Quorum Technologies

GloQube
Glow discharge system

User Manual
026936

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Quorum Technologies Ltd is the manufacturer of a range of electron microscopy (EM) preparation equipment.

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Disclaimer
The components and packages described in this document are mutually compatible and guaranteed to meet or exceed the published performance specifications. No performance guarantees, however, can be given in circumstances where these component packages are used in conjunction with equipment supplied by companies other than Quorum Technologies.

1 Health and safety

Safety is very important when using any instrumentation and this chapter should be read by all users of our equipment.
This section of the manual applies to all equipment supplied by Quorum Technologies, not just the particular instrument to which this manual refers.

Included in this chapter are details on warning notations, good working practices and information on European Community (EC) legislation regarding 'Control of Substances Hazardous to Health' (COSHH) and risk analysis.

1.1 Control of substances hazardous to health (COSHH)

The EC legislation regarding the 'Control of Substances Hazardous to Health' requires Quorum Technologies to monitor and assess every substance entering or leaving their premises. Consequently any returned goods of whatever nature must be accompanied by a declaration form available from Quorum Technologies, reference number HSC100 (attached to back of this manual). Without this declaration Quorum Technologies reserves the right not to handle the substance/item. Also in accordance with EC regulations, we will supply on request hazard data sheets for substances used in our instruments.

1.2 Safety policy

This section contains important information relating to all health and safety aspects of the equipment. As such it should be read and understood by all personnel using the instrument - whether as an operator or in a service capacity.

Quorum Technologies is committed to providing a safe working environment for its employees and those that use its equipment and conducts its business responsibly and in a manner designed to protect the health and safety of its customers, employees and the public at large. It also seeks to minimise any adverse effects that its activities may have on the environment.

Quorum Technologies regularly reviews its operations to make environmental, health and safety improvements in line with UK and European Community legislation.

Quorum Technologies cannot be held responsible for any damage, injury or consequential loss arising from the use of its equipment for any other purposes, or any unauthorised modifications made to the equipment.

All service work carried out on the equipment should only be undertaken by suitably qualified personnel. Quorum Technologies is not liable for any damage, injury or consequential loss resulting from servicing by unqualified personnel. Quorum Technologies will also not be liable for damage, injury or consequential loss resulting from incorrect operation of the instrument or modification of the instrument.

1.3 Conformity

This instrument is supplied in a form that complies with the essential protection requirements of the Electromagnetic Compatibility Directive 2014/30/EU and the essential health and safety requirements of the Low Voltage Directive 2014/35/EU. Conformity is demonstrated by compliance to EN61326-1:2006 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements and EN61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements and RoHS2 Directive 2011/65/EU. Any modifications to the equipment, including electronics or cable layout, may affect the compliance with these directives.

1.4 Servicing

1.4.1 Disclaimer

All service work on the equipment should be carried out by qualified personnel. Quorum Technologies cannot be held liable for damage, injury or consequential loss resulting from servicing from unqualified personnel. Quorum Technologies will also not be liable for damage, injury or consequential loss resulting from incorrect operation of the instrument or modification of the instrument.

1.4.2 Operators and service engineers

A normal operator of the equipment will not be trained in, nor qualified for service work on the equipment and may cause a hazard to themselves or others if such work is attempted. Operators should therefore restrict themselves to the normal operation of the equipment and not by removing covers from the electronic equipment or dismantling of the instruments.

Service Engineers who are suitably trained to assess and isolate electrical, mechanical and vacuum hazards should be the only personnel who access the equipment.

1.5 Hazard signals and signs

1.5.1 Hazard signal words

The standard three hazard signal words are defined as follows:

DANGER	Imminently hazardous situation or unsafe practice that, if not avoided, will result in death or severe injury.
WARNING	Potentially hazardous situation or unsafe practice that, if not avoided, could result in death or severe injury.
CAUTION	Potentially hazardous situation or unsafe practice that, if not avoided, may result in minor or moderate injury or damage to equipment.

1.5.2 Hazard labels used on equipment

Several hazard symbols may be found on the equipment, they are shown in Table 1 below with their meaning:

Table 1 - Hazard warning symbols

 **Caution: risk of electric shock**	 **Caution: refer to accompanying documents**	 **Caution: Equipment is heavy. Risk of injury**

1.6 Risk analysis

1.6.1 Personal operational risks

The following is a list of tasks carried out by both the operator and service engineer where recognised risks have been observed. Listed is the personnel protection equipment (PPE) which is suggested for use for various tasks on any system.

Table 2 - Personal operational risks

Task	Carried out by: Nature of hazard:	Recommended PPE
Cleaning of parts / samples with isopropanol (IPA)	Operator / Service engineer. Splash hazard to eyes, drying of skin	Protective goggles, protective gloves.
Use of liquid nitrogen in sample cooling etc.	Operator / service engineer. Burn risk. Asphyxiation risk.	Thermally protective gloves and goggles should be worn. Ensure adequate ventilation.
Lifting of Heavy Items	Service engineer. Dropping on foot. Back strain.	Protective footwear. Use lifting equipment.
Filling septum sealed vial	Operator/Service engineer: Splash and inhalation hazard	Protective gloves, fill in a fumehood.

1.6.2 Hazardous materials

Isopropanol (IPA). Hazard Signal Word: DANGER.

For certain service tasks isopropanol is suggested for cleaning components before use in the vacuum system. It should be noted that isopropanol is a flammable liquid and as such should not be used on hot surfaces. In addition it is recommended that suitable protective gloves are worn when using isopropanol.

Methanol (Synonyms: methyl hydrate, wood spirit, methyl hydroxide), is a chemical with the formula CH_3OH). Hazard Signal Word: DANGER.

Only operators with experience in the safe handling of chemicals should use methanol with this equipment. The law requires you to control the use of chemicals at work. To do this you need to assess the risks in your own workplace and implement and maintain effective control measures.

Pentylamine/Alkylamine (Synonyms: 1-Aminopentane, n-Amylamine), is a chemical compound with the formula $CH_3(CH_2)_4NH_2$. Hazard Signal Word: DANGER.

Only operators with experience in the safe handling of chemicals should use pentylamine with this equipment. The law requires you to control the use of chemicals at work. To do this you need to assess the risks in your own workplace and implement and maintain effective control measures.
Fill only under a fume hood and transfer to instrument in the correct vessel, (see 3.2.1)

1.7 Good working practices

It is essential that good hygienic working practices are adopted at all times especially in an ultra high vacuum or cleanroom environment and these are generally of the 'common sense' type. Some simple good practice rules are:

- If in doubt don't.
- If in doubt ask.
- When handling solvents wear face mask, gloves, apron and work only in a well ventilated area. Ideally work in a fume hood.
- Mop up any spillages immediately.
- When handling or decanting mineral oils wear protective clothing.
- Aerosols of mineral oils, such as that produced by gas ballasting, can prove to be hazardous and an exhaust is recommended.
- Before attempting to service electrical apparatus, isolate from the mains.
- Treat all unknown substances as hazardous.
- Dispose of substances in an appropriate manner.
- Use the correct tool for the job.
- Keep a straight back and bend from the knees when lifting heavy objects.
- Affix pressurised gas cylinders firmly to walls or racks. Use the correct regulating valves on gas cylinders and always transport cylinders using the appropriate specialist trolley.
- Obey safety regulations regarding lifts, hoists and machine tools.
- Always make sure you understand a procedure well before attempting it for the first time.

1.8 Scope

This manual is intended for all users of the GloQube manufactured by Quorum Technologies and provides information on the safe operation and maintenance of the instrument.

Please note that the servicing and maintenance procedures should only be carried out by qualified service personnel and it is essential that all users should read the Health and Safety section of this manual.

1.9 Return of goods

If goods are to be returned to Quorum Technologies for repair or servicing the customer should contact their local distributor, company which supplied the equipment or the factory directly before shipment. A 'Returns Authorisation Number' should be obtained in advance of any shipment. This number is to be clearly marked on the outside of the shipment.

All returned goods are to be accompanied by a completed 'Returned Goods Health and Safety Clearance' form, HSC-100, attached to the outside of the package (to be accessible without opening the package) and a copy of the form should be faxed or emailed in advance to the factory. A copy of this form can be found at the end of this manual or requested directly from Quorum Technologies; the details can be found on page two of this document.

Solvents must not be present in equipment being returned for service or repair, the vial must be removed and any substances disposed of in an appropriate manner.

1.10 Returns procedure

1.10.1 Warranty claim

Electronic and basic servicing capabilities exist at most in-country appointed distributor, however all components are sold with a return to factory warranty (unless otherwise stated) which covers failure during the first 12 months after delivery. This is extended by a further two years if the warranty form is returned to Quorum Technologies.

Returns must be sent carriage paid; Quorum Technologies will cover the return carriage costs. This covers defects which arise as a result of a failure in design or manufacturing. It is a condition of warranty that equipment must be used in accordance with the manufacturers' instructions and not have been subjected to misuse. This warranty does not cover consumable items such as sputter coating targets and carbon evaporation material. To make a claim under the terms of this warranty provision contact the Customer Service Department of your local Quorum Technologies representative in the first instance.

1.10.2 Chargeable repairs

Always contact your local Quorum Technologies representative or company which supplied the equipment in the first instance. They will be pleased to assist you and will be able to provide an estimate of repair costs; many offer local repair facilities.
For routine repairs, where down-time is not critical, the target standard return time at Quorum Technologies is 20 working days.

1.10.3 Packaging and carriage

All goods shipped to the factory must be sealed inside a clean plastic bag and packed in a suitable carton. If the original packaging is not available, Quorum Technologies should be contacted for advice. Quorum Technologies will not be responsible for damage resulting from

inadequate returns packaging or contamination of delicate structures by stray particles under any circumstances. All non-warranty goods returned to the factory must be sent carriage pre-paid, (Free Domicile). They will be returned carriage forward (Ex-Works).

2 Introduction

2.1 Scope

This manual covers the installation and operation of the GloQube dual chamber, glow discharge system. The system is designed to provide a surface charge modification treatment of coated TEM (Transmission Electron Microscopy) support grids, tapes and other substrates using air, methanol or pentylamine/alkylamine. It is designed to modify the surface charge to change a surface to being hydrophilic or hydrophobic.

2.2 Basic overview of the system

The system is of a dual chamber design, with touchscreen control and dedicated firmware. It is equipped with a “clean” chamber for the purpose of treating a sample in air in order to obtain a hydrophilic surface and a “vapour” chamber for the treatment of a sample with either methanol or alkyl/pentyl amine to obtain surfaces that are hydrophobic.

Figure 1 - Overview of the system

2.3 Introduction to glow discharge

2.3.1 Background

Glow discharge in a reduced atmosphere of air has been the commonly accepted method to render carbon support films for electron microscopy (EM) hydrophilic (i.e. with a net negative charge) prior to adsorbing suspensions of biological material on to the surface (Dubochet et al., 1971). In other words, to convert naturally hydrophobic ('water-hating') carbon-coated transmission electron microscopy (TEM) support grids into a hydrophilic ('water-loving') condition. As mentioned, this is usually performed in a vacuum chamber and by placing the coated grid between two parallel electrode plates to which a high voltage is applied a glow discharge (plasma) is formed. The vacuum need not be high vacuum, backing vacuum from a rotary pump is more than sufficient.

NB: Glow discharges are sometimes considered to be 'imperfect' plasmas and cannot be used to plasma etch or plasma ash specimens, their use mainly being confined to altering surface energies, not the removal of bulk material.

As described above, the glow discharge process traditionally takes place in a reduced atmosphere of air, but by using other vapours such as methanol or alkyl/pentyl amines a different surface modification effect can be achieved. A charged surface property can be used as a positive advantage.

2.3.2 Importance for electron microscopy

Why are these properties important for electron microscopists?

