

Constant flow sampler

QB1



User manual

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1 General information

Receiving goods

Remove the packaging and verify the correspondence to the order and the integrity of the content.

In case of damaged package, immediately note it on the delivery paper the courier will ask you to sign as receipt, without the note, no refund from insurance or replacement will be accepted. In case of evident damage, you can also refuse the delivery, always with written notification on the courier documents.

Damages occurred after unpacking the goods, must be notified within 8 days (D.D.T) with written communication to the courier and considering them responsible for any possible consequence.

Test

Test and calibration are done at Dado Lab's facility, at the end of it, a report is produced and including results and acceptability verification for all the executed tests.

To request a test at your place, please contact your local dealer.

Warranty Conditions

Warranty cover the instrument for 12 months from the delivery/test of the goods.

Disposable/rechargeable batteries have a warranty of 6 months.

Consumable materials, like components which have to be replaced periodically during the lifetime of the instrument (protection filters, fuses or lamps) are not covered by the warranty.

Warranty Exclusions / Limitation

Dado Lab cannot be considered responsible for any damage or flaws caused by external factors, accidental damages, improper uses, modification on any part, transformation, use of non original parts, negligence or lost of the instrument during the delivery of the instrument.

The warranty will not cover any repair or job which is not done by Dado Lab or authorized dealer. The responsibility is, in any case, limited to the value of the purchased instrument.

In case of malfunctioning, please contact:

service@dadolab.com

Conformity

Safety and CE mark

Dado Lab declares the instrument is in compliance with the following standard:

Low voltage instruments directive BT 2014/35/UE

Directive 2011/65/UE ROHS - Restriction of Hazardous Substances Directive

Directive EMC 2014/30/UE for the electro-magnetic compatibility (EMC)

Machinery Directive 2006/42/EC

Sampling Methods

Dado Lab declares that the instrument is compliant to the following standards and methods for the sampling.

Workplace atmospheres

UNI EN ISO 13137:2015

Pumps for the sampling of chemical agents with a volume flow rate of over 5 l/min. Requirements and test methods

Stack Emission

UNI EN 13284-1:2017

Stationary source emissions – Determination of low range mass concentration of dust – Part 1: Manual gravimetric method.

UNI EN 1911

Stationary source emissions - Determination of mass concentration of gaseous chlorides expressed as HCl - Standard reference method

UNI EN 14385

Stationary source emissions – Determination of the total emission of As, Cd, Cr, Co, Cu, Mn, Ni, Pb, Sb, Tl and V

UNI EN 13211

Stationary source emissions. Manual method of determination of the concentration of total mercury

CEN/TS 13649:2014

Stationary source emissions. Determination of the mass concentration of individual gaseous organic compounds. Activated carbon and solvent desorption method.

Environment

UNI EN ISO 16000-7

Indoor air - Part 7: Sampling strategy for determination of airborne asbestos fibre concentrations.

Safety rules

To safely operate the instrument, carefully follow those indications.

1. Do not remove, for any reasons the enclosure panels, without having turned off the instrument and disconnected the power supply cable.
2. Always connect the instrument to a power socket equipped with operational and efficient grounding.
3. Do not operate the QB1 outdoor without having provided protection from weather events (rain, humidity etc).
4. Before starting any operation, find a flat and stable accommodation for the QB1 with an adequate surrounding space for ventilation.
5. Operating temperature $-10\div 40^{\circ}\text{C}$
6. Max sampled gas temperature 45°C
7. Avoid contact and sampling of corrosive and flammable compounds.

Precautions for humidity

Condense formation inside the sampler, reduces the lifetime of some components, such as the pump itself and dry gas meter as well.

Be sure the gases entering the QB1 are dry.

In case of presence of very wet/condensing gases during the sampling, at the end of the operation, allow the sampler to work with open air for at least 10 minutes.

The supply includes

QB1 is supplied with the following items:

- ◆ QB1 sampler
- ◆ Power cable
- ◆ Sampling line quick connector
- ◆ Hose barb for leak check
- ◆ Operation quick guide

2 Parts identification

Connections panel QB1 V1.5 - V3.0

1. Vacuum meter indicating the line pressure drop with range 0 ÷ 1 Bar
2. Ball flowmeter, with indication scale in NI/min (@ 20°C e 101.3 kPa)
3. Water trap inspection window
4. Dust protection filter cap
5. Sampling line quick connector
6. Low flow regulation knob, range 0.2 ÷ 3.0 NI/min
7. High flow regulation knob, range 2 ÷ 32 NI/min
8. Sampled gas exhaust, equipped with 1/8" gas threaded connector
9. Protection fuse box, type 5x20 T1.6A
10. Power switch

