

Instruction Manual GDX_SO2

Gas dosing unit for sulphur dioxide

Intended use : gas dosing of sulphur dioxide into test chambers according to DIN EN ISO 6988 / DIN 50018.
The GDX_SO2 has to be operated only by experienced staff, who are entitled to handle with hazardous gases.

Abbreviations and icons :



: Information

SO2 : sulphur dioxide, SO₂



: ATTENTION – hazardous gas.



: Danger - important notices that have to be observed.

Safety hints

When operating GDX_SO2 the safety data sheet for sulphur dioxide has to be observed !



Before opening the housing disconnect mains !.

Limited Warranty

QCAL Messtechnik GmbH warrants that the GDX_SO2 and component parts are free from defects in workmanship and materials under normal and proper use as specified by the Instruction Manual provided with this product. The term of the warranty begins on the date of delivery to the buyer and extends for 2 YEARS.

The warranty does not cover claims whatsoever due to abuse, misuse, neglect alteration or accident, or use in applications for which the the GDX_SO2 were either not designed or not approved by QCAL Messtechnik GmbH, or due to the buyer's failure to maintain normal maintenance, improper selection or misapplication. This warranty shall further be void if the operating and other instructions as provided with the Instruction Manual are not strictly complied with.

Buyer shall not be entitled to recover from QCAL Messtechnik GmbH any consequential damages or loss of use, time, profits, income, or other incidental damages.

issue : 28.01.2015

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Installation – startup operations



Assembly of gas tubings have to be performed under a hood ! – according to fig1.



The SO₂ gas container has to be installed in an **upright position** – shut-off valve on top. The SO₂ inside the gas container is liquid.



For tubing installations using SWAGELOK® tube fittings the instructions from manufacturer Swagelok have to be observed. A pressure regulator is not necessary for max. 32°C ambient temperature.



If the GDX_SO₂ is connected directly at the SO₂ gas container it has to be made sure that the temperature of the gas container is lower than the ambient temperature of the inlet tubings and the GDX_SO₂ to avoid condensation of SO₂ inside the tubings and the GDX_SO₂.

