Window

The screenshot shows the same software interface, but now the table has five rows of data:

Runtime	Comment	Total Gas Flow	Test Gas Flow	Zero Gas Flow	Dilution	Trigger
0	Step 1	300	0.2	299.8	1500	☐
10	Step 2	300	2	298	150	☐
20	Step 3	300	20	280	15	☐
30	Step 4	300	200	100	1.5	☐
40	Step 5	300	0	300	0	☐

A red arrow points from the 'Test Gas Flow' header to the pencil icon in the top right corner of the table area. Another red arrow points from the pencil icon to a text box below.

...until the *Flow Protocol/Sequence* is complete

Connected to PGD-Device V1.01 7/27/2024 12:40 PM

Sequencer Window

Click on the *Calculator Icon* will open the *Gas Consumption Calculator*. After adding the volume of the test gas bottle and the actual gas pressure (Pre-Pressure Test Gas Bottle) the actual volume of the gas bottle (Pre-Volume), the overall gas consumption of the *Flow Protocol*, the pressure of the test gas bottle after running the *Flow Protocol* and the gas volume within the bottle after running the *Flow Protocol* is calculated automatically

Gas Consumption

Pre-Protocol
Flow Protocol 1

Enter Volume Test Gas Bottle (L)
10

Enter Pre-Pressure Test Gas Bottle (bar)
150

Pre-Volume Test Gas Bottle (L) @ Year
1500.000 L

Consumption of Test Gas (L)
2.85 L

Post-Pressure Test Gas Bottle (bar)
149.715 bar

Post-Volume Test Gas Bottle (L)
1497.145 L

Close

Sequencer Window

Precision Gas Dilutor

Flow Protocol 1

Runtime Comment Total Gas Flow Test Gas Flow Zero Gas Flow Dilution Trigger

After saving the *Flow Protocol*...

Sequencer Window

Precision Gas Dilutor

Channel 1
Gas: Nitrogen
Conversion Factor: 1.0000
V: 6.00 mL/min to 300.00 mL/min
Temperature: 28.01 °C
Actual: 0 / 0% / 0.00 mL/min
Setpoint: 0.00 mL/min

Channel 2
Gas: Nitrogen
Conversion Factor: 1.0000
V: 0.20 mL/min to 10.00 mL/min
Temperature: 28.01 °C
Actual: 3 / 0% / 0.00 mL/min
Setpoint: 0.00 mL/min

Channel 3
Gas: Nitrogen
Conversion Factor: 1.0000
V: 0.00 mL/min to 300.00 mL/min
Temperature: 28.01 °C
Actual: 0 / 0% / 0.00 mL/min
Setpoint: 0.00 mL/min

Flow Monitor

	Test Gas Flow	Zero Gas Flow	Total Gas Flow	Dilution Factor
Setpoints	10.00 mL/min	290.00 mL/min	300.00 mL/min	30.00
Actual	10.00 mL/min	290.01 mL/min	300.01 mL/min	

Flow Control

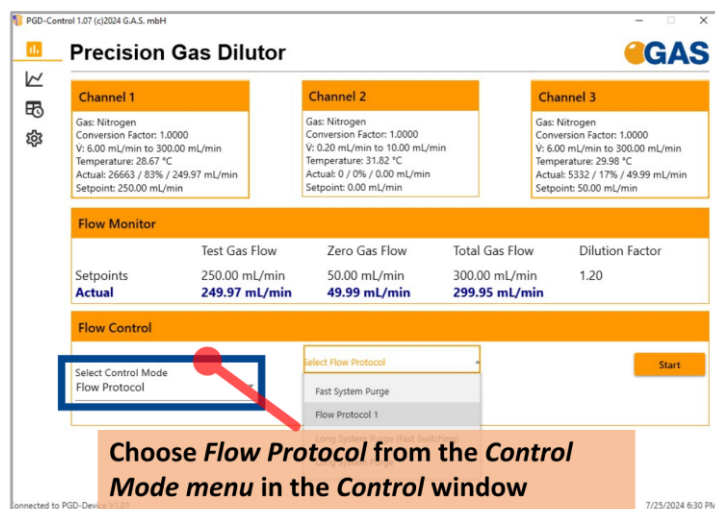
Select Control Mode
Flow Protocol

Select Flow Protocol
Fast System Purge
Flow Protocol 1
Long System Purge (Fast Switching)
Long System Purge