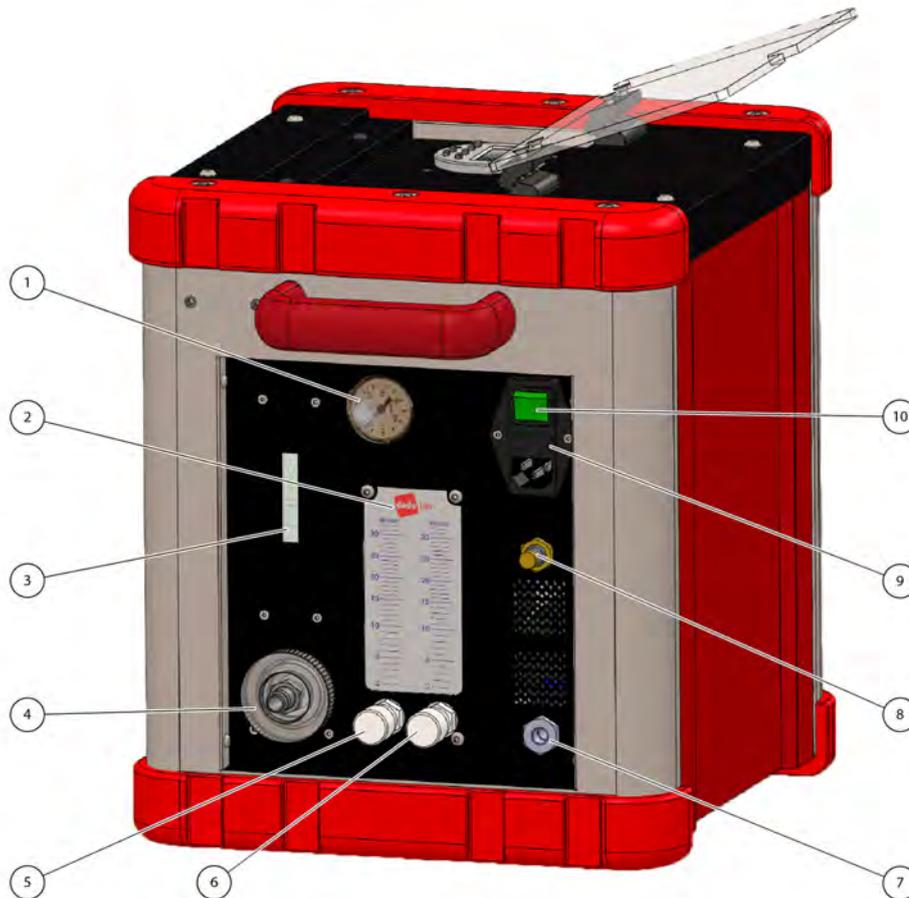


Connections panel QB1 V5.0

1. Vacuum meter indicating the line pressure drop with range 0 ÷ 1 Bar
2. Ball flowmeter, with indication scale in NI/min (@ 20°C e 101.3 kPa)
3. Water trap inspection window
4. Sampling line quick connector
5. Flow regulation knob, range 2 ÷ 32 NI/min
6. Flow regulation knob, range 2 ÷ 32 NI/min
7. Sampled gas exhaust, equipped with 1/8" gas threaded connector
8. Bypass valve (see chapter "6 Leak test - QB1

V5.0" on page 14)

9. Protection fuse box, type 5x20 T3.15A
10. Power switch



Connections panel QB1 V1.5DC

1. Vacuum meter indicating the line pressure drop with range 0 ÷ 1 Bar
2. Ball flowmeter, with indication scale in NI/min (@ 20°C e 101.3 kPa)
3. Water trap inspection window
4. Sampling line quick connector
5. Flow regulation knob, range 0.2 ÷ 3 NI/min
6. Flow regulation knob, range 2 ÷ 32 NI/min
7. Sampled gas exhaust, equipped with 1/8" gas threaded connector
8. External battery connector
9. Protection fuse box, type 5x20 T1.6A
10. Power switch



Connections panel QB1 V2x5DC

1. Protection fuse box, type 5x20 T1.6A
2. Power switch
3. Vacuum meter indicating the LINE 1 pressure drop with range 0 ÷ 1 Bar
4. Vacuum meter indicating the LINE 2 pressure drop with range 0 ÷ 1 Bar
5. Sampling LINE 1 quick connector
6. Sampling LINE 2 quick connector
7. Sampled gas exhaust, equipped with 1/8" gas threaded connector LINE 1
8. Sampled gas exhaust, equipped with 1/8" gas threaded connector LINE 2
9. LINE 1 Flow regulation knob, range 0.2 ÷ 5.0 NI/min
10. LINE 2 Flow regulation knob, range 0.2 ÷ 5.0 NI/min
11. LINE 1 Ball flowmeter, with indication scale in NI/min (@ 20°C e 101.3 kPa)
12. LINE 2 Ball flowmeter, with indication scale in NI/min (@ 20°C e 101.3 kPa)



Controls panel QB1 V1.5 - V3.0 - V5.0

1. Polycarbonate protection cover
2. Turn-on timer programmer
3. Temperature of the sampled gas
4. Dry Gas Meter, with 0.1 liters resolution