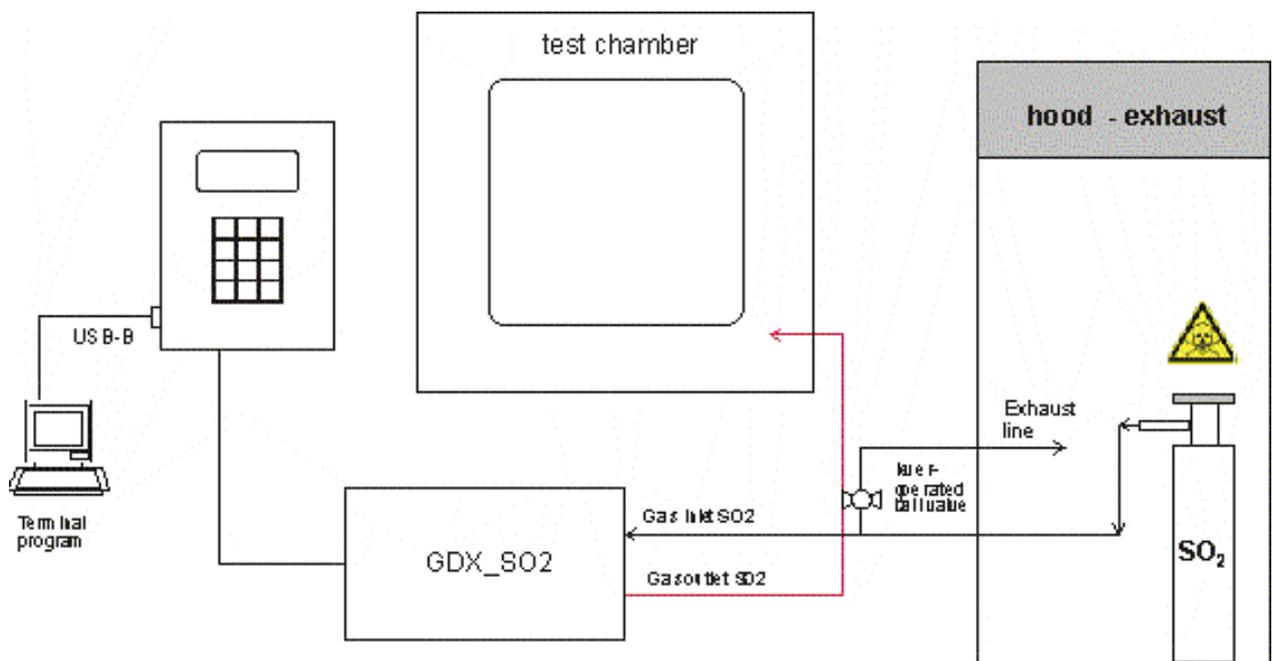


Fig. 1: Setup GDX_SO₂

1.  Install the exhaust tubing into a hood according to fig.1. Close the lever-operated ball valve and the cap.
2. Install the Swagelok® fitting at the inlet GDX_SO2.

3.  **Important :** Fix the T - fitting as shown :



4. Apply pressure by opening the gas container valve and close again after some seconds.

5.  **Adjust the inlet pressure to 0.5 ... 1 bar(g)**
6. Check for leaks at the connections by using leak detection liquid.
7. Connect the outlet SO2 tubing (1/8 inch OD) to the test chamber .
8. Perform a test by dosing a small amount of SO2 (e.g. 30 cm³)



If the equipment is not used : close the gas container valves.

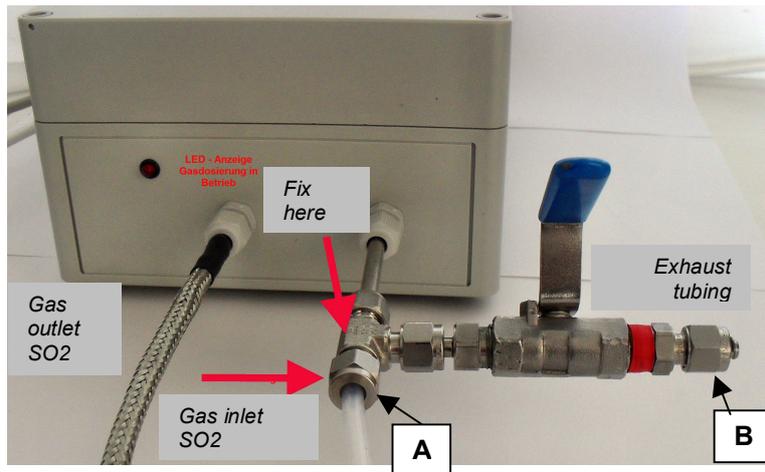


Fig. 2: gas connections GDX_SO2

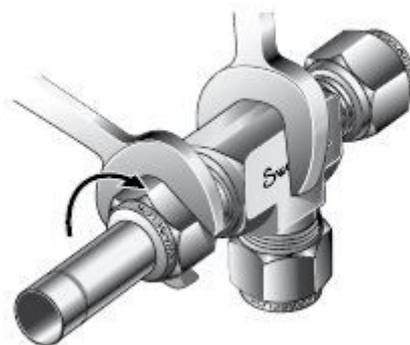
Gas connections :

Gas inlet :

- A) Swagelok 6mm OD union tee (SS 316Ti) for connection to gas cylinder or pressure reducer SO2.
- B) Exhaust tubing 6 mm OD for flushing / pressure release (e.g. FEP, PTFE, PFA , OD = 6 mm).



When assembling the fittings : secure the union tee with an open-end wrench (13 mm).



If the exhaust tubing is not installed the cap must be installed for safety as shown above.