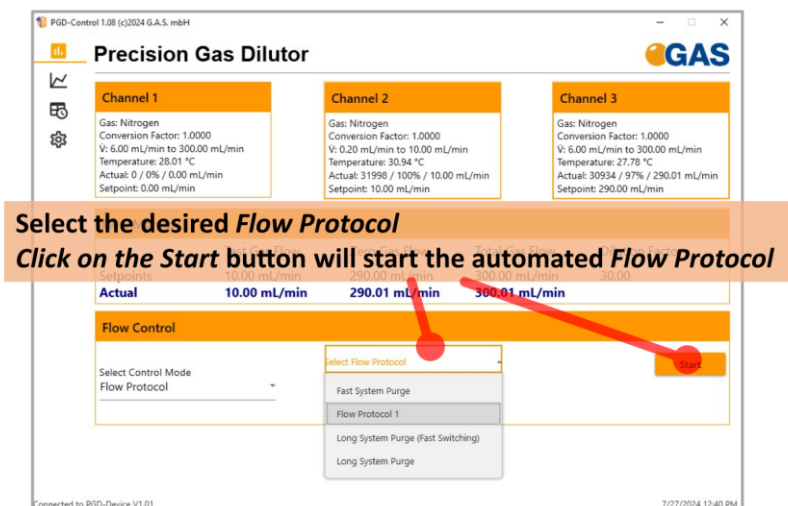
Start

...it is available in the *Flow Protocol List* and can be started in the *Control Mode Window*