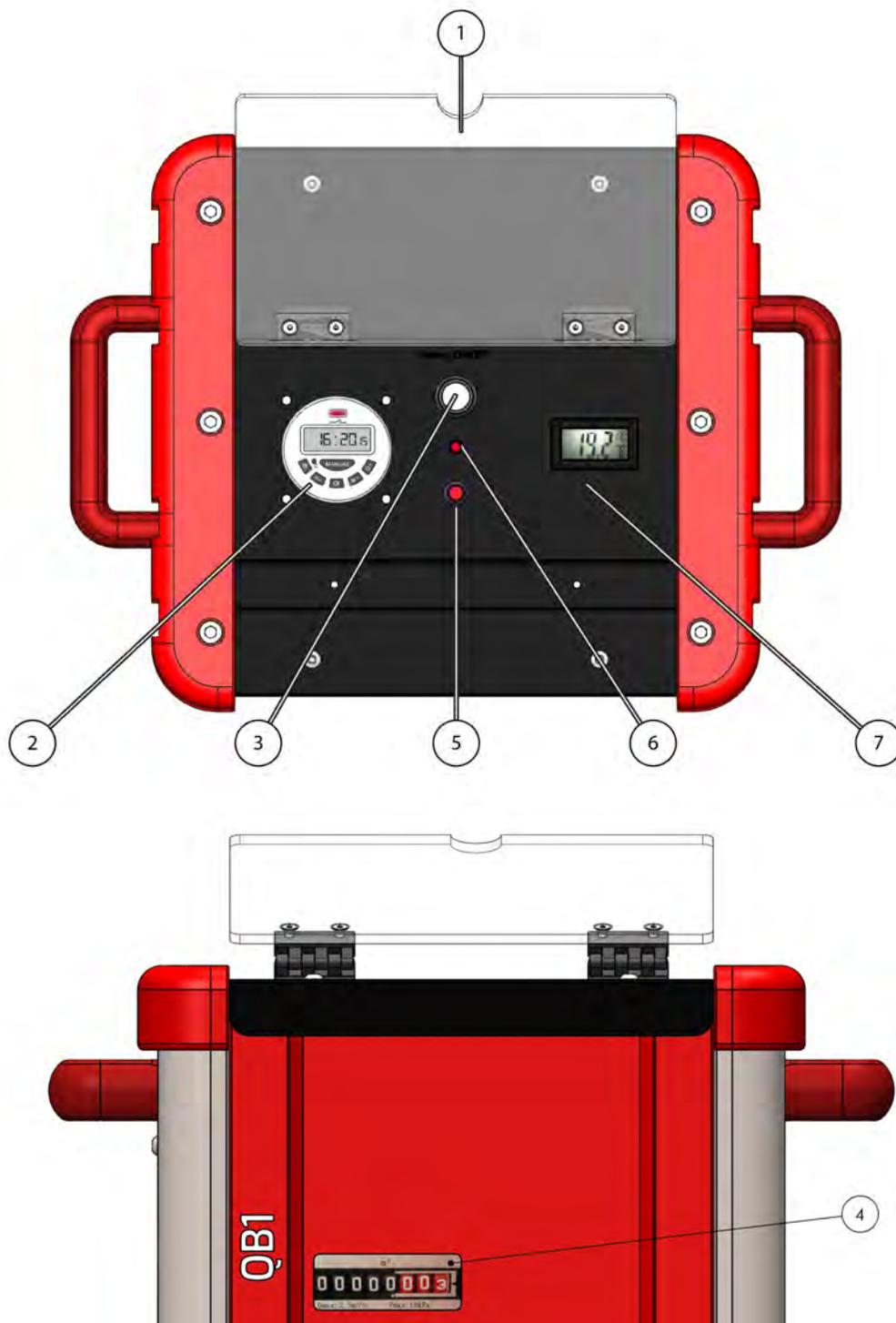


Controls panel QB1 V1.5DC

1. Polycarbonate protection cover
2. Turn-on timer programmer
3. Battery power switch
4. Dry Gas Meter, with 0.1 liters resolution
5. Reset button after battery recharge
6. Battery status led:
Green = charged battery
Yellow = battery about to die
Red = low battery
7. Temperature of the sampled gas

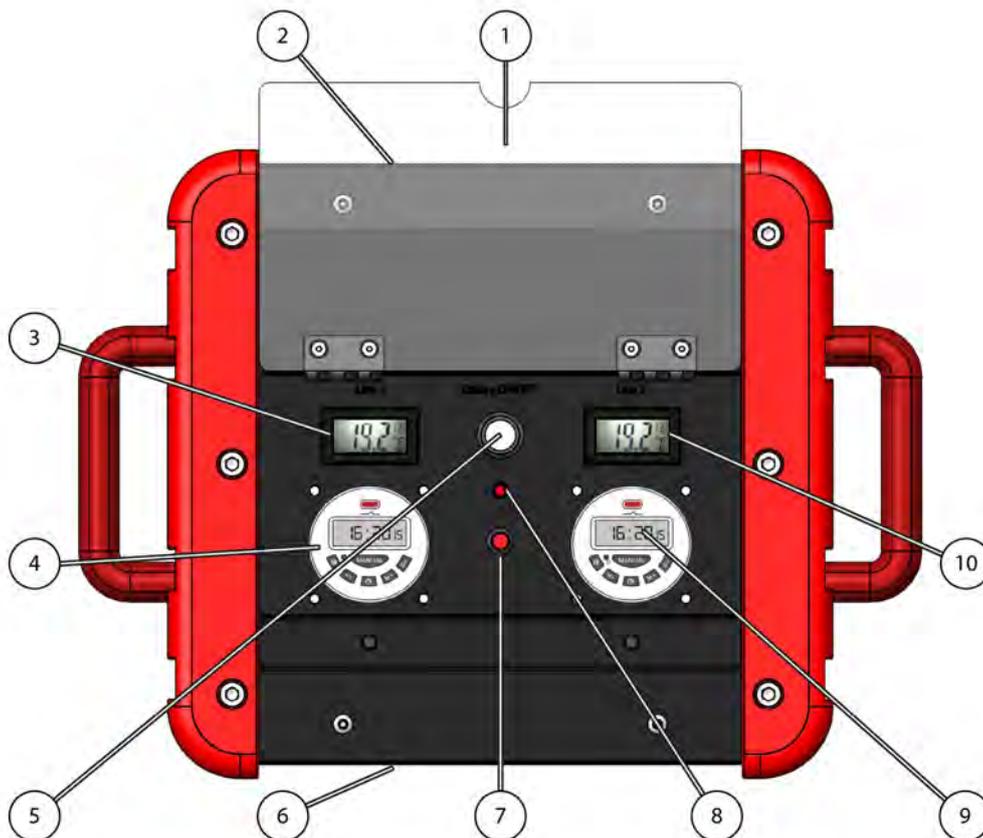
When the battery is low, the electronic disconnect it to avoid damages. Once disconnected, in

order to restore the battery operation, perform a complete charge cycle and press the reset button