Samples (viruses, nano-particles, cells etc.) are commonly in the form of a suspension dispersed on a TEM grid accompanying some sort of support film (i.e. formvar/carbon). The support film, when produced, usually has a variable, charged surface. Evaporated carbon film is naturally hydrophobic, but not uniformly so, therefore the “spreading” of the suspension is very difficult.

2.3.2.1 Hydrophobicity and Hydrophilicity

Hydrophobicity is the physical property of a molecule (known as a hydrophobe) that is ostensibly “repelled” from a mass of water. In reality there is no repulsive force involved; it is actually an absence of attraction. Hydrophobic molecules tend to be non-polar and, thus, prefer other neutral molecules and non-polar solvents. Hydrophobic molecules in water often cluster together, forming micelles. Water on hydrophobic surfaces will exhibit quite a high contact angle (Figure 2). In short, an aqueous solution has to be “forced” to come into contact with a hydrophobic (non-polar) surface.

Figure 2 - Hydrophobic surface – large contact angle

The closer that the contact angle (θ) is to 0°, the better is the degree of hydrophilicity.

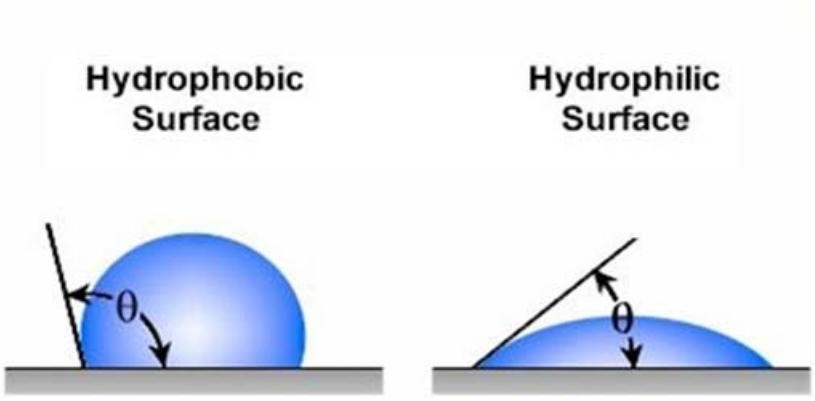


Figure 3 - Hydrophobic and Hydrophilic surface comparing contact angle

High	**Contact Angle**	**Low**
Poor	**Adhesiveness**	**Good**
Poor	**Wettability**	**High**

In contrast to a hydrophobic surface, water and liquid spreads very easily on a hydrophilic surface (Figure 4), and the contact angle, θ, is much lower.

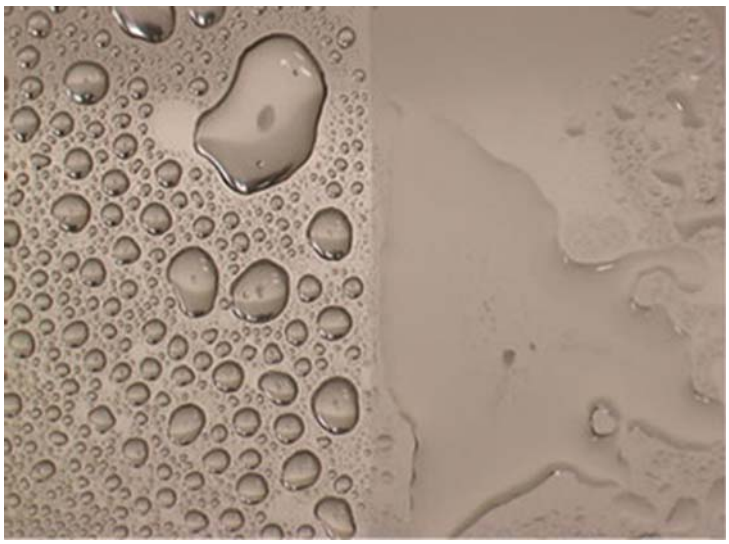


Figure 4 - Hydrophobic surface **Hydrophilic surface**

2.3.3 Glow discharge in air – Hydrophilic –ve

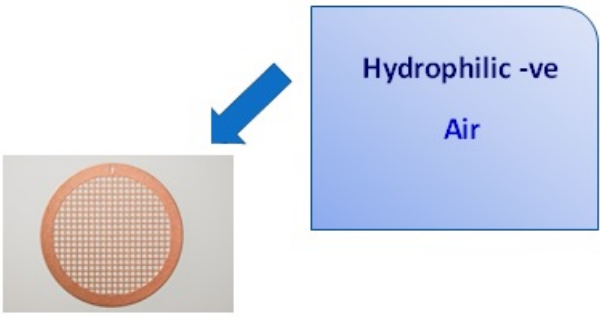


Figure 5 - Hydrophilic –ve surface

The standard method of glow discharge to render carbon support films and other surfaces hydrophilic is to conduct the process in a vacuum with a reduced volume of leaked in air.

The product of this process provides a surface that is on the whole Hydrophilic –ve, i.e. a net negative charge. The surface does not undergo significant modification other than a change of charge and the effect is not permanent. This treatment of the film avoids aggregation of particles at the grid square boundaries when the sample droplet is applied.

2.3.4 Glow discharge with hydrocarbons (methanol) – Hydrophobic -ve

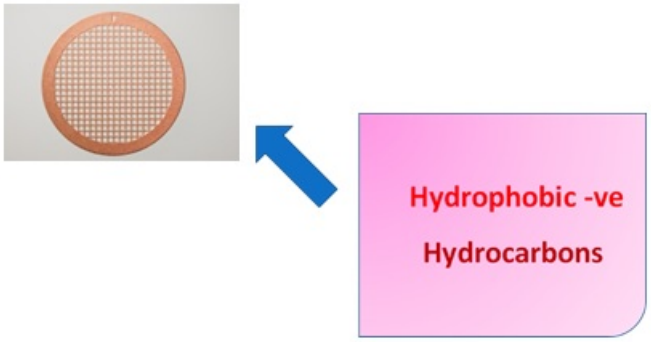


Figure 6 – Hydrophobic -ve surface

A carbon film treated in a reduced atmosphere of hydrocarbon, usually methanol, produces a hydrophobic –ve surface. As with the air only treatment this effect is not a permanent one.

Positively charged macromolecules such as ferritin and cytochrome c family of proteins (associated with the inner membrane of mitochondria) adsorb strongly.

2.3.5 Glow discharge with alkyl amines – Hydrophobic +ve

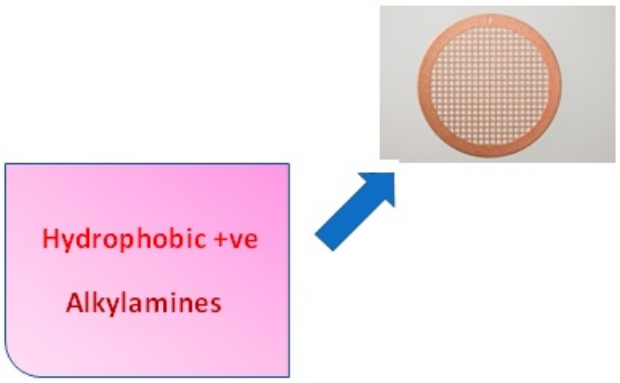


Figure 7 - Hydrophobic +ve surface

A carbon film treated in an alkyl amine vapour is negatively charged. This is usually achieved by using pentylamine (other amines can be used such as pentylamine and amylamine). Dimensional changes to the film thickness occur from the deposited polymer. Glow discharge in the presence of such vapours causes plasma polymerisation in the chamber, depositing a thin layer of polyamines onto the carbon surface as well as the chamber itself. It is for this reason that we advocate carrying out glow-discharging in an amine atmosphere in a separate chamber to residual air. This is why the GloQube was designed to have a “clean chamber” for air and a “vapour chamber” for an amine atmosphere.

Table 3 - Chamber designation labels

	Clean chamber label		Vapour chamber label

Glow-discharging in an amine atmosphere was originally used to permit nucleic acids to adhere to carbon film (Dubochet et al., J. Ultrastr. Res. 35 (1971) 147-167). Since nucleic acids are negatively charged at neutral pH, they do not attach to a carbon film that has been glow-discharged in residual air, because, as described in 2.3.3 above; this process results in a negatively charged surface.

This is also suitable for other negatively charged macromolecules, i.e. it can be used to chemically attach a wide variety of biological molecules including proteins, antibodies, and nucleic acids

Note: In published literature you will often find contradictory information about the hydrophobicity of films glow discharged in this way, some say that it makes the surface hydrophilic, others hydrophobic.

2.3.6 Glow discharge with magnesium acetate – Hydrophilic +ve

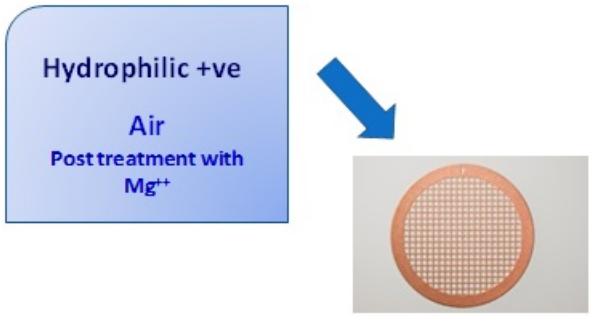


Figure 8 - Hydrophilic +ve surface

A positively charged hydrophilic film is the one type of film that cannot be obtained using glow discharge alone. However, this can be partially overcome by glow discharge in air followed by post treatment with a 5 mM solution of magnesium acetate. The negative charges of the hydrophilic surface are neutralised by the Mg^{++} ions from the solution. Another simple way is by using 0.1 % (w/v) polylysine solution after the glow-discharge. This procedure is suitable for DNA molecule suspensions on grids, or for AFM using substrates of freshly cleaved mica or HOPG (Highly Ordered Pyrolitic Graphite).

2.3.7 Glow discharge summary

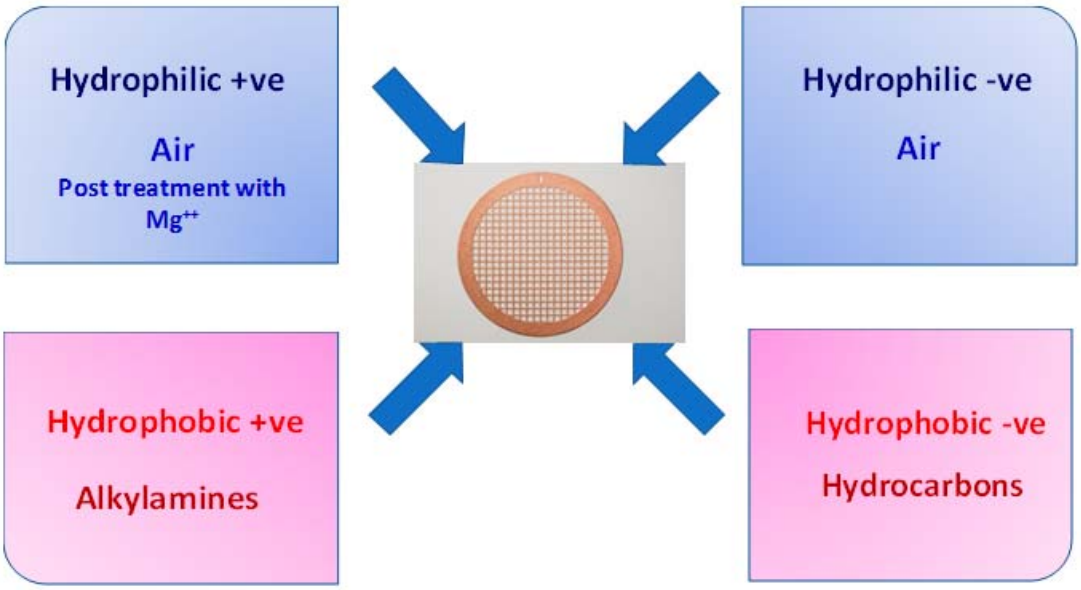


Figure 9 – Substrate surface charge overview

- Evaporated carbon support film is naturally hydrophobic
- Most specimens like a hydrophilic surface
- Surfaces can be made either hydrophilic or hydrophobic
- Surfaces can be +ve or –ve

3 Installation

The system is bench mounted and may be positioned in any convenient space. A single mains socket is required for power. The rotary pump can be positioned behind the GloQube and takes its power from the main instrument.