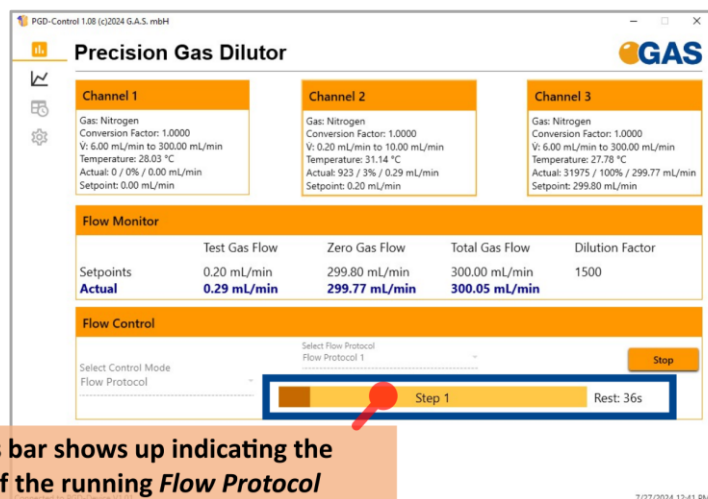
Start Flow Protocols



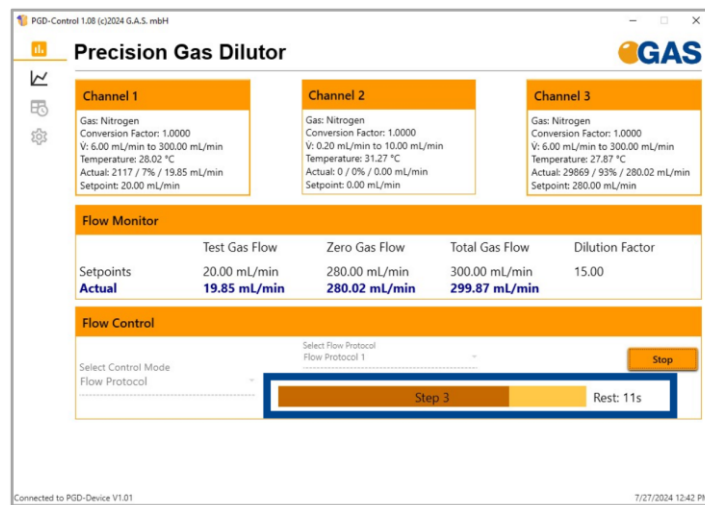
Start Flow Protocols



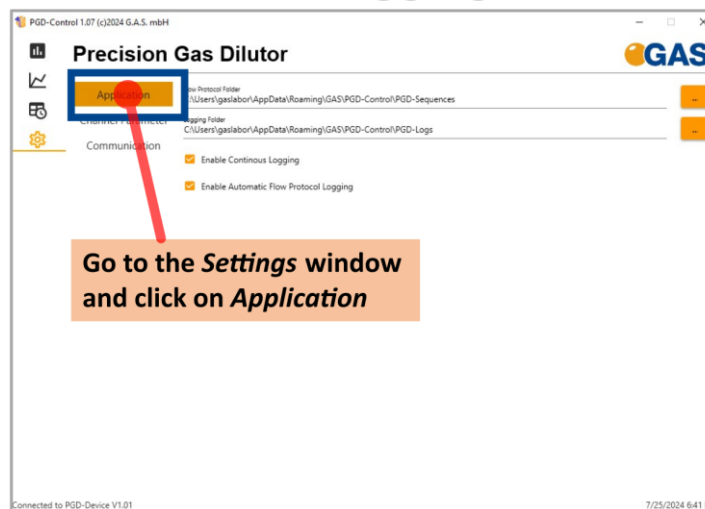
Start Flow Protocols



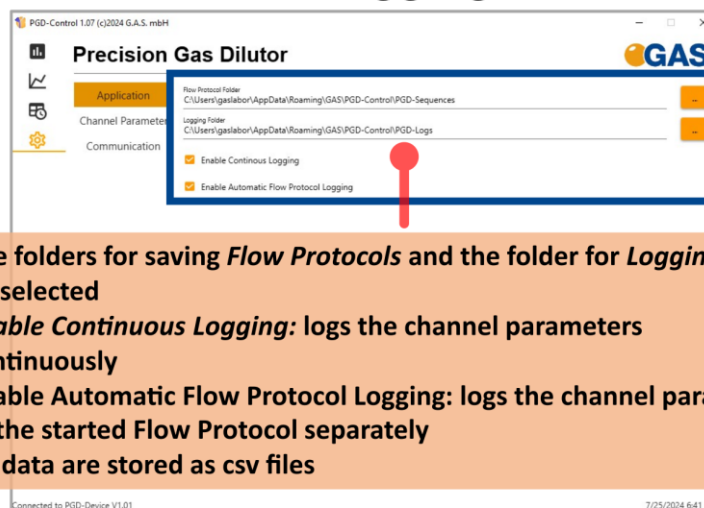
Start Flow Protocols



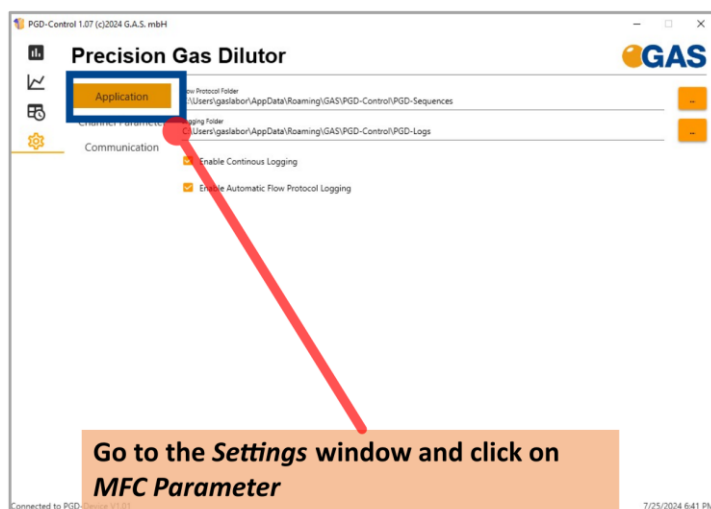
Data Logging



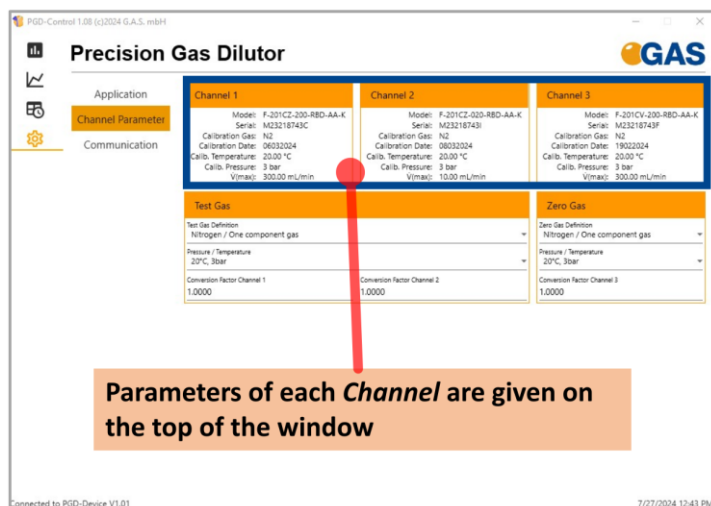
Data Logging



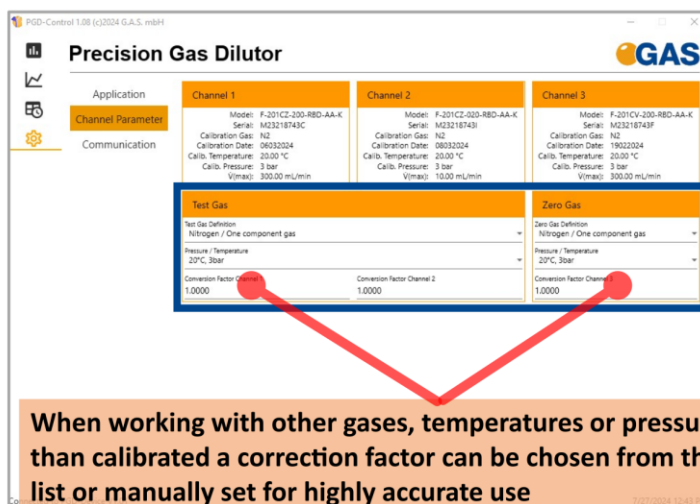
Channel Parameter



Channel Parameter



Channel Conversion Factors



Channel Conversion Factors

PGD-Control 1.08 (c)2024 G.A.S. mbH

Precision Gas Dilutor

Application
Channel Parameter
Communication

Channel 1	Channel 2	Channel 3
Model: F-201CZ-200-RBD-AA-K Serial: M23218743C Calibration Gas: N ₂ Calibration Date: 06032024 Calib. Temperature: 20.00 °C Calib. Pressure: 3 bar V(max): 300.00 mL/min	Model: F-201CZ-200-RBD-AA-K Serial: M23218743D Calibration Gas: N ₂ Calibration Date: 06032024 Calib. Temperature: 20.00 °C Calib. Pressure: 3 bar V(max): 10.00 mL/min	Model: F-201CV-200-RBD-AA-K Serial: M23218743F Calibration Gas: N ₂ Calibration Date: 19022024 Calib. Temperature: 20.00 °C Calib. Pressure: 3 bar V(max): 300.00 mL/min

Test Gas

Test Gas Definition
Nitrogen / One component gas
Manual Calculation
Nitrogen / One component gas
Methane / One component gas
Hydrogen / One component gas
Helium / One component gas
Biogas / 70% CH₄, 30% CO₂ (mol %)
Carbon dioxide / One component gas

Zero Gas

Zero Gas Definition
Nitrogen / One component gas
Pressure / Temperature
20°C, 3bar
Conversion Factor Channel 3
1.0000

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Drop down list of saved gases and the corresponding conversion factors of **Channel 1 and 2 (Test Gas Channels)**