Controls panel QB1 V2x5DC QB1-D

1. Polycarbonate protection cover
2. LINE 1 Dry Gas Meter, with 0.1 liters resolution
3. Temperature of the sampled gas on LINE 1
4. LINE 1 Turn-on timer programmer
5. Battery power switch
6. LINE 2 Dry Gas Meter, with 0.1 liters resolution
7. Reset button after battery recharge
When the battery is low, the electronic discon-
8. Battery status led:
Green = charged battery
Yellow = battery about to die
Red = low battery
9. LINE 2 Turn-on timer programmer
10. Temperature of the sampled gas on LINE 2



3 Timer setup



Date and Time

Press the "C" key to reset the actual program before starting

Hold <P> and press:

- D+ to set day of the week
- H+ to set hour
- M+ to set minutes

The instrument is equipped with a Lithium battery to backup date and time information, this also allow the automatic restart after power failure.

The Lithium battery recharges when the instrument is connected to power supply and switched on [I].

Pump manual ON / OFF

Pressing the MANUAL Pressing the MANUAL key you can force the start of the pump.

This key is active also during a time based program.

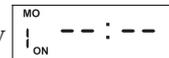
At every press, the display will shows (in sequence):

- AUTO Automatic execution of the set program
- OFF Pump OFF
- ON Pump ON

How to program timed sampling

You can program up to six turn on and off within the same day. To set up a time turn on proceed as follow:

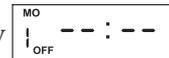
Press <P> the display will show



Press D+ to select the day of the week (15 different combinations available)

The press H+ for the hour and M+ for the minutes of the first turn on.

Press <P> the display will show



As for the turn on, select the day with D+, hour with H+ and minutes M+. Press <P> to confirm

If you want to add new timed turn on, proceed with the second ON

Press <P> to activate the program..

4 Thermometer



The thermometer shows the sampled gas condition measured inside the dry gas meter.

The temperature is expressed in °C and it's used to normalize the volume considering the mean value between the sampling starting and final temperature value.

5 Dry Gas Meter



Readings and normalization of the volumes

The totalizer of the installed dry gas meter has a resolution of 0.1 liters.

Before starting the sampling, take note of the volume and temperature values.

At the end of the operation, read again the volume indicated and note it, with temperature value as well.

Normalization of the volume can be done using the following formula:

$$V_s = V_m \cdot \frac{P_a}{101.3} \cdot \frac{T_n}{273 + T_{gm}}$$

Where:

V_s [lt] = Normalized volume

V_m [lt] = Dry gas meter total volume

P_a [kPa] = Ambient pressure

T_n [K] = Normalization temperature

T_{gm} [°C] = Dry gas meter temperature

6

Leak check - QB1 V5.0



Sampling line leak check

QB1 V5.0 is equipped with a bypass valve that allows to perform the leak check of the sampling line as per regulations.

- Check the leak
- Slowly let air enter the sampling line
- Turn off the pump
- Close the bypass valve

Leak check

- Connect the sampling line
- Turn on the pump
- Close the sampling line
- Open the bypass valve and adjust the vacuum to about 0.5bar

7 QB1-D

Dilution sampler

QB1-D is a special version of the QB1 V2x5DC in which the flowrate of the secondary pump delivers the dilution air instead of sampling.

This particular version is dedicated to VOCs sampling in accordance with the EN13649 which requires the dilution of the sample with, previously cleaned and dehydrated, ambient air introduced in the dilution chamber of the probe (HP1).

The dilution sampling offers the advantage of improving the adsorbing effect on the sampling tube thanks to the lower temperature and dehydrated gas stream conditions. This allows also to use only one charcoal tube and to greatly reduce the stripping effect, usually due to high temperatures and water presence.

To set the dilution rate, e.g. 1:4, regulate the total sampling flowrate, 1 lt/min for instance, and the dilution flowrate, 0.8 lt/min, the difference of the two values, 0.2 lt/min will be the resulting sampling flowrate.

The sampled volume will be given by the difference between the total sampled and the dilution volumes.

Flowrates definition

The sampling flowrates depends on tubes used:

0.4 l/min - large tubes (600 mg)

1.0 l/min - jumbo tubes (1000 mg)

Set the flowrate on LINE1 flowmeter

Calculate dilution flowrate

The flowrate depends from humidity of duct fumes, the ambient temperature and must avoid reaching the condensation point in the sampled gas.

The graph on page 17 shows the dilution flowrate to set on QB1-D sampler.

1. Find the RD value (dilution ratio) finding on X axis the rw of duct gas (ratio by volume of the vapor content e.g. 10% of vapor equals 0.1 of rw).
2. Find the corresponding curve on ambient temperature and read on Y axis the RD value.
3. Multipling RD value with sampling flowrate chosen, you find the dilution flowrate to use

An example:

- Jumbo tubes 1000 mg with 1.0 l/min flowrate
- ambient temperature 20 °C
- gas humidity 10% (rw 0.1)

From the graph, the RD value is about 0.75

The dilution flowrate:

$$F_{\text{tot}} \cdot \text{RD} = 1 \cdot 0.75 = 0.75 \text{ l/min}$$

The dilution flowrate on LINE 2 flowmeter. The actual FC sampling flow is given by:

$$\text{FC} = F_{\text{totale}} - F_{\text{diluizione}}$$

The sampled volume is the difference from Total

$$\text{FC} = 1 - 0.75 = 0.25 \text{ l/min}$$

volume and dilution volume:

$$V1n = (V1_{\text{fin}} - V1_{\text{ini}}) \cdot \frac{273}{101.3} \cdot \frac{P_{\text{amb}}}{T_{\text{dgm1}}}$$