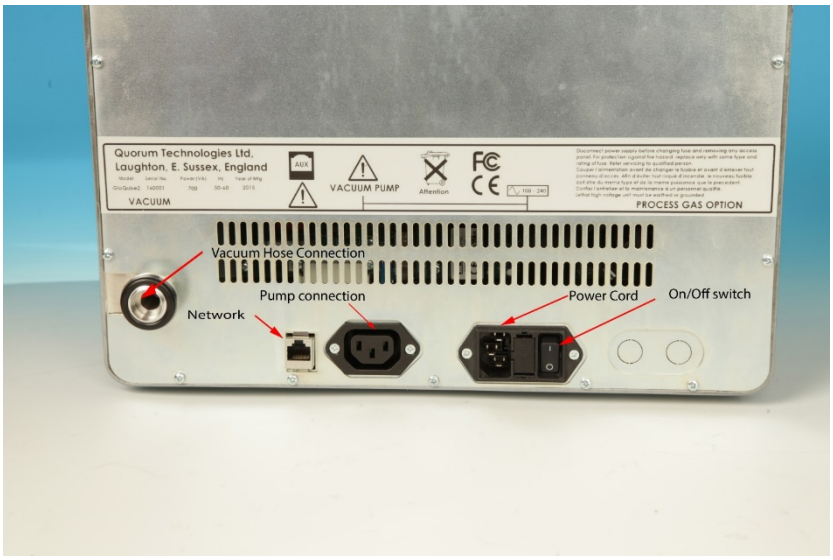


Figure 10 - Connections for Installation

3.1 Connecting the rotary pump and power cords

This section describes how to fill the rotary pump with oil, connect the oil mist filter, connect the vacuum hose to the GloQube and connect the electrical power cords.

3.1.1 Filling the pump with oil

- Remove the red screw cap on the top of the pump
- Insert a small funnel to assist in filling with oil
- Carefully pour in the oil from the 1 litre bottle provided (Part number 13233).
- Fill to approximately 1 cm below the full mark
- Replace red screw cap

Figure 11 - Rotary pump oil fill

3.1.2 Connect the oil mist filter

- Screw the blue oil mist filter (07803) in to the aluminium filter carrier
- Using the KF 16 clamp provided, clamp the filter and carrier onto the outlet side of the rotary pump (marked with ↓) making sure that the mesh filter and 'O' ring carrier are in situ.

Figure 12 - Rotary pump – oil filter connection

3.1.3 Connect the stainless steel vacuum hose

- Using the KF 16 clamp and 'O' ring carrier provided, attach the stainless steel vacuum hose to the unit as shown in Figure 13.
- Connect the other end of the hose to the inlet side of the vacuum pump (↑) using the KF 16 clamp and 'O' ring carrier/filter provided (Figure 13).

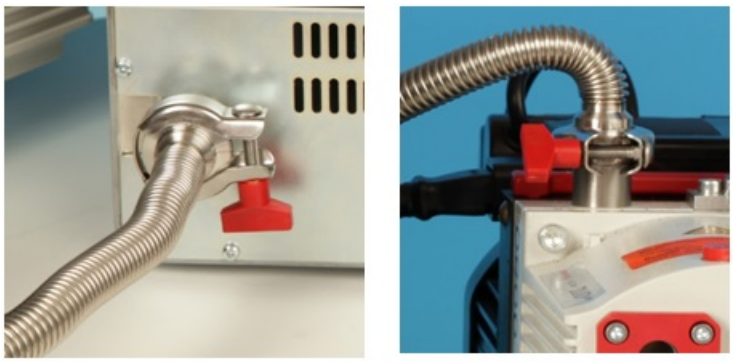


Figure 13 - Rotary pump – vacuum hose connection to GloQube and pump

3.1.4 Connect the power cords

- Take the power cord with the mains plug and connect to the power in socket next to the on/off switch (See Figure 10 for location). Plug the other end into a suitable mains socket (do not switch on yet).
- Take the other double ended lead and plug one end into the pump and the other into the back of the GloQube (this is identified as "pump connection" in Figure 10).
- Check that the voltage switch is set to the correct voltage for your country and then switch on the pump (Figure 14).

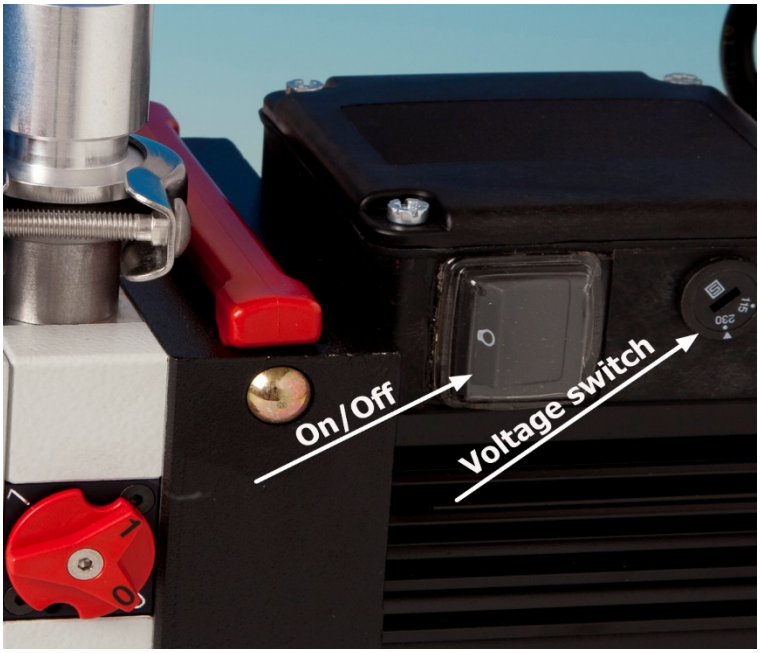


Figure 14 - Rotary pump

The unit should now look as in Figure 15 below.

Figure 15 - Fully connected

3.2 Filling and installing the vapour injection system

The vapour injection system is made up of a glass vial which is sealed by a septum. As the vial is loaded into the injection system housing the septum is pierced by a hypodermic needle. The needle is covered by a shutter which opens as the vial is rotated preventing any risk of injury to the user. (See Figure 16 and Figure 17).

Figure 16 - Vapour injection system installed

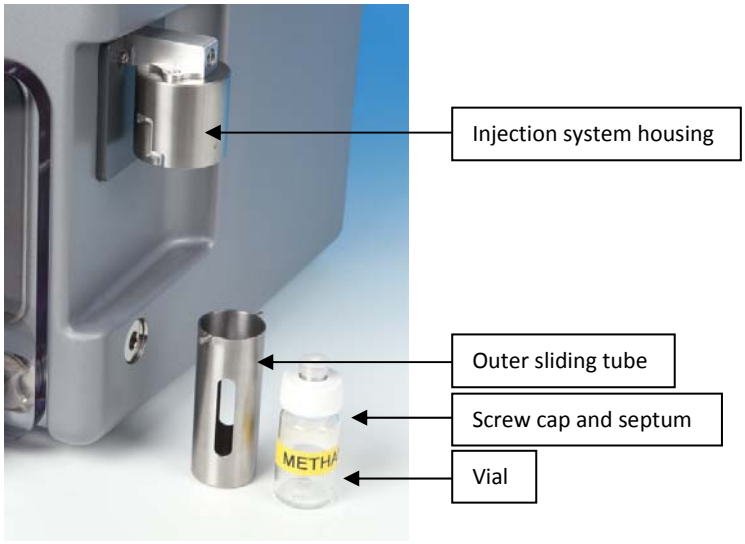


Figure 17 - Injection system main components

3.2.1 Filling the vial

It is recommended that the vial be filled in a fume cupboard. It should only be filled to about half of its volume. Observe normal safety precautions for the liquid being used. If in doubt, consult your local health and safety representative and conduct your own risk assessment. Once the vial is filled and sealed it can then be placed inside the outer sliding tube ready for fitting to the GloQube.

3.2.2 Fitting the screw cap and septum

The cap for the vial is made up of the following components:

- Protective cap
- Septum
- Screw cap
- Metal spacer (This is not a consumable)
- Cap seal
- Vial

These are assembled in the order shown in Figure 18.

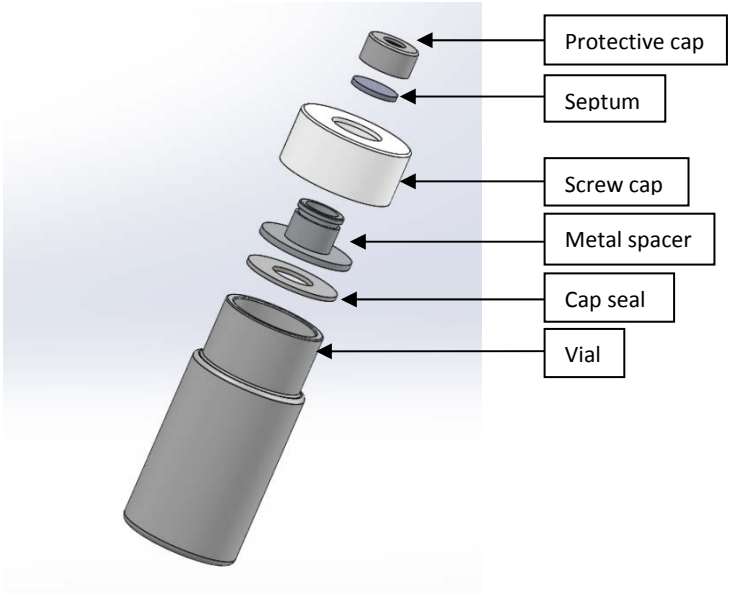


Figure 18 - Vial components

These components are available as a consumable pack (less the metal spacer) see section 7.1 consumables and spare parts.

3.2.3 Loading the vial

The vial is fitted to the system by locating the two lugs (Figure 19) on the outer sliding tube into the corresponding slots in the injection system housing. The sliding tube is then pressed upwards, rotated clockwise, pressed up again and once more rotated clockwise where it will lock in place (See Figure 20). Removal is simply by rotating anti-clockwise as the spring loading will push the outer sliding tube downwards.

Figure 19 - Locating lugs

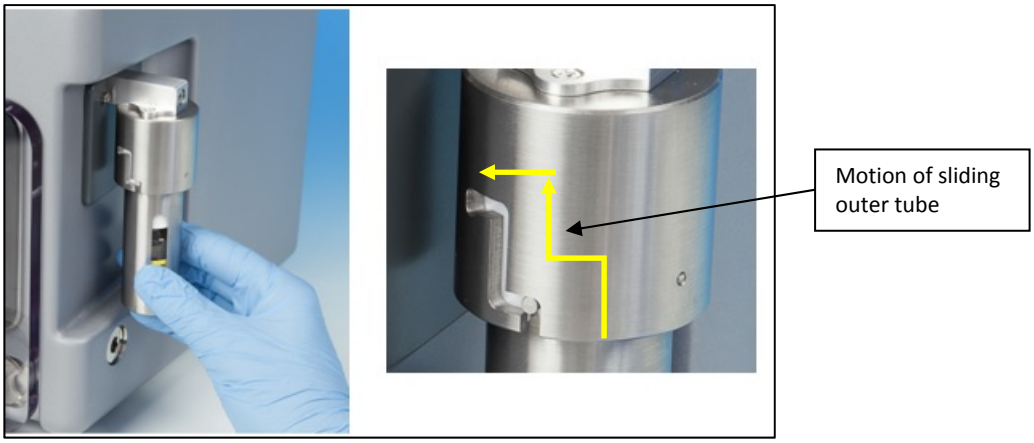


Figure 20 - Injector mounting

3.2.4 Loading the samples

Each chamber of the GloQube is fitted with a tray for supporting samples (See Figure 21).