Gas outlet :

PFA tubing 1/8 inch OD, 1/16 inch ID with protection tube. The outlet PFA tubing has to be connected to an appropriate adapter for the test chamber gas inlet. Maximum temperature : 250 °C.
If necessary the tubing inside the test chamber can be extended according to fig. 3

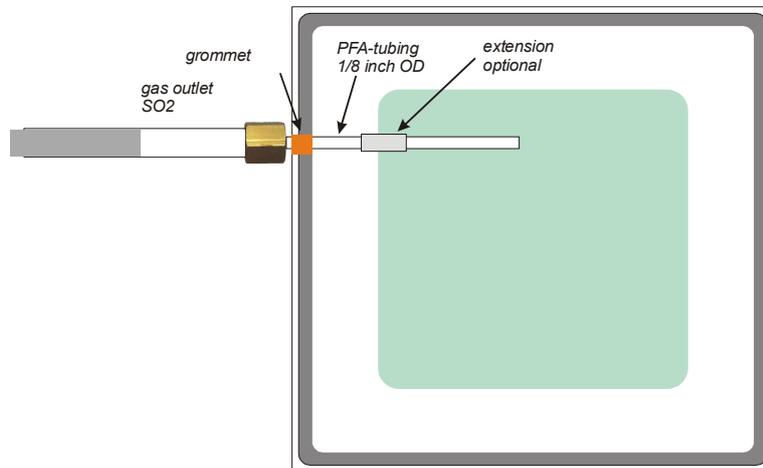


Fig. 3: gas outlet SO2

Electric connection :

Mains cable : 88 ~ 264 VAC, 47 ~ 63 Hz - 230 V AC, 1.5 mm².
Fuse : 1 A. Operational readiness is indicated by a LED.

External signal for START dosing SO2 :

The 3 – pin female connector D has to be connected to the controller of the test cabinet. The dosing is started by a 24 V DC signal



Pin assignment : Pin 2 : + 24 V DC / Pin 3 : GND

Software installation - Terminal program :

The software has to be installed as usual by executing setup.exe. The program can be downloaded from the directory : setup/english – setup.exe.

The software needs a driver for the USB – interface (virtual COM – port driver). The driver can be downloaded from the directory : driver.

Connect the GDX_SO2 (USB – A – port under the black cover 'Connect PC') with an USB – B – port at the PC..



The calibration data and other details can be found in the directory info.

Operation

Menu (operation panel) - keypad

The * key is used for confirmation ,O.K.', the # key or 2 key is used for cancellation 'ESC'.

1 – START dosing SO₂ : starts dosing of SO₂ the preset volume SO₂. The red LED next to the gas outlet shows dosing operation (outlet valve open).

2 - 2(#): STOP : Cancellation of dosing process - alternatively # can be used.

3 – Set volume SO₂ : this menu item is for setting the volume SO₂, unit : cm³ (mL).  For the input 4 digits have to be keyed in (with leading zeros, e.g. : 0200 for 200 cm³ SO₂). The volume is referred to the reference conditions (standard : 20 °C, 1000 hPa). The reference conditions can be changed by the terminal program.

4 – Connection -> PC : for connection to the PC Terminal program via USB cable. Functions :
a) Setting of dosing volume SO₂ in cm³ (mL). This can also be performed by keyboard input - Menu 3.

b) Setting of refernce data for temperature in °C and pressure (ambient pressure) in hPa.  The ambient pressure must be set as absolute pressure - not related to sea level.



For data recording it is not necessary to select this menu point.

5 – Calibration : for this menu item it is mandatory to connect the GDX_SO₂ to a PC.

5.1) The pressure SO₂ a) has to be adjusted if a pressure regulator is used or b) is applied to the GDX_SO₂ directly (usage without pressure regulator). In this case the pressure only depends on the temperature of the gas container (vapour pressure SO₂ – see diagramm).