V1n = Dry gas meter Volume contatore LINE 1 (at 273 K and 101.3 KPa conditions) [Nl]

V1ini, V1fin = Dry gas meter volumes at start and end of sampling [l]

Pamb = Ambient pressure [kPa]

Tdgm1 = Temperature at Dry gas meter "LINE 1" [K]

Dilution volume:

$$V2n = (V2_{\text{fin}} - V2_{\text{ini}}) \cdot \frac{273}{101.3} \cdot \frac{P_{\text{amb}}}{T_{\text{dgm2}}}$$

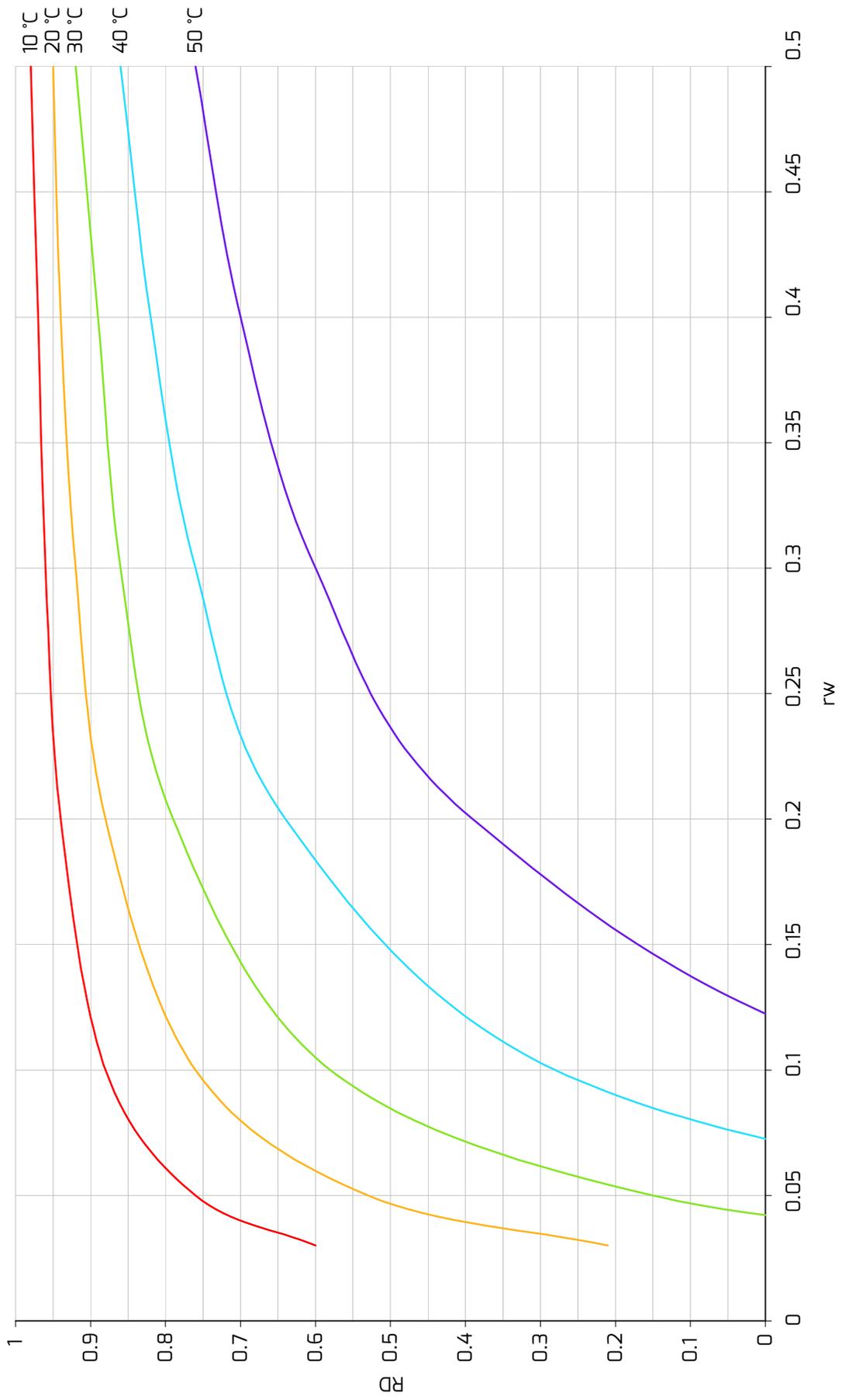
V2n = Dry gas meter volume "LINE 2" (dilution) (at 273 K and 101.3 kPa conditions) [Nl]

V2ini, V2fin = Dry gas meter volumes at start and end of sampling [l]

Tdgm2 = Temperature at Dry gas meter "LINE 2" [K]

Sampled volume is:

$$V = V1n - V2n$$



8 Maintenance

Replace the protection filter

In the event of accidental suction of liquids, particulate matter or foreign bodies, it is necessary to replace the protective filter to efficiently handle QB1.

To do this, unscrew the transparent filter cap by hand.