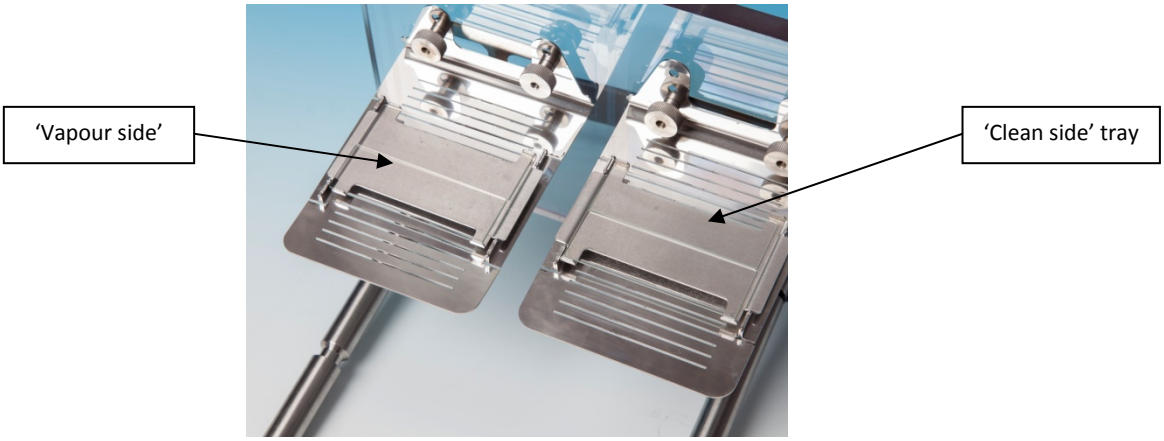


Figure 21 - Sample support trays

The GloQube is vented and the door slid open. Normally, for TEM grids, glass microscope slides are used to load the grids. Each tray can accommodate 2 standard 3" x 1" slides. Place the grids onto the slide(s) making sure they are well spaced. Transfer the slide(s) to the selected tray ('clean' or 'vapour' side) as shown in Figure 21. Carefully, close the door so as not to disturb the grids. Run the chosen treatment profile. Other samples or even grids can be placed directly on the trays and treated in the same way.

4 Operation

4.1 Key Features

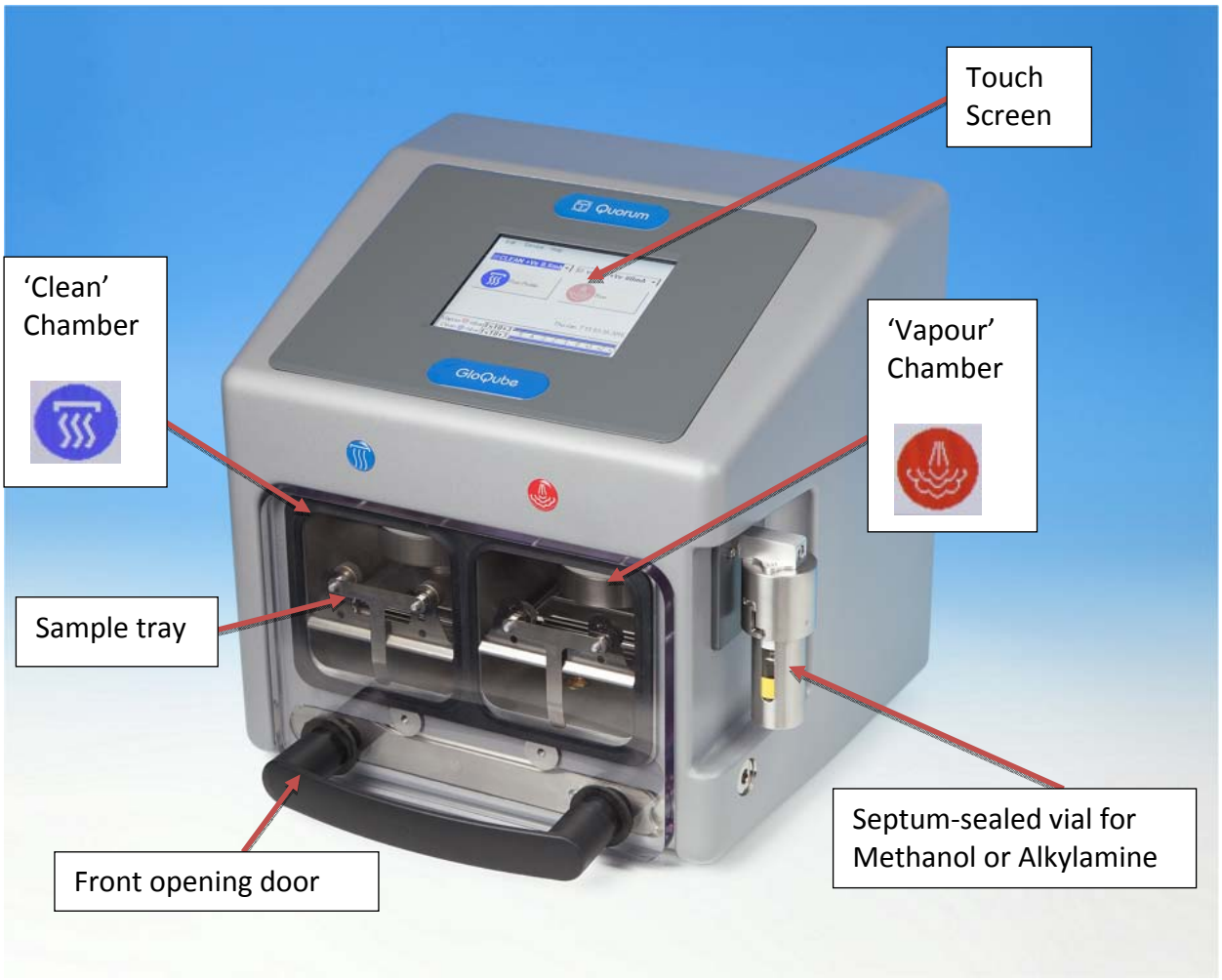


Figure 22 - System overview

4.2 Switching on

After connecting the pump, vacuum hose and cables as described in section 3.1, make sure that the rotary pump is switched to the correct voltage (Figure 14) and the pump power switch is switched to on.

On the back of the GloQube unit, turn the power switch on (Figure 10). The system will now boot up into the Startup screen (See Figure 23).

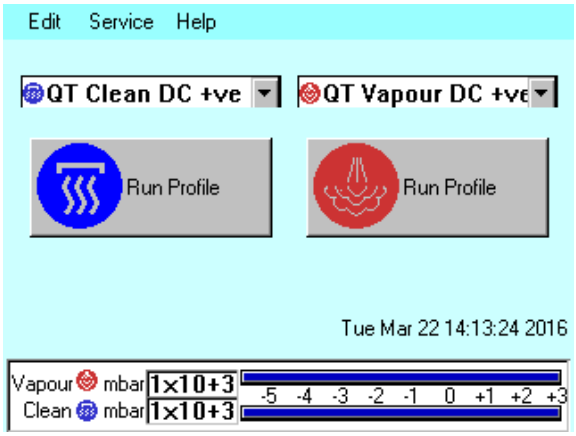


Figure 23 – Start-up screen

5 Running the system

5.1 Screen overview

Once the software has booted up, the initial screen appears on the touch screen display of the GloQube unit. The screen is laid out in four functional zones.

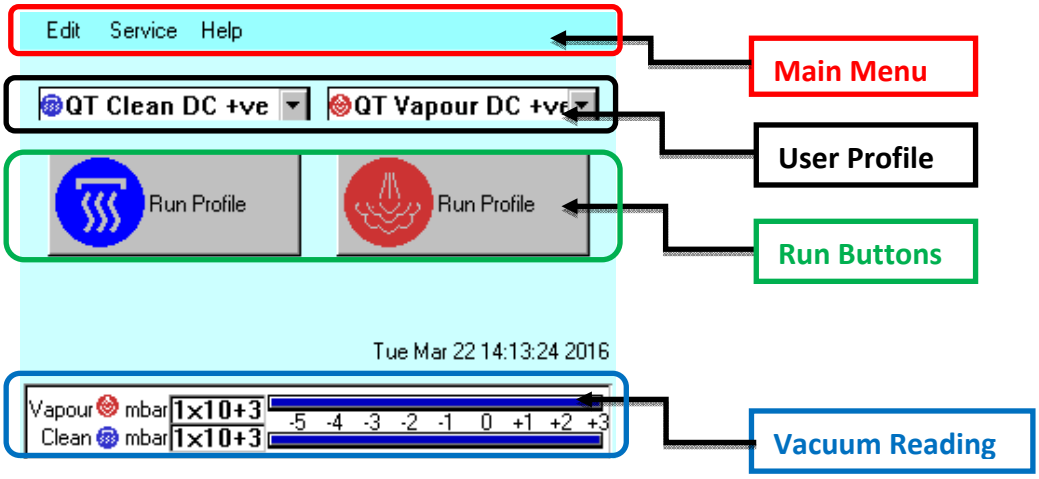


Figure 24 – Start-up screen zones

5.2 Screen functions

The main menu has three headings which control all the functions of the GloQube. These are Edit, Service and Help (See

Figure 24 above).

5.2.1 Edit

The Edit element of the menu contains three sub menus**, Profiles, System** and **User**. (See Figure 25).

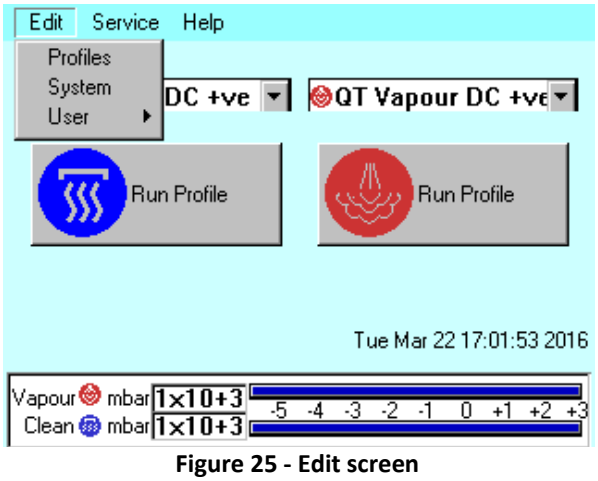


Figure 25 - Edit screen

5.2.1.1 User management

The GloQube does not employ a user account system with individual login, instead users are granted access privileges at a group level. There are two groups to which a user can have access, **User** and **Administrator.**

User is lowest level security group and is not password protected. The GloQube, when switched on, automatically starts up in **User** mode. In this mode the operator can only run, edit and create new profiles, modifying **System** parameters is not permitted.

The second security group is **Administrator,** this is password protected, and the password is **admin**. This can be changed afterwards, if required. At this level, it is possible to access the **System** settings and also create other **User** groups with customised privileges.

5.2.1.2 Changing User group

When first switched on the GloQube starts in **User** group mode, to switch to **Administrator** level follow the procedure set out below:

i. Select **Edit** from the Main menu
ii. Choose **User**
iii. Select **Level,** a dialog box will appear on the screen, Figure 26.