Channel Conversion Factors

PGD-Control 1.08 (c)2024 G.A.S. mbH

Precision Gas Dilutor

Application
Channel Parameter
Communication

Channel 1	Channel 2	Channel 3
Model: F-201CZ-200-RBD-AA-K Serial: M23218743C Calibration Gas: N ₂ Calibration Date: 06032024 Calib. Temperature: 20.00 °C Calib. Pressure: 3 bar V(max): 300.00 mL/min	Model: F-201CZ-200-RBD-AA-K Serial: M23218743D Calibration Gas: N ₂ Calibration Date: 06032024 Calib. Temperature: 20.00 °C Calib. Pressure: 3 bar V(max): 10.00 mL/min	Model: F-201CV-200-RBD-AA-K Serial: M23218743F Calibration Gas: N ₂ Calibration Date: 19022024 Calib. Temperature: 20.00 °C Calib. Pressure: 3 bar V(max): 300.00 mL/min

Test Gas

Test Gas Definition
Nitrogen / One component gas
Manual Calculation
Nitrogen / One component gas
Methane / One component gas
Hydrogen / One component gas
Helium / One component gas
Biogas / 70% CH₄, 30% CO₂ (mol %)
Carbon dioxide / One component gas

Zero Gas

Zero Gas Definition
Nitrogen / One component gas
Pressure / Temperature
20°C, 3bar
Conversion Factor Channel 1
1.0000
Conversion Factor Channel 2
1.0000
Conversion Factor Channel 3
1.0000

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Drop down list of saved gases and the corresponding conversion factors of **Channel 3 (Zero Gas Channel)**

Channel Conversion Factors



For calculation of conversion factors:

visit: <https://www.fluidat.com>

Channel Conversion Factors



Go to Conversion factor → Gas Conversion factor

Channel Conversion Factors

GAS CONVERSION FACTOR CALCULATIONS

Calculate the conversion factor from one gas to another. For the definition of the theoretical conversion factor for a target fluid, see [below](#).