5.2) Dosing is started : * . Inlet and outlet valve are opened

5.3) During the dosing the data for pressure and timersignal are sent to the Terminal program. From these data the calibration data are calculated.

6 – Leaktest : this menu item is for performing a rough leaktests of the components inside the GDX_SO₂. First step : pressure is applied to the unit by opening the inlet valve. Outlet valve is closed. Pressure (at start) is measured and displayed. Second step : inlet valve is closed. Pressure is

measured and displayed until the GDX_SO₂ is switched off.  If the pressure drops more than 50 digits per hour the GDX_SO₂ has to be checked precisely for leakage.

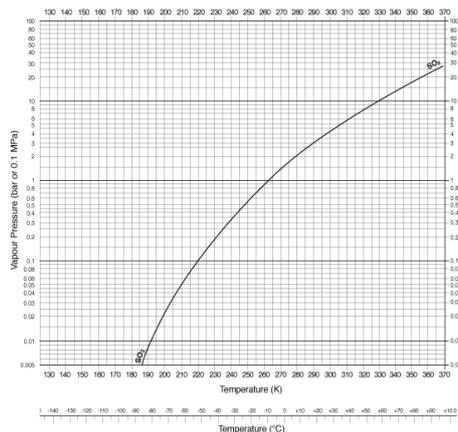


Diagram 1 : vapour pressure SO₂ (Absolut in bar)

Normal Operation :

- Switch on the GDX_SO₂ . Setpoint for dosing volume and reference data for pressure and temperature are displayed.

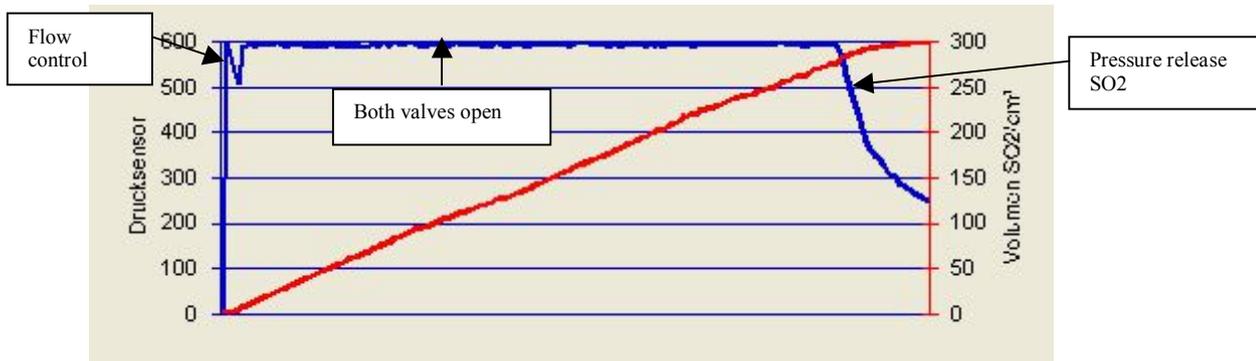


- OPTIONAL : connect to PC for data storage and start Terminal program.

- **OPTIONAL** : if necessary set (change) the dosing volume SO2 (**Menu 3**) : Vol(mL) : 4 digits
 - example :
0 1 0 0 for 100 mL SO2 (100 cm³ SO2 at reference conditions).
 Confirm (*). Diese Einstellung wird im internen Speicher gespeichert und ist auch nach dem Ausschalten noch eingestellt (EEPROM).