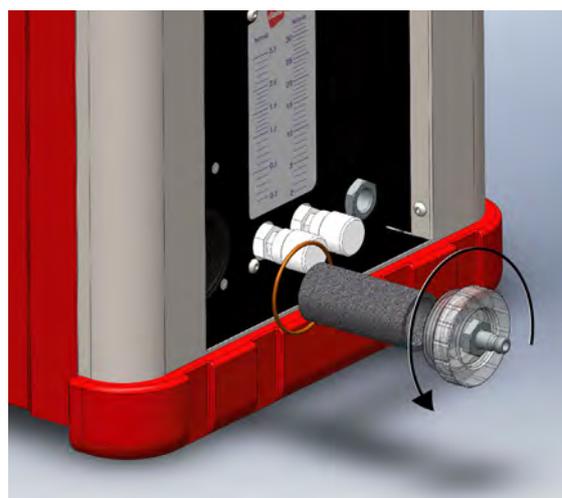
Remove the filter and wipe away any traces of moisture and solid objects with a damp cloth.

Do not use solvents or alcohol.

Reassembling the filter, check the sealed O-ring (supplied with the protection filter kit).

In case of wear replace it.

Apply a light layer of silicon grease on the thread and on the o-ring and close the cap by tightening it by hand.



Protection Filters Kit of 10 pcs. p/n 101 101 3010

Vacuum leak check

After replacing the filter or other maintenance operations it is always good practice to execute a pump leak check.

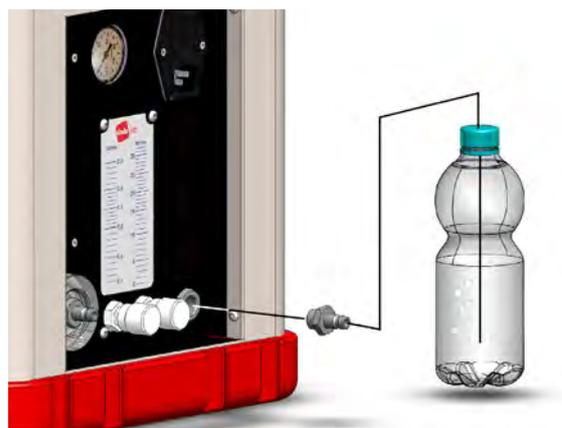
Connect a hose barb with 1/8" gas thread at the outlet of the instrument.

Connect a tube to the hose barb and to an impinger, or simply to a bottle containing some water.

Partially close the flow regulation knobs.

Start the pump and close the suction.

Wait a few seconds and then verify for the presence of bubbles, there shouldn't be any or just couple.



Liquid removal

This procedure lists the steps necessary to remove liquids accidentally entered into the QB1 sampler and trapped in the suction protection device.

It is recommended to replace the protection filter at the suction inlet.

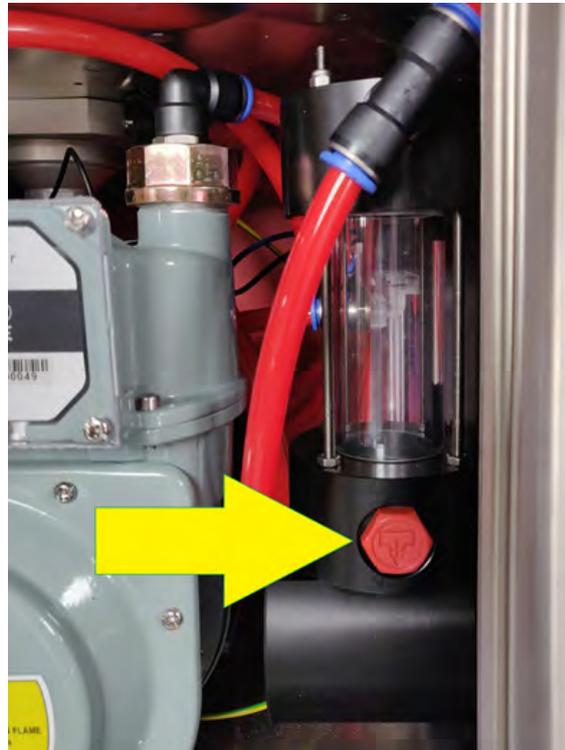
Side panel opening

Open the two closing screws using an allen key 3 and slide the panel downwards.



Tank emptying

Using a socket wrench on 19, turn the red cap anticlockwise. The liquid will now come out. If necessary, tilt the sampler to facilitate emptying of the container.



Pay attention to the tightening of the cap: it is sufficient to hand-tighten and tighten gently with the socket wrench, as the cap has a sealing gasket.

Reinstall the side panel

9 Technical specifications

Sampled gs conditions	dry with max temperature 45°C
Gas inlet	With protection filter and quick connector
Working temperature	-10 ÷ 40°C 95% UR
Stocking temperature	-10 ÷ 50°C 95% UR
Construction	Inox steel and aluminium
Size	330 x 310 x 360 mm (L x P x H)

Characteristics and accuracy of the measures

Volume

Dry gas meter	class G1.6
Flowrate range	0.016 m ³ /h ÷ 2.5 m ³ /h
Accuracy	2% of the measure
Resolution	0.1 liters

Ball flow meter

Range	see the available models table
Accuracy	5% f.s.