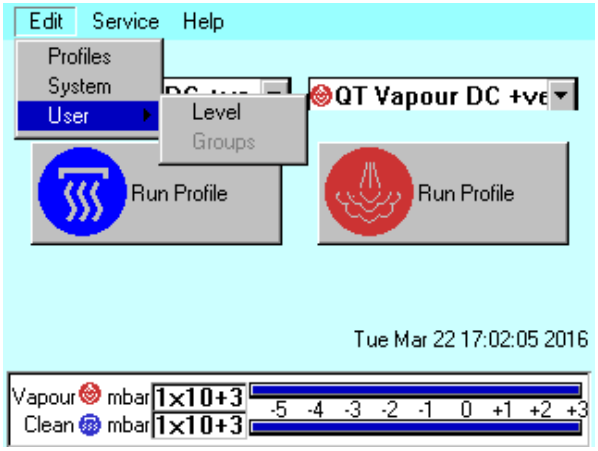


Figure 26 - Edit User level

To change **User** level to **Administrator**:

i. Tap on the Access code box and a keypad will appear
ii. Type the password into the Access code box
iii. Press OK and then OK, a pop up box will appear with confirmation of administrator rights (Figure 29), press OK and the instrument will be in Administrator mode

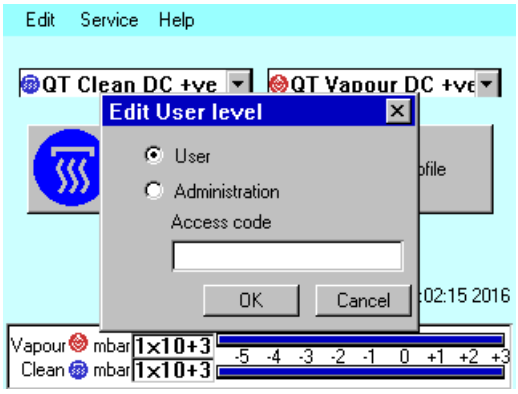


Figure 27 - Edit user level screen

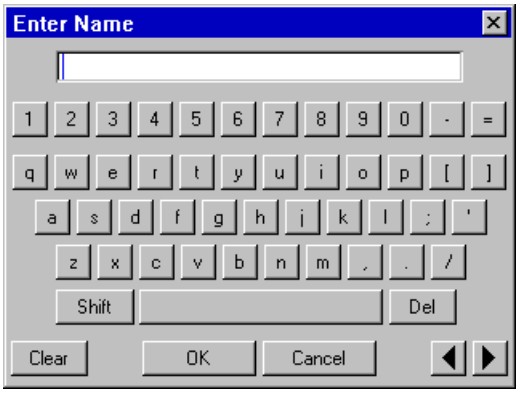


Figure 28 - Keyboard

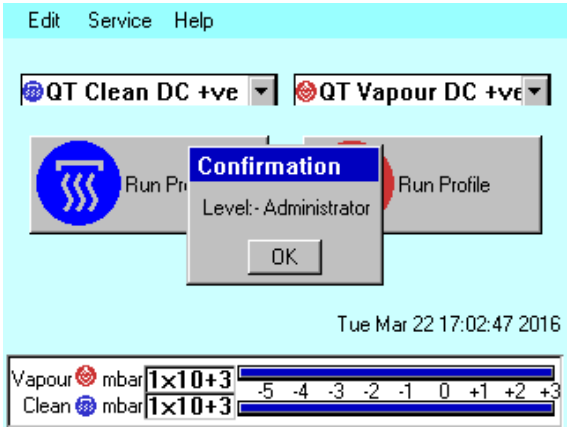


Figure 29 - Administrator level

5.2.1.3 System

The **System** menu is the second sub-menu within the **Edit** element of the main menu (Figure 25).

Tapping on **System** opens a further sub-menu called **Glow Discharge** which contains three further sub-elements called **Network, System and Maintenance** (See Figure 30).

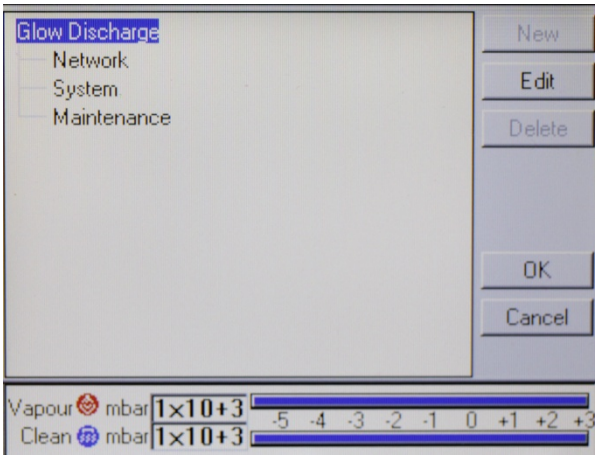


Figure 30 - System sub-menu

To link the GloQube to your network, first use a standard CAT5/5e cable with RJ45 network connectors to connect the GloQube AUX Network port (Figure 10) directly to your computer's network port or a network hub/switch.

The **Network** category determines the IP address used by the instrument for network connections. To edit **Network** properties, tap on **Network** and then tap on the **Edit** button.
The network properties are displayed as in Figure 31.

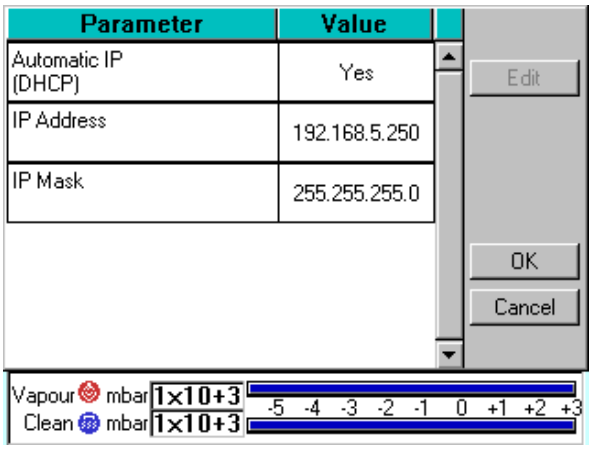


Figure 31 - Network IP Address

To set the instrument to use an IP address automatically generated by your DHCP server, ensure that the Automatic IP (DHCP) parameter is set to 'Yes'. If your network does not have a configured DHCP server, you will need to set the IP address manually. To set the IP address manually, set Automatic IP (DHCP) to '**No'** then enter the primary IP address and subnet mask address manually.

5.2.1.4 Connecting to a Network

To connect to a network ensure that you have connected the instrument correctly to your network. Choose **Service** then **Connect Network** on the menu tree. A dialog box confirms that the connection is active and shows its IP address.

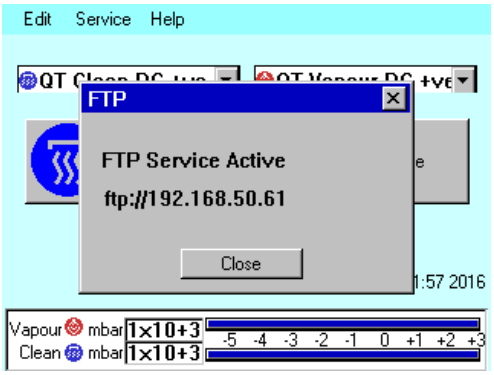


Figure 32 - Active ftp address

5.2.1.5 System

This menu is reached by tapping **Edit**, **System** then **System**.

5.2.1.6 Profiles

The operation of the GloQube is controlled by a profile. A profile dictates a sequence of events in a typical glow discharge cycle. A profile can also be created to carry out simple operations such as pumping or venting of the sample chamber. Many of the basic operations of the instrument such as pumping, outgassing or venting the chamber occur automatically, as does the sequence in which they occur.

The GloQube is supplied with several default profiles to perform the basic and most common operations (Figure 23). Custom, new profiles can also be created to suit your particular application. Existing profiles can also be modified in order to change specific functions.

5.2.1.7 Editing an existing profile

On selecting the profile sub menu, a list of current profiles is displayed as shown in Figure 33.

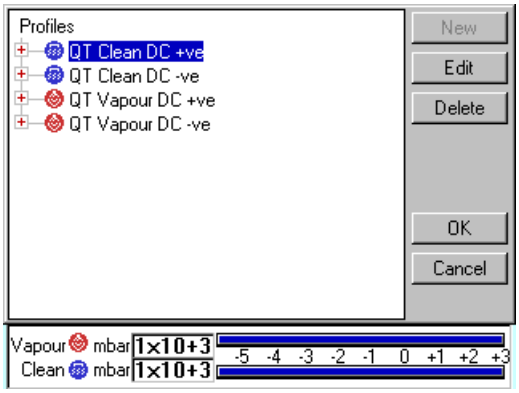


Figure 33 - Profile list

Select ‘Edit’ to access the profile settings (See Figure 34).

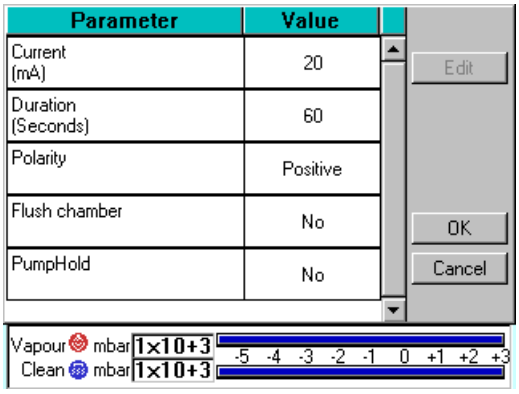


Figure 34 - Edit parameter screen

Choose the parameter which is to be edited and type the new value in using the keypad.(See Figure 35). Press 'Cancel' to ignore the new setting.

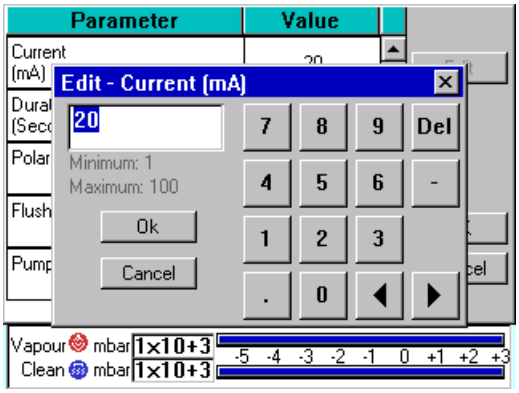


Figure 35 - Edit parameter keyboard

The polarity of the discharge may also be changed (See Figure 36).

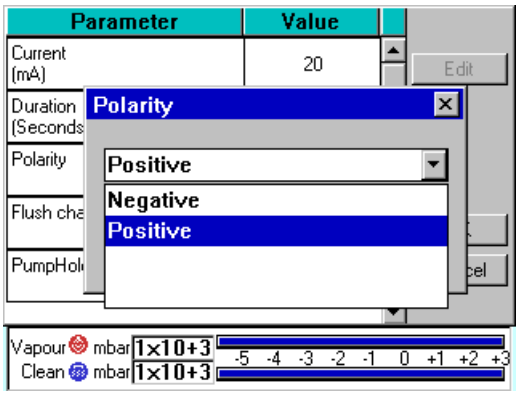


Figure 36 - Edit polarity menu

5.2.1.8 Polarity and the use of alkyl or pentyl amine

The change of polarity is important if alkyl or pentyl amine is being used in the vapour chamber, when creating or using a profile for this process it is important that the polarity of the glow discharge head is set as **DC –ve**. A typical process time is suggested as 45 seconds with a bleed vacuum of 8 x10-2 mbar.

5.2.1.9 Adding a new profile

From the 'Profiles' sub-menu (see Figure 33) select the top line 'Profiles'. Select 'New'. (This appears 'greyed out' in the screen shot if another profile is highlighted) See Figure 37.