Fluid from		Fluid to	
Fluid:	N2 ("Nitrogen")	Fluid:	He ("Helium")
Phase:	Gas	Phase:	Gas
Flow:	300 mln/min	Flow:	426.2 mln/min
0.00 °C and 1013.25 hPa (a)		0.00 °C and 1013.25 hPa (a)	
Pressure:	0 bar (a)	Pressure:	0 bar (a)
Temperature:	20 °C	Temperature:	20 °C
Density (n):	1.250 kg/m ³	Density (n):	0.1785 kg/m ³
Heat capacity (cal):	1042 J/kg.K	Heat capacity (cal):	5196 J/kg.K
Viscosity:	1.746E-05 Pa.s	Viscosity:	1.997E-05 Pa.s
Thermal cond. (cal):	0.02838 W/m.K	Thermal cond. (cal):	0.1672 W/m.K
Instrument model 1):	F-201CV		

Calculate

On the left side of the page the initial parameters of the *Channel* have to be set

Channel Conversion Factors

GAS CONVERSION FACTOR CALCULATIONS

Calculate the conversion factor from one gas to another. For the definition of the theoretical conversion factor for a target fluid, see [below](#).

Fluid from		Fluid to	
Fluid:	N2 ("Nitrogen")	Fluid:	He ("Helium")
Phase:	Gas	Phase:	Gas
Flow:	300 mln/min	Flow:	426.2 mln/min
0.00 °C and 1013.25 hPa (a)		0.00 °C and 1013.25 hPa (a)	
Pressure:	0 bar (a)	Pressure:	0 bar (a)
Temperature:	20 °C	Temperature:	20 °C
Density (n):	1.250 kg/m ³	Density (n):	0.1785 kg/m ³
Heat capacity (cal):	1042 J/kg.K	Heat capacity (cal):	5196 J/kg.K
Viscosity:	1.746E-05 Pa.s	Viscosity:	1.997E-05 Pa.s
Thermal cond. (cal):	0.02838 W/m.K	Thermal cond. (cal):	0.1672 W/m.K
Instrument model 1):	F-201CV		

Choose the initial fluid, flow, unit, output pressure, temperature and model type of the *Channel* (all parameters can be found in the provided certificate)

Channel Conversion Factors

GAS CONVERSION FACTOR CALCULATIONS  N2 ("Nitrogen") >

Calculate the conversion factor from one gas to another. For the definition of the theoretical conversion factor for a target fluid, see [below](#).

Fluid from		Fluid to	
Fluid:	N2 ("Nitrogen")	Fluid:	He ("Helium")
Phase:	Gas	Phase:	Gas
Flow:	300 min/min 0.00 °C and 1013.25 hPa (a)	426.2 min/min 0.00 °C and 1013.25 hPa (a)	
Pressure:	0 bar (a)	0 bar (a)	
Temperature:	20 °C	20 °C	
Density (n):	1.250 kg/m ³	0.1785 kg/m ³	
Heat capacity (cal):	1042 J/kg.K	5196 J/kg.K	
Viscosity:	1.746E-05 Pa.s	1.997E-05 Pa.s	
Thermal cond. (cal):	0.02838 W/m.K	0.1672 W/m.K	
Instrument model ¹⁾ :	F-201CV		

Calculate

On the right side of the page the target parameters of the *Channel* have to be set

Channel Conversion Factors

GAS CONVERSION FACTOR CALCULATIONS  N2 ("Nitrogen") >

Calculate the conversion factor from one gas to another. For the definition of the theoretical conversion factor for a target fluid, see [below](#).