- **START dosing (Menu 1) or by external Start signal** : - the GDX_SO2 checks inlet pressure. If pressure is too low : Error message : Low pressure. Possible reasons : gas container is closed – gas container is not connected – gas container is empty.
- only when started by MENU - 1 : Confirm dosing volume and start of dosing : *.
- After confirmation the outlet valve is opened – the red LED at gas outlet is ON. The flow SO2 is calculated from pressure every 0.2 s. The display shows the actual volume, the target volume (Vtotal) and the pressure SO2 (Press. / bar).
- The dosing can be stopped anytime by : : # or 2
- The dosing proceeds in 5 steps :
 1. Pressure check – inlet valve open – outlet valve closed
 2. Flow check of SO2 – inlet valve closed – outlet valve closed – dosing is started. The pressure inside the unit should drop.
 3. Normal dosing – inlet and outlet valves are open.
 4. When the total volume has reached the (target volume - 8 cm³) : the inlet valve is closed – outlet valve is still open. The SO2 pressure inside the unit drops (see diagram) :



5. When either the total volume has reached the target volume or the pressure is below 0.1 bar(g) : the inlet valve and outlet valve is closed. The dosing is finished. The actual dosed volume SO2 is displayed. The LED is off.
- When dosing is finished the GDX waits for 60 s. During this time it is not possible to start dosing.

Terminalprogram – Connection to PC

The Terminal program has the following features :

- Data recording during dosing process.
- Setting of dosing volume (normally set via keyboard).
- Setting of reference conditions (temperature in °C and ambient pressure in hPa or mbar).
 Pressure is the absolute pressure - not related to sea level.

Calibration - Menu 5

This menu item can be used for calibration and test.

If this procedure is started inlet and outlet valve are opened and data (pressure, time) are recorded by the terminal program. To stop this procedure key in # or 2 .

For calibration suitable test equipment is necessary.

QCAL Messtechnik GmbH can perform gravimetric calibration – traceable to National Standards with a calibration protocol according to DIN EN/ISO 17025.

Maintenance – Taking out of service

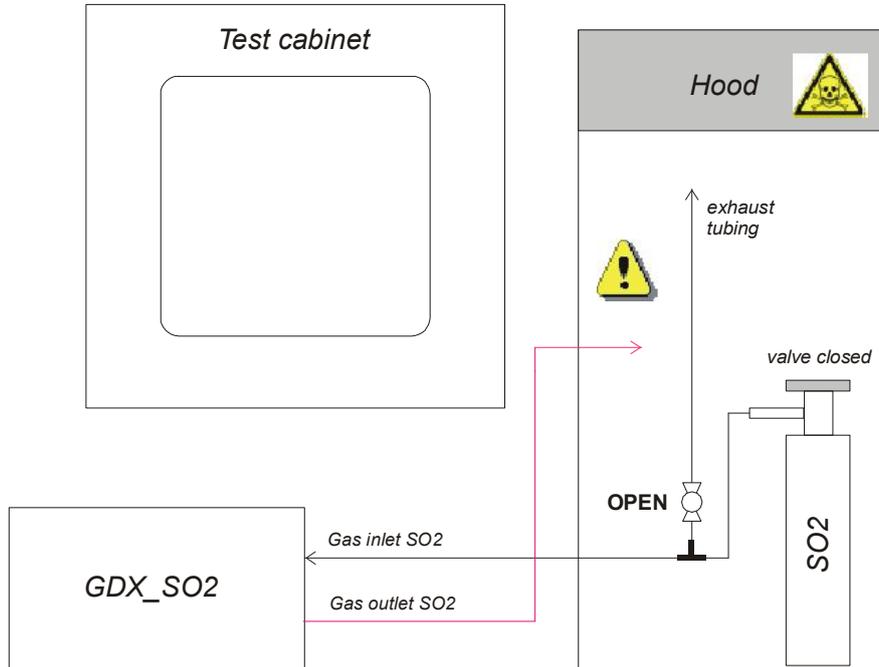


*If the equipment is not used the shut-off valve at the SO₂ gas container has to be closed.
For taking out of service proceed according to fig. 2 :*



For safety reasons the operations have to be taken under a hood !