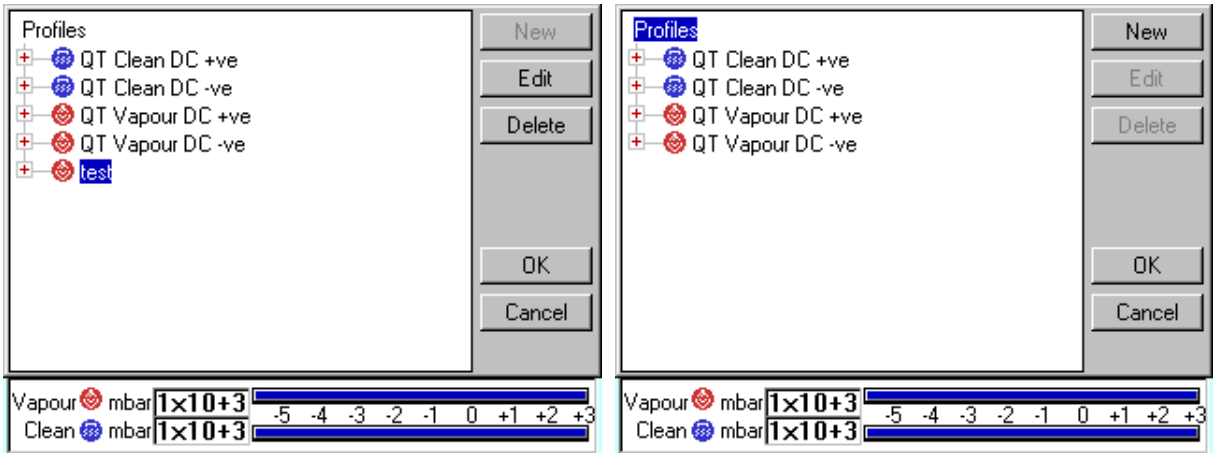


Figure 37 - Edit and create new profile menu

Touch the type of profile to be created (Vapour, Clean, Vent...) from the pull down menu (see Figure 38). Touch in the profile name area and type in a name for the new profile. Touch 'OK'. The new profile appears at the end of the list of profiles (see Figure 39). Touch 'Edit' to change the parameters as described in 5.2.1.7.

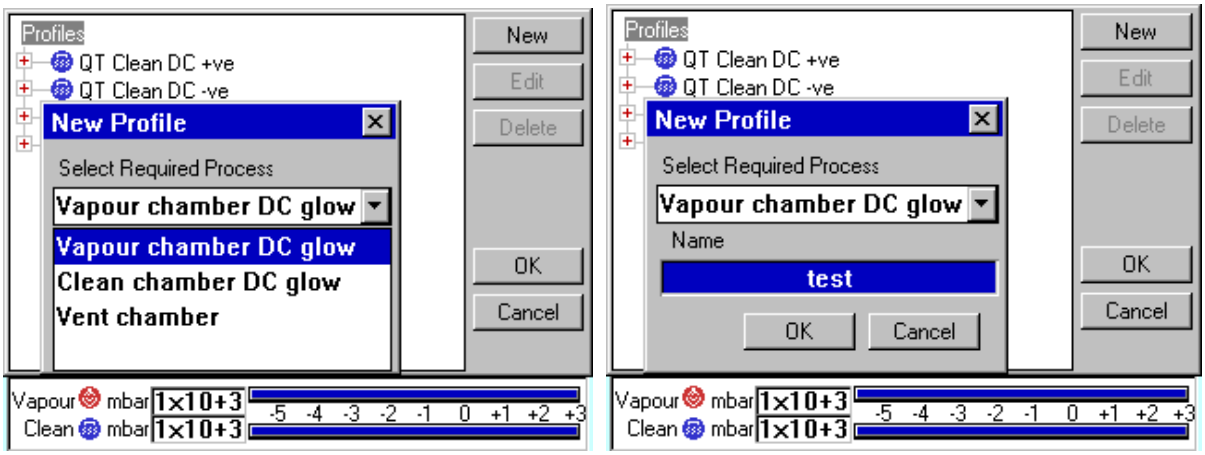


Figure 38 - Selecting a profile type and naming new profile

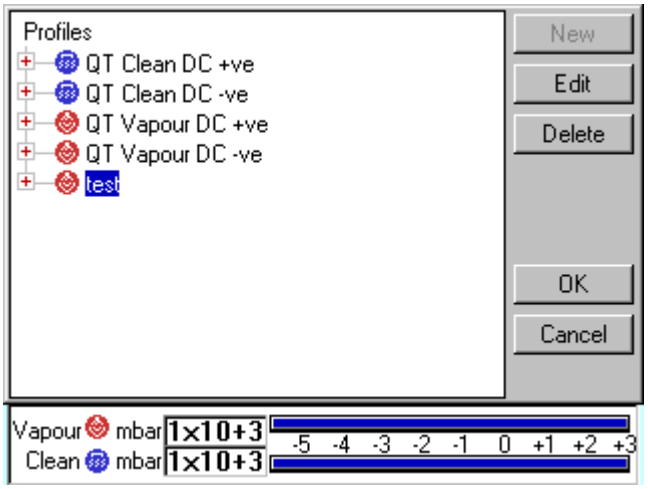


Figure 39 - New profile in list

5.2.2 Service

The **Service** menu contains five sub-menus, **Set Time, System, Maintenance, Process Log** and **Connect Network** (See Figure 40 below).

The S**ystem** sub-menu will be 'greyed out' if you are logged in as a standard user, this option will be available if you are logged in as an Administrator.

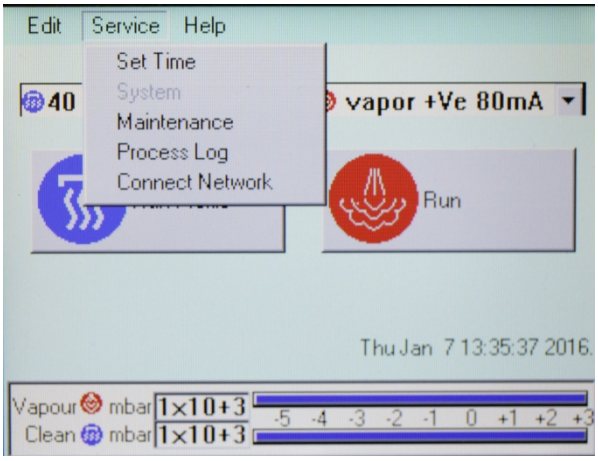


Figure 40 - Service menu

5.2.2.1 Set Time

In this sub-menu you can set the date and time for the GloQube (See Figure 41). By selecting this option, a separate pop up will appear for each function, then by selecting each display window the Day, Month, Year and Time can be individually adjusted. To change any of the numerical fields, tap in the box and then select the correct value using the displayed keypad. Tap on the OK button to confirm the changes or on the Cancel button to discard them.

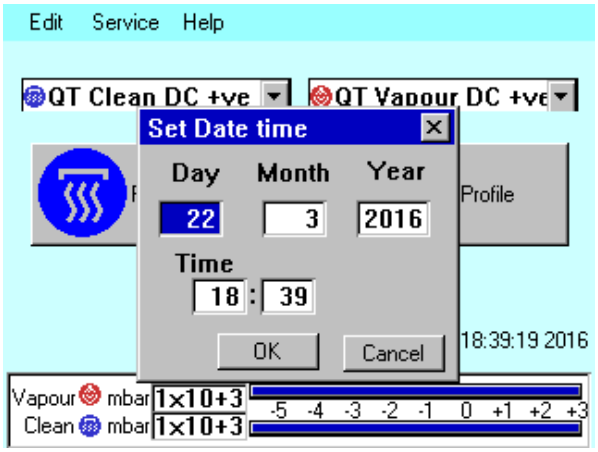


Figure 41 - Set time

5.2.2.2 System

5.2.2.3 Maintenance

This option allows you to change the default settings for cleaning reminders.
To change the settings, tap on **Maintenance** and the maintenance parameters will then be displayed (see Figure 42).

The time of the last clean will be displayed in the top window; the second window displays the elapsed time since the last clean; the next window displays the number of hours that the GloQube has been running and the final window displays the time of the last service.

When a system clean has been performed the window will look like this:

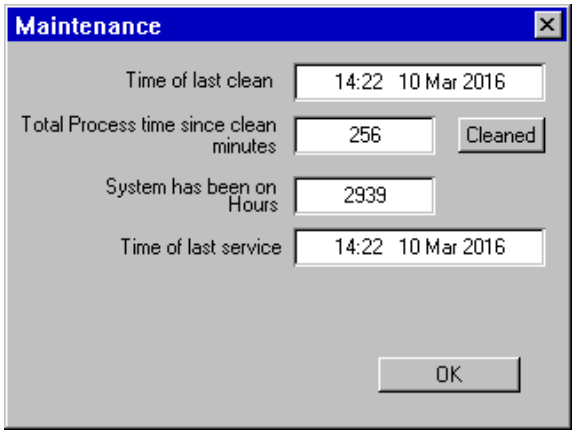


Figure 42 - Maintenance parameters

5.2.2.4 Process log

In this sub-menu the process log is displayed. This function is a record of each process that has been run on the GloQube. There can be a maximum of 100 processes saved at any one time.

After that point, the system will begin to over-write any existing, earlier logs. Process events are listed in order, with the most recent at the top of the list. The log displays five events on each page. To browse through the list, use the buttons in the lower left corner to navigate through the list, allowing viewing of other pages (see Figure 43).

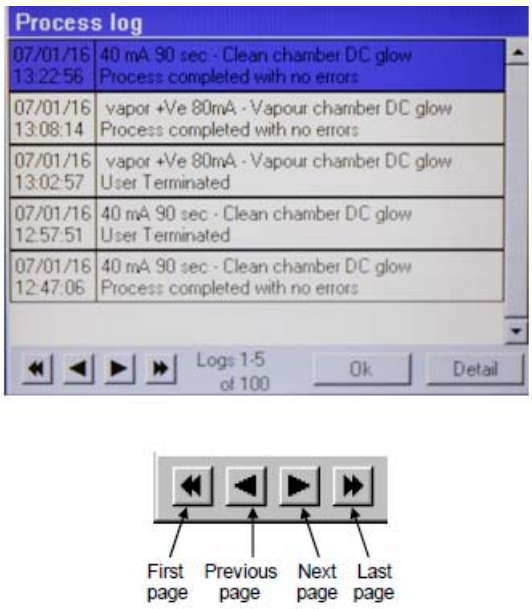


Figure 43 - Process log and navigation buttons

5.3 Help menu

Touching the help button allows the user to view information about the system and access the help system.

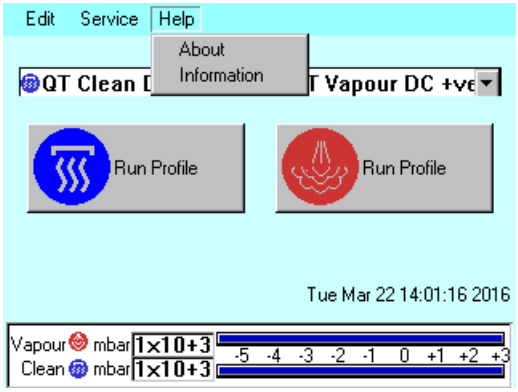


Figure 44 - Help sub menu

Touching the ‘About’ button will display details of the current firmware (See Figure 45).

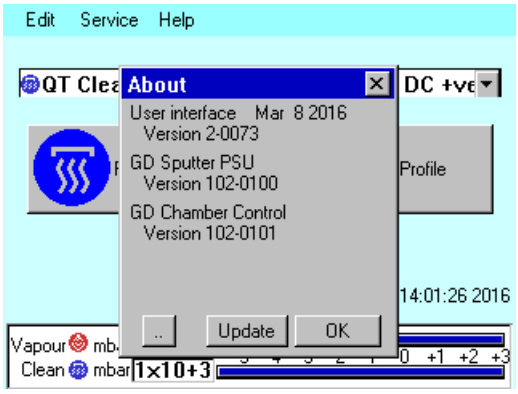


Figure 45 - About screen

Touching 'Information' will display the help topic window (See Figure 46).