Dry gas meter temperature

Range	-50 ÷ 70°C
Accuracy	± 1 °C
Resolution	0.1 °C

Suction pressure drop (excluding V2x5DC model)

Vacuum meter	Range 0 ÷ 1 Bar
Accuracy	± 5%

Specific characteristics for each model

QB1 V1.5

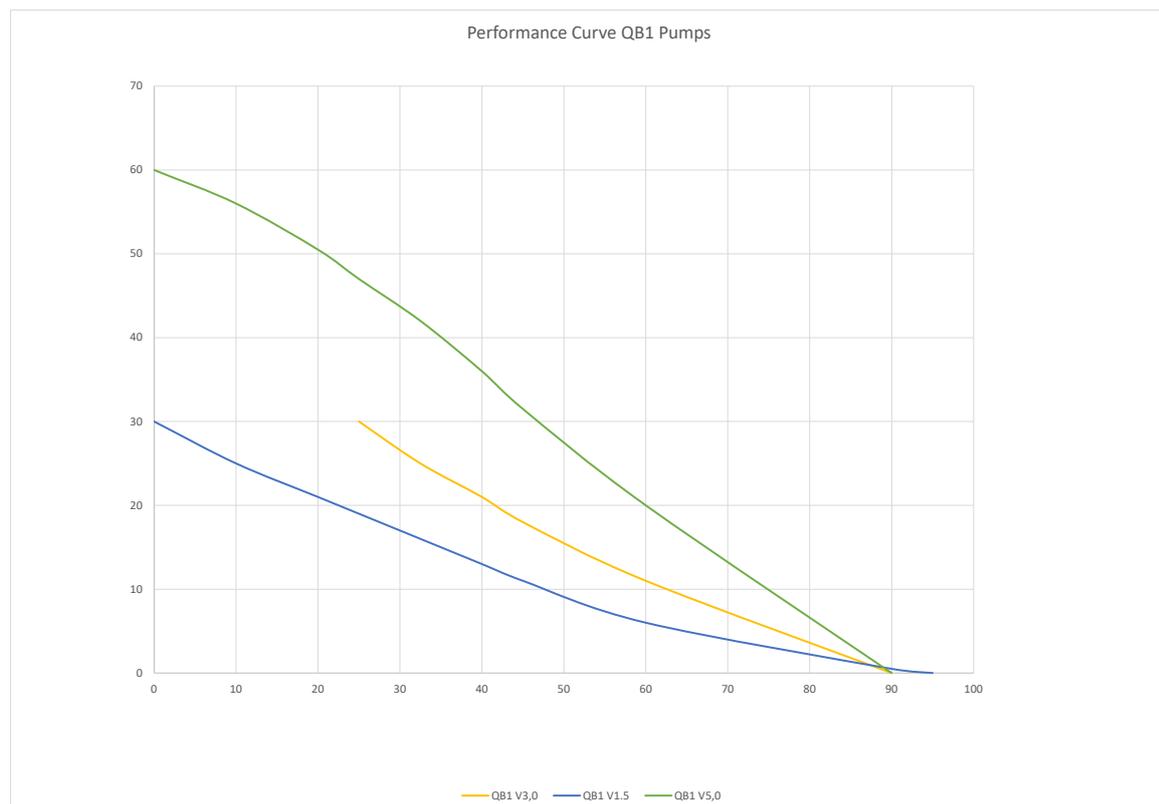
Pump	Single head diaphragm	
Nominal max flowrate	32 l/min	
Flowmeters scale indication	0.2 ÷ 3.0	2 ÷ 30 NI/min
Overall weight	9.5 Kg	
Power supply	230Vac ± 10% 50/60Hz - 50 W Fuse 1.6A	

QB1 V3.0

Pump	Double head diaphragm	
Nominal max flowrate	55 l/min	
Flowmeters scale indication	0.2 ÷ 3.0	2 ÷ 30 NI/min
Overall weight	11 Kg	
Power supply	230Vac ± 10% 50/60Hz - 100 W Fuse 1.6A	