Fluid from		Fluid to	
Fluid:	N2 ("Nitrogen")	Fluid:	He ("Helium")
Phase:	Gas	Phase:	Gas
Flow:	300 min/min 0.00 °C and 1013.25 hPa (a)	426.2 min/min 0.00 °C and 1013.25 hPa (a)	
Pressure:	0 bar (a)	0 bar (a)	
Temperature:	20 °C	20 °C	
Density (n):	1.250 kg/m ³	0.1785 kg/m ³	
Heat capacity (cal):	1042 J/kg.K	5196 J/kg.K	
Viscosity:	1.746E-05 Pa.s	1.997E-05 Pa.s	
Thermal cond. (cal):	0.02838 W/m.K	0.1672 W/m.K	
Instrument model ¹⁾ :	F-201CV		

Calculate

After all parameters have been set click on the *Calculate* button

Channel Conversion Factors

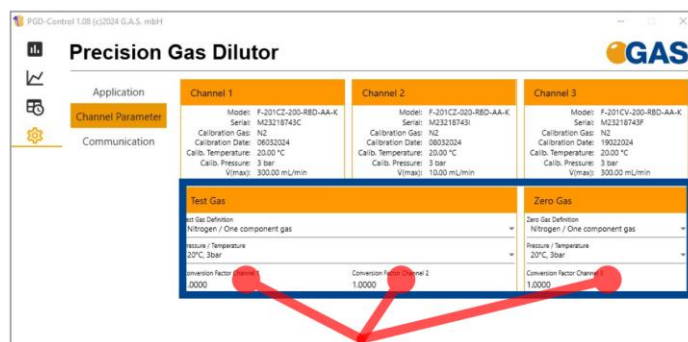
Calculate

¹⁾ The model selected determines the calculation method, however, the calculation routines do **not** check whether the model is suitable for the entered flow range and process conditions or not.

	N2 [mln/min]	He [mln/min]	Conversion factor
10	30.00	42.29	0.7094
25%	75.00	106.3	0.7056
50%	150.0	213.8	0.7015
75%	225.0	321.2	0.7005
100%	300.0	426.2	0.7039

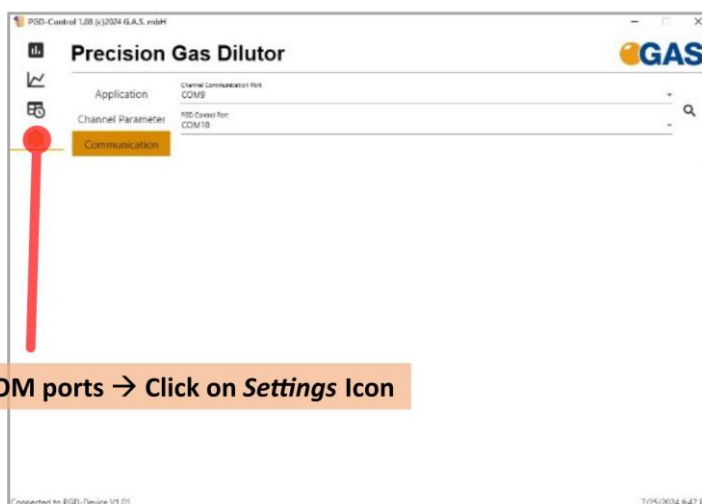
Calculate the mean value of the depicted *Conversion Factors*

Channel Conversion Factors



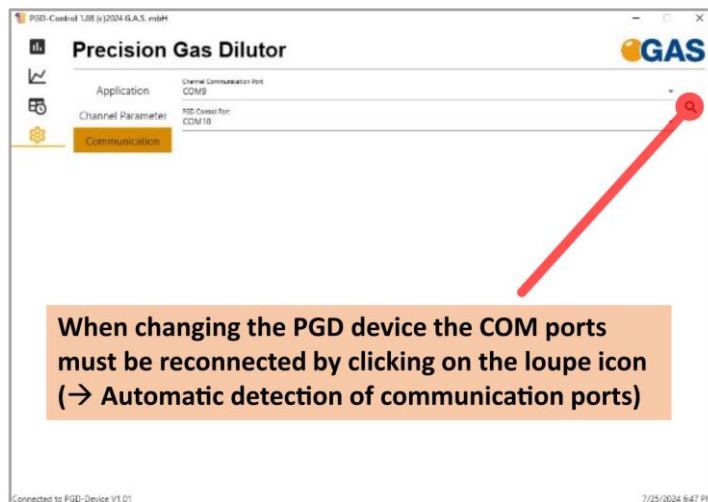
Enter the calculated *Conversion Factor(s)*. Now the *Channel* will automatically include the *Conversion Factor*. The *Conversion Factors* can easily be changed back and forth by this procedure. Furthermore the *Test Gas Channels* and the *Zero Gas Channel Conversion Factors* can differ if needed.