1. Pressure release SO2 :



2. Flushing with air / inert gas

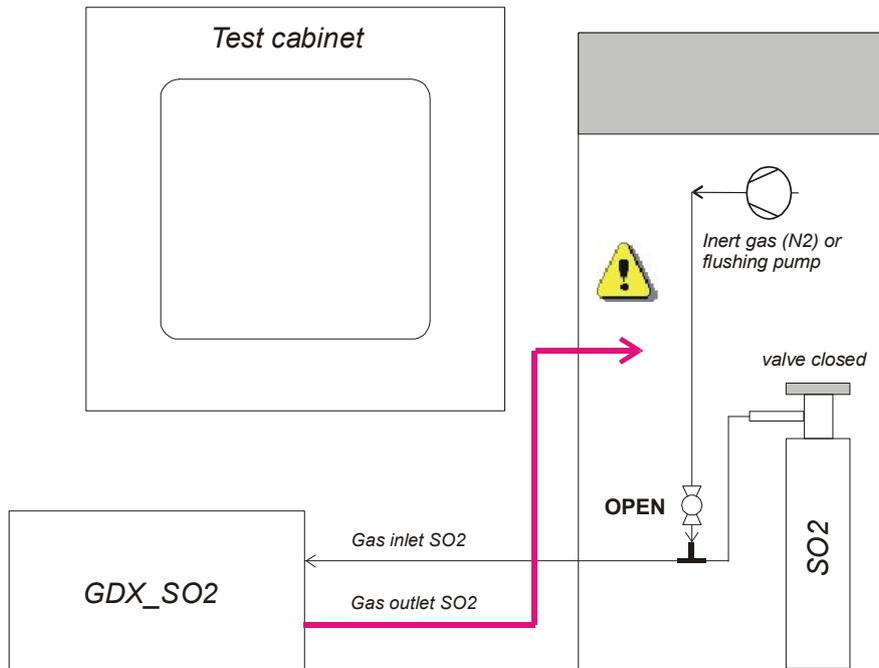


Fig. 2 : Taking out of service



Important hints

1. The SO₂ gas container has to be installed in an upstanding position – shut-off valve on top. The SO₂ inside the gas container is liquid.
2. If the GDX_SO₂ is connected directly to the gas container (without pressure reducer) : the temperature of the gas container must be lower than the ambient to prevent condensation of SO₂ in the tubings and GDX_SO₂ unit.
3. The safety data sheet SO₂ has to be observed.
4. If the SO₂ pressure is too low it can be caused by the following reasons :
 - shut-off valve is closed
 - Gas container is empty
 - Ball valve at the union tee is open –  SO₂ is released in big amounts !
 - Leakage. In this case a leak check has to be performed.  **GDX_SO₂ must be taken out of operation !**

Flushing of the GDX_SO₂ unit

See figure 2.

1	Close the shut-off valve at the gas container.	
2	Open ball valve at the union – SO₂ escapes ! into the hood	
3	Connect flushing pump / inert gas	
4	Switch GDX_SO ₂ on.	
5	Choose menu item 6 (inlet and outlet valves are opened)	
6	Wait at least 10 minutes	
7	Disconnect GDX_SO ₂ and tubings	

Operation of the ball valve

- ball valve is designed to be used in the fully open or fully closed position. Using a ball valve in the partially open position can result in seat damage
- Applying excessive torque in an attempt to turn a ball beyond its 90 degree stop point could damage the valve stops and misalign the ball.
- Operate the valve periodically in order to assure that the ball is able to move freely.
- In case of leakage the ball valve has to be replaced.

Technical Data

Power supply : 88 ~ 264 V AC, 47 ~ 63 Hz

Current consumption : max. 1 A, fused

Ambient conditions : 10 ° C to 40°C, 0 to 95% rh

Gas inlet conditions : particel-free gas sulphur dioxide,
max. allowed inlet pressure: 2 bar

Internal volume (SO₂) : geometric volume < 8 cm³, pressure x volume < 0,8 bar x dm³

Dimensions : GDX_SO₂ : 250 x 190 x 99 mm
Operation panel : 130 x 180 x 60 mm

Weight : 3000 g