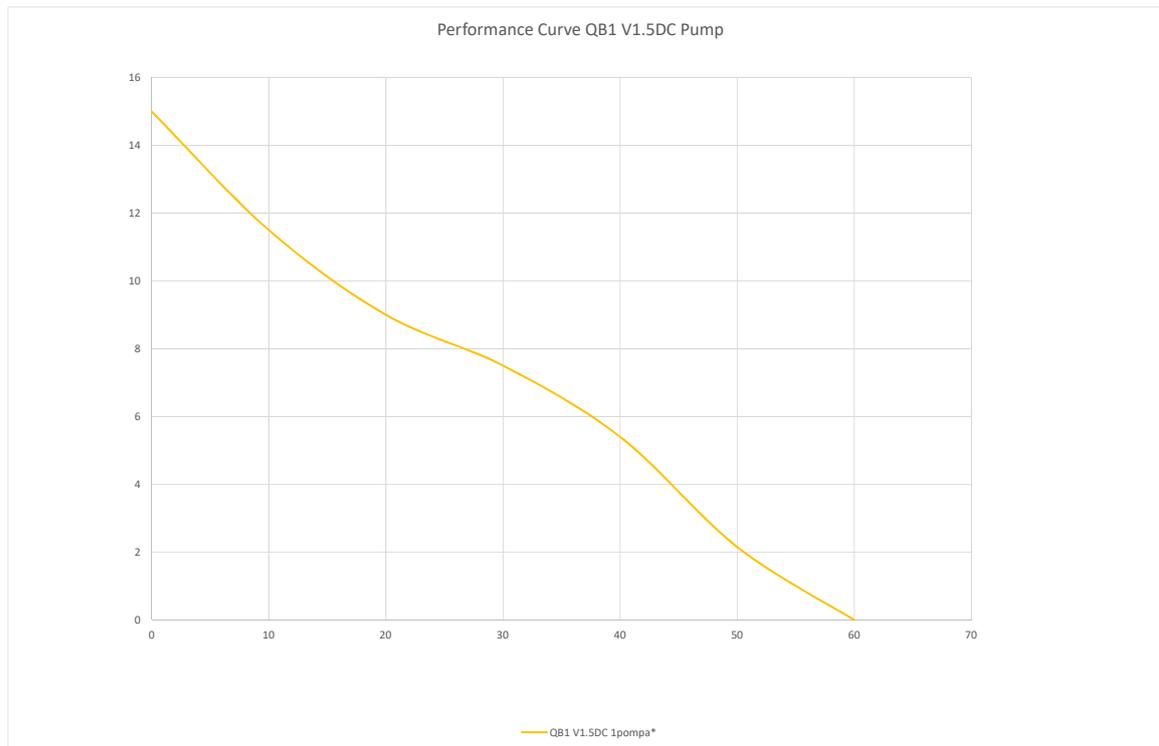
QB1 V5.0

Pump	Rotary vane	
Nominal max flowrate	75 l/min	
Flowmeters scale indication	2 ÷ 30	2 ÷ 30 NI/min
Overall weight	13 Kg	
Power supply	230Vac ± 10% 50/60Hz - 150 W Fuse 3.15A	



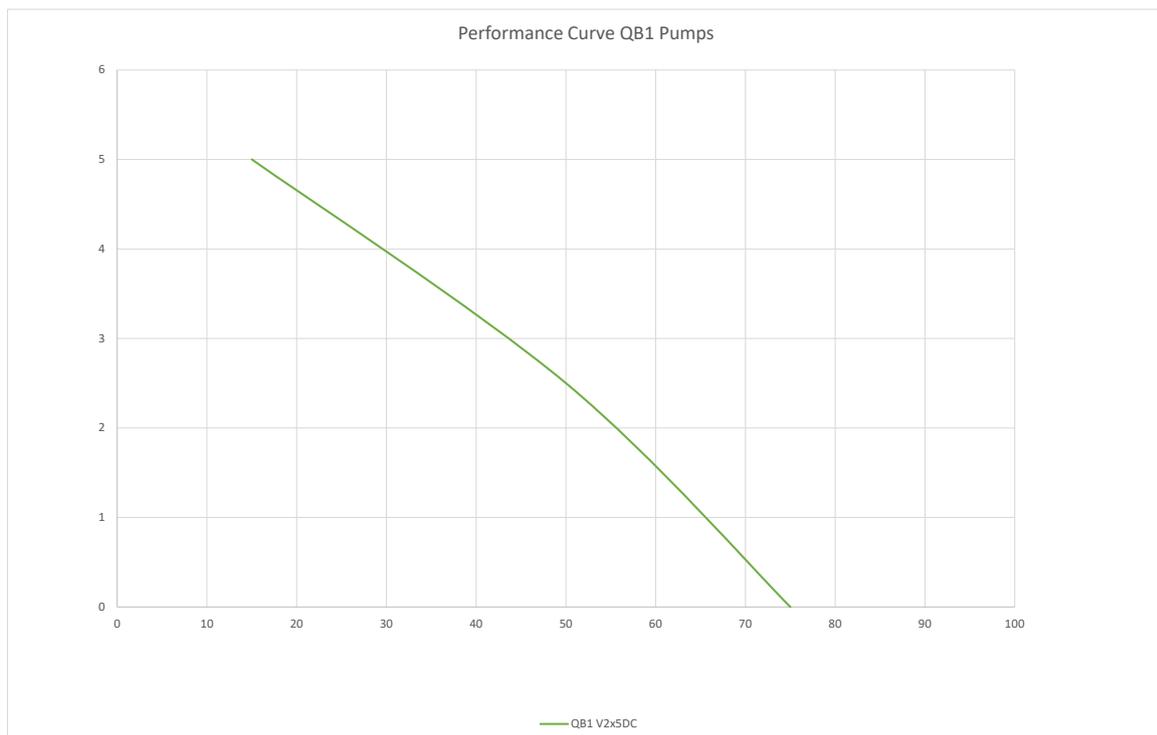
QB1 V1.5DC

Pump	Single head diaphragm 24Vdc
Nominal max flowrate	16 l/min
Flowmeters scale indication	0.2 ÷ 3.0 2 ÷ 30 NI/min
Overall weight	9 Kg without battery
Power supply	230Vac ± 10% 50/60Hz - 50 W Fuse 1.6A
Ingresso 24 Vdc	With external connector, power consumption 2.5 Ah



QB1 V2x5DC

Pump	x2 Single head diaphragm 24Vdc	
Nominal max flowrate	11 l/min	
Flowmeters scale indication	0.2 ÷ 5.0	0.2 ÷ 5.0 NI/min
Overall weight	13 Kg including batteries	
Power supply	230Vac ± 10% 50/60Hz	Fuse 1.6A
Built-in batteries	x2 12Vdc 2.3 Ah	



QB1 -D

Pump	x2 Single head diaphragm 24Vdc	
Nominal max flowrate	5 l/min	
Flowmeters scale indication	0.1 ÷ 2.0	0.1 ÷ 2.0 NI/min
Overall weight	13 Kg including batteries	
Power supply	230Vac ± 10% 50/60Hz	Fuse 1.6A
Built-in batteries	x2 12Vdc 2.3 Ah	



Information on the WEEE (RAEE) symbol

Proper disposal of the product (electrical and electronic waste)

(Applicable in countries with separate collection systems)

The symbol on the product, accessories or documentation indicates that the product and its electronic accessories (such as batteries) must not be disposed of with other waste at the end of its life cycle. To avoid any damage to the environment or to health caused by incorrect waste disposal, the user is invited to separate the product and the above accessories from other types of waste, giving them to the authorized parties according to local regulations.

Users are invited to use the recovery circuits available in the local community. Otherwise, contact your supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories must not be disposed of together with other commercial waste.

The device and accessories shown in this manual may vary depending on the country in which the products are distributed.

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