COM Ports



To check the COM ports → Click on *Settings* Icon

COM Ports



When changing the PGD device the COM ports must be reconnected by clicking on the loupe icon (→ Automatic detection of communication ports)

7.2 Data Logging Format

Data are logged as csv files.

Column Header	Description
Date	Date of recording
Time	Time of recording / seconds
spZeroGas	Setpoint Zero Gas Flow / mL/min
spTestGas	Setpoint Test Gas Flow / mL/min
ch(n)sp	Setpoint of Channel n / mL/min
ch(n)act	Actual value of Channel n / mL/min
ch(n)temp	Temperature of Channel n
ch(n)cf	Conversion Factor of Channel n

n = Channel index = 1 or 2 or 3

8 Maintenance

Natural aging and the wear of certain components of the equipment require regular cleaning and maintenance. With proper care and maintenance, the Precision Gas Dilutor should provide years of trouble-free operation. There are no adjustments to be made. There are routine service operations as described below.



INFORMATION!

Other maintenance of the equipment than mentioned in this manual must be carried out by G.A.S. or personnel authorized by G.A.S.

Please contact G.A.S. 6-8 weeks in advance to optimize the turn-around time!

8.1 Routine Maintenance of the Customer

Operation	Description	Interval
Purge procedure	Depending on the substances and substance concentrations introduced into the device the system should be purged regularly using an inert gas species, such as N ₂ 5.0.	Depends on the introduced substance properties and concentrations and also on the run time of the system. When used 24/7 the system should be purged once per week – once per month.

Routine Maintenance by G.A.S.

Operation	Description	Interval
System Check-up and Recalibration	- Regular check of all device parts - Leak-check - Flow check (accuracy, reproducibility) of flow channels - Recalibration of flow channels - ...	When used with gases in quality 5.0 or higher: Once per year Lower gas quality can result in shorter maintenance intervalls

9 Appendix

9.1 Technical Data Precision Gas Dilutor

Model: Precision Gas Dilutor	
Channels (Ch)	
Inlet pressure (Calibrated)	3.0 bar (g)
Outlet pressure	0 bar (g)
Flow Accuracy	± (0.5 % Reading + 0.1 % Full Scale)
Turn down ratio	1:50
Ch1	Test Gas Channel
Ch2	Test Gas Channel
Ch3	Zero Gas Channel
Dynamic range (Flow rate Ch1) @ N ₂ , 3 bar (g), 20 °C	6 - 300 ml/min (hardware can be adjusted)
Dynamic range (Flow rate Ch2) @ N ₂ , 3 bar (g), 20 °C	0.2 - 10 mL/min (hardware can be adjusted)
Dynamic range (Flow rate Ch3) @ N ₂ , 3 bar (g), 20 °C	6 - 300 ml/min (hardware can be adjusted)

Automated Channel Switch	Setpoint (Test Gas Flow) > Maximum Flow (Ch2) → Switch to Ch1 and vice versa
Communication	
USB	2.0 Type B connector
General data	
Power Supply	Input line voltage: Grounded AC, 85 to 264V Input line frequency: 47-63 Hz Input current: < 2.8 A Output voltage: 24 VDC Output current: 9.2 A internal Max Power: < 221 Watt
Power Consumption	< 30 Watt
Net weight	~8 kg
Dimensions	Standard 19" Rack, 2HU L x W x H = 475.08 x 484.9 x 103.3 mm
Connections	
Gas ports (inlet/outlet)	3 mm
Operating conditions	
Temperature	5-50°C
Humidity (max, non-condensing)	80 % at 25°C
IP rating	IP20

9.2 Troubleshooting



INFORMATION!

This chapter is a collection of possible practical problems and serves as a guide for making an initial assessment. It makes no claim to be complete.

Problem	Device does not start
Possible Cause	Problem with the electrical power supply
Action	Check the current power supply and restart the system. If that still does not help contact the G.A.S. service hotline.
Problem	No communication with PGD Control
Possible Cause	USB cable not connected
Action	Check USB cable and USB cable connection between PGD and PC / Restart PGD Control
Problem	Channel Status LED turns red
Possible Cause	Actual flow is not equal to set point
Action	Check the gas source pressure. Flow channels need a certain input pressure to work properly. Check if there is any flow resistance on the output of the device.