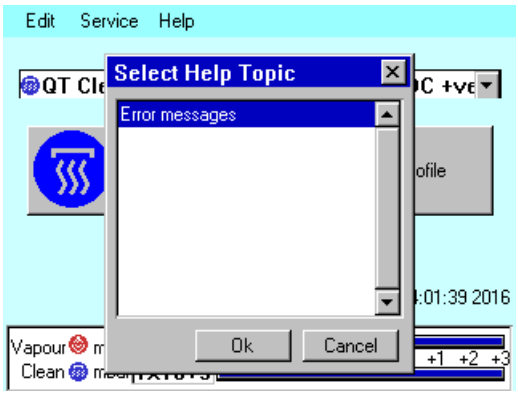
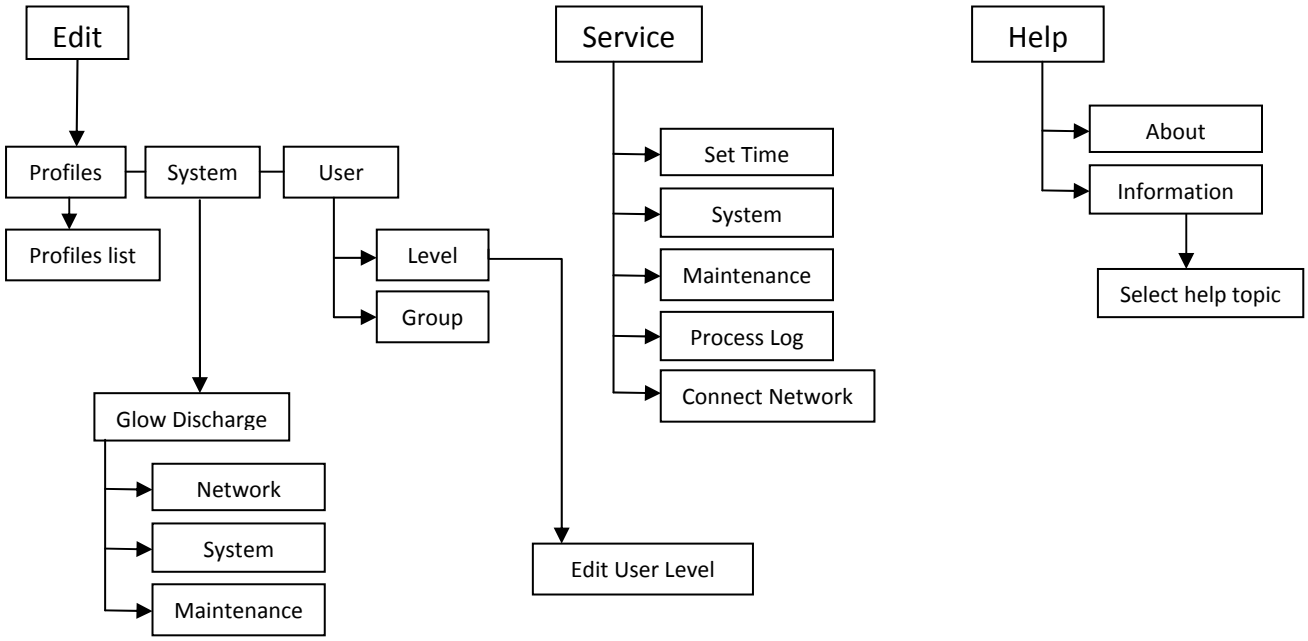


Figure 46 - Help topic menu

5.4 GloQube Menu structure



6 Basic maintenance

6.1 Door removal

To remove the door, simply push the sliding locking bar to the left using the scalloped cut-out and pull the door outwards (See Figure 47).

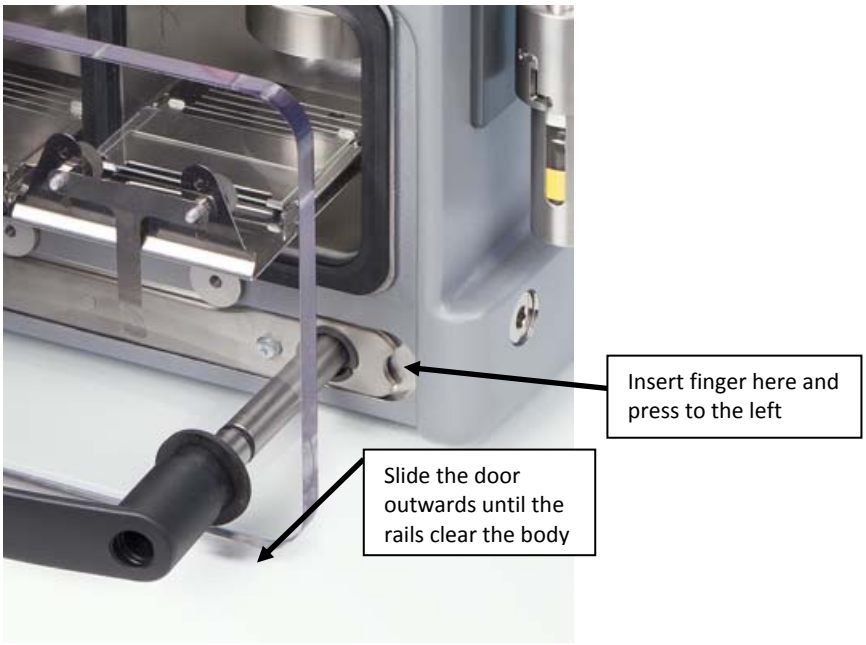


Figure 47 - Door removal

6.2 Door replacement

Align the two guide rods with the holes on the main body and push the door into place. The locking bar will latch automatically (See Figure 48).

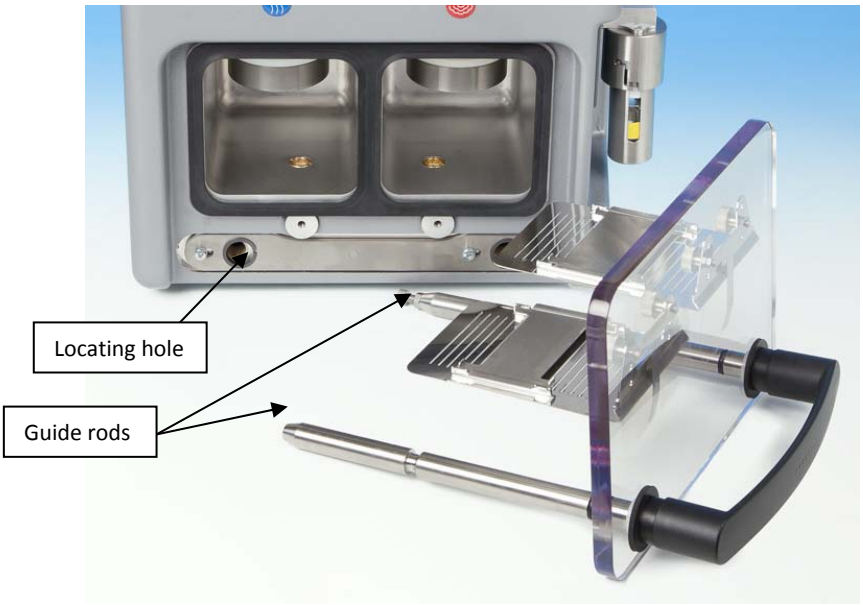


Figure 48 - Door replacement

6.3 Needle replacement

NB: When replacing the needle take great care as they are very sharp.

- Remove the vial
- Remove the two screws retaining the vial mounting ring (See Table 4)
- Carefully remove the needle from the Luer adapter

- Attach a new needle to the Luer adapter
- Replace the vial mounting ring and tighten the two screws

Table 4 - Replacing the needle

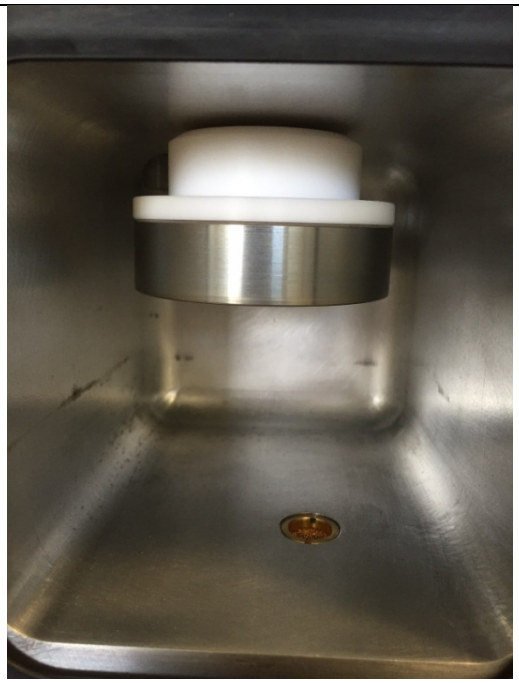
		
Remove the two screws	Remove the locating ring	Remove the needle

6.4 Cleaning the chambers

- Remove the front door as described in 6.1
- Wearing suitable gloves, simply unscrew the glow discharge head (see Table 5). Replacement is the reverse of removal
- Carefully wipe the inside of the chambers with a lint free cloth dampened with isopropyl alcohol
- Similarly, wipe the glow discharge head

Note: the vapour chamber could have deposits from the hydrocarbons which have been used. Take suitable precautions and dispose of the cloth after use as required by your local safety policy.

Table 5 - Glow discharge head

 Glow discharge head	 Glow discharge head removed

7 Consumables and spare parts

7.1 Consumables

Description	Part #	Quantity supplied in pack
Hypodermic needle Pack	26938	12
Lipped Door Seal	26864	1
Glass Vial Pack *(cap,septum,screw cap,seal and vial)*	26928	10
Metal spacer *(Vial height extender)*	25264	1

8 Terms and Conditions

8.1 Definitions

‘Seller’ means Quorum Technologies Ltd.
‘Buyer’ means the person, company or academic/government institute placing the order.
‘Order’ means the order placed by the Buyer for the supply of the goods.
‘Goods’ means the equipment and parts (or any of them) covered by the order.

8.2 General

Any Order, whether following a quotation or tender or not, shall incorporate these Conditions of Sale. The Seller shall not be bound by any variation or modification of/substitution for/addition to these conditions (even though included in or referred to in the purchase order or other Buyer's document), except as expressly agreed in writing by the Seller.

8.3 Quotations

Quotations shall be valid for acceptance for a period of 30 days unless otherwise specified by the Seller.

8.4 Delivery Date

Any date named by the Seller for delivery is given and intended as an estimate only and the Seller shall not be liable for any loss or damage howsoever arising out of delay in delivery.

8.5 Place of Delivery

Unless otherwise agreed in writing all deliveries shall be ex Seller's works. The Seller will at the request and expense of the Buyer arrange carriage and insure the Goods against normal transit risks, but in the event of loss or damage whether or not caused by the negligence of the Seller or its carrier or any other person, the Seller's liability shall be limited to passing on to the Buyer the benefit of such insurance. If the Goods are to be sent abroad, the Buyer shall procure at their own expense any import licence required for the country to which the Goods are to be dispatched.

8.6 Storage

In the event of Seller not receiving forwarding instructions within seven days after notification in writing to the Buyer that the Goods are ready for dispatch, the Goods will be stored by the Seller at the risk and expense of the Buyer.

8.7 Passing of Property and Risk to Buyer

The risk in the Goods shall pass to the Buyer at the point of delivery. The point of delivery shall unless otherwise agreed in writing be ex Seller's works. The Property in the Goods remains with

the Seller until such time as the Seller has received full and final payment in accordance with the contract.

8.8 Security Interest

Seller reserves and Buyer grants to Seller a security interest in all Products sold and all proceeds thereof to secure the full payment and performance by Buyer of its obligations and liabilities to Seller. Buyer acknowledges and agrees that this document or copies of this document may be filed with the appropriate authorities as a financing statement and agrees to execute and deliver such other document as Seller may request in order to evidence or perfect such security interest.

8.9 Terms of Payment

The terms of payment shall be net 30 days from dispatch. Quorum Technologies Ltd. understands and will exercise our statutory right to interest under the Late Payment of Commercial Debts (Interest) Act 1998 if we are not paid according to the agreed terms. Interest will be applied using the Bank of England Base Rate + 8% and calculated on a daily basis in accordance with the following formula: Interest Payable = Debt x Interest Rate x Number of days late/365. Additionally Quorum Technologies Ltd reserves the right to withdraw standard and extended warranty terms from Buyers who fail to meet the agreed payment terms.

Quorum Technologies Ltd. reserve the right to pursue debtors for the recovery of all other costs and expenses including any legal fees and expenses incurred in collecting overdue amounts or otherwise enforcing its rights under these terms and conditions.

8.10 Delivery In Instalments

Where the contract permits delivery by instalments, each delivery shall be deemed to be a separate contract provided that failure by the Buyer to pay for any instalment shall entitle the Seller to terminate the whole contract by notice in writing to the Buyer.

8.11 Installation, Tests and Take-Over

Where the contract provides for installation of the Goods by the Seller, the Buyer shall at its own expense comply with the requirements of the Site Preparation Guide supplied to the Buyer by the Seller prior to the delivery of the goods.
When the installation of the Goods is complete and all tests to be made by the Seller have been passed to the reasonable satisfaction of the Buyer, the Buyer shall forthwith take-over the Goods and shall certify accordingly. The Buyer shall be liable for any damage to or loss of the Goods arising from any use of, or attempt to use, the Goods by the Buyer, its servants or agents prior to the date of take-over unless such use of, or attempt to use, the Goods is made under the supervision of the Seller's Representative.
The Warranty Period shall run from the date of take-over of the Goods by the Buyer save that, in the event that the Buyer fails to fulfil any of his obligations under the aforesaid Site Preparation Guide to the extent that the installation is delayed for more than 60 days from the date of shipment, the Warranty Period shall commence on the 61st day of delay.

8.12 Buyer's Tests

If the Buyer requires tests or inspections to be made, in addition to the standard tests and inspections made by the Seller, the Buyer shall be responsible for any costs incurred by the Seller in the performance of such tests or inspections. The results of tests carried out at the request of the Buyer will be certified to the Buyer as required.

8.13 Force Majeure

In the event of delivery being in the opinion of the Seller substantially delayed for any of the following, including but not limited to strikes, lock-outs, transport delays, war, riots, Acts of God or any other cause beyond the reasonable control of the Seller, the Seller shall be entitled at their option either:
To treat the contract as terminated in which case the Seller shall return to the Buyer any pre-payment made by the Buyer and subject to such repayment neither party shall have any further rights against the other, or:
The Seller may deliver the Goods as soon as the circumstances causing the delay cease, provided that delivery of no part of the Goods shall be delayed for more than 12 months from the original stated delivery date.

8.14 Warranty

Standard 12-month warranty

The Seller undertakes to replace or repair, at its option, any Goods supplied by the Seller (save as provided in (f) below) if a defect in material or workmanship arises under conditions of normal and proper use and maintenance (fair wear and tear excepted), provided that all of the following are true:

The Goods were operated and maintained in accordance with the Seller’s operating instructions.

The claim is first notified promptly in writing to the Seller.

The defect occurs within 12 months from the date of take-over of the Goods by the Buyer in accordance with the provisions of Clause 8.11 - Installation, Tests and Take-Over.

The Goods have not been repaired or modified by anyone other than the Seller or at the Seller’s direction.

In the case of Goods not of its own manufacture, the Seller’s responsibility shall be limited to the passing on to the Buyer the benefit of any guarantee or warranty given to the Seller by the manufacturer of such Goods.

Filaments, gaskets, targets and consumable items are themselves excluded from the warranty provisions.

Extended three-year warranty

The Seller may, from time to time, offer extended warranty terms on certain products. Extended warranty terms cover manufacturing defects only and require the defective component to be returned, carriage paid, to the factory. Return carriage costs are also the responsibility of the customer. These terms are offered at the absolute discretion of the Seller and are subject to the fulfilment by the Buyer of certain criteria which are published by the Seller in the Extended Warranty Registration Form and supplied with each product. Failure to comply with these criteria will limit the warranty to the standard 12-months only.

As outlined in Payment Terms (see section 9) Quorum Technologies Ltd reserves the right to withdraw standard and extended warranty terms from Buyers who fail to meet the agreed payment terms.

8.15 Bespoke Goods

Where the Seller has manufactured Goods to the design of, or furnished by, the Buyer, the Seller accepts no liability for design errors or the consequences thereof, and the Buyer shall indemnify the Seller against all demands, damages, costs, and expenses arising in connection with such design.

The Seller disclaims all other warranties - whether express or implied, oral or written - with respect to the Goods, including without limitation all warranties of merchantability or fitness for any purpose. The Seller does not warrant that the Goods are error-free or will accomplish any particular results.

The foregoing states the entire liability in contract and in tort of the Seller in respect of defective Goods and the Seller shall not, save as expressly provided herein, be liable for any other claim in regard to defects in the Goods.

8.16 Technical Representation

All drawings, descriptive matter, technical specifications and other particulars given in respect of the Goods (whether oral or in catalogues or advertisements or accompanying or referred to in Seller's quotation) are stated in good faith as being correct but are not binding in detail and do not form part of the contract unless stated to do so in the quotation. It is the Buyer's responsibility to ensure that the Goods ordered are sufficient and suitable for the Buyer's purposes. All recommendations and advice are given without charge and, whilst given in good faith, are given without responsibility on the Seller's part.

8.17 Patent Rights

The Seller shall indemnify the Buyer against any claim for infringement of Letters Patent, Registered Design, Trade Mark or Copyright by the use or sale of the Goods supplied by the Seller to the Buyer and against all costs and damages which the Buyer may incur in any action for such infringement or for which the Buyer may become liable in such action

Provided always that this indemnity shall not apply to any infringement which is due to the Seller having followed a design or instruction furnished or given by the Buyer or to the use of the Goods in a manner or for a purpose or in a foreign country not specified by or disclosed to

the Seller, or to any infringement which is due to the use of such Goods in association or combination with any other article or material not supplied by the Seller.

Provided also that this indemnity is conditional on the Buyer giving to the Seller the earliest possible notice in writing of any claim being made or action threatened or brought against the Buyer and on the Buyer permitting the Seller at Seller's own expense to conduct any litigation that may ensue and all negotiations for a settlement of the claim.

The Buyer on their part warrants that any design or instruction furnished or given by them shall not be such as will cause the Seller to infringe any Letters Patent, Registered Design, Trade Mark or Copyright in the execution of the order.

8.18 Design Rights

Any specifications, plans, drawings, patterns or designs supplied by the Seller to the Buyer in connection with the contract shall remain the property of the Seller, and any information derived therefrom or otherwise communicated to the Buyer in connection with the contract shall be regarded by the Buyer as secret and confidential and shall not, without the consent in writing of the Seller, be published or disclosed to any third party, or made use of by the Buyer except for the purpose of implementing the contract.

8.19 Limitation of Liability

Seller shall indemnify the Buyer against all claims founded on damage or injury which arise out of or to the extent of any negligent act or omission of the Seller, its servants or agents whether such claims are made by the Buyer or by a third party against the Seller or against the Buyer provided, however, that nothing in this condition shall render the Seller liable for injury or damage resulting from any negligent act or omission of the Buyer, its servants or agents, or any other contractor employed by the Buyer and the Buyer shall indemnify the Seller against all actions, demands and expenses arising in connection with any such injury or damage.

The Seller shall have in force Employer's Liability Insurance for a limit of £1,000,000 and Product Liability Insurance and Public Liability Insurance for a limit of £1,000,000 per occurrence and £2,000,000 in the aggregate and save as so provided neither the Seller nor its servants or agents shall have any liability to the Buyer or any third party for negligence or otherwise.

The Buyer shall maintain in full force and effect Employer's Liability Insurance and Public Liability Insurance in respect of its own liabilities and such insurances shall be extended to indemnify the Seller against any claim for which the Buyer or any contractor employed by the Buyer may be legally liable.

The Seller shall not be liable for loss of profit, loss of market or any other indirect or consequential loss howsoever arising and the Buyer accepts that the warranties and conditions set out in these Conditions of Sale apply to the contract in lieu of all warranties and conditions implied into a contract by common law or statute, and that any such implied warranties and conditions are hereby expressly excluded to the extent permitted by law.

8.20 Default and Insolvency

If the Buyer shall default in or commit any breach of its obligations to the Seller or if the Buyer becomes insolvent or bankrupt or (being a company) makes an arrangement with its creditors or has an administrative receiver or administrator appointed or commences to be wound up (other than for purposes of amalgamation or reconstruction), the Seller may, without prejudice to any other of his rights, terminate the contract forthwith by notice in writing to the Buyer or to any person in whom the contract may have become vested.

Upon termination as aforesaid it shall be lawful for the Seller to enter upon and take possession of any goods, wherever situated, for which the full purchase price has not been paid and to dispose of same without further notice to the Buyer.

8.21 Applicable Law

The construction, validity and performance of the contract shall be governed by the law of England and the parties hereto shall submit to the jurisdiction of the English Courts.

Quorum Technologies

Judges House
Lewes Road
Laughton
East Sussex BN8 6BN
England
Tel: +44 1273 815340

Declaration of Contamination Form HSC-100

The repair and/or service of Preparation Equipment and Accessories can only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer reserves the right to refuse acceptance of consignments submitted for repair or maintenance work where the declaration has been omitted.

This declaration may only be completed and signed by authorised and qualified staff.

1. Description of component

Equipment type/model: _____
- Code No:. _____
- Serial No.: _____
- Invoice No. (if known) _____
- Delivery Date.: (if known)_____

2. Reason for return:

_____
_____
_____
_____
_____

3. Equipment condition

Has the equipment been used? Yes/No

What type of operating medium was used?

_____

- Is the equipment free from potentially harmful substances? Yes/No

(If Yes go to Section 5)
(If No go to Section 4)

4. Process related contamination of Equipment/ Accessories.

- Toxic	Yes/No
- Corrosive	Yes/No
- Explosive*	Yes/No
- Microbiological*	Yes/No
- Radioactive*	Yes/No
- Other harmful substances	Yes/No

* We will not accept any Equipment/Accessories which have been radioactively, explosively, or microbiologically contaminated without written evidence that such Equipment/Accessories has/have been decontaminated in the prescribed manner.

Please list all harmful substances, gases and dangerous by-products, which have come into contact with the Preparation Equipment and Accessories.

Trade name Product name Manufacturer	Chemical name and symbol	Danger class	Precautions associated with substance.	First aid measures in the event of an accident.
1.				
2.				
3.				
4.				
5.				

5. Legally Binding Declaration.

I hereby declare that the information supplied on this form is complete and accurate. The despatch will be in accordance with the appropriate regulations covering Packaging, Transportation and Labelling of Dangerous Substances.

Name of Organisation: _____
Address: _____
_____ Post Code: _____
Tel.: _____ Fax.: _____
Name: _____ Job Title: _____
Date: _____ Company Stamp:

PLEASE ATTACH ONE COPY TO THE OUTSIDE OF THE CONSIGNMENT. FAX ONE COPY TO CUSTOMER SERVICE ON +44 1273 813439