For technical and applications advice plus our on-line shop for spares and consumable parts visit www.quorumtech.com

<table>
<thead>
<tr>
<th>Issue</th>
<th>Date</th>
<th>Details</th>
<th>Revised By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>07/02/2000</td>
<td>Initial Issue for new instrument</td>
<td>DJR</td>
</tr>
<tr>
<td>2</td>
<td>17/08/2000</td>
<td>CAR 0564 Rear Panel diag. and fuses Up date</td>
<td>PRM</td>
</tr>
<tr>
<td>3</td>
<td>06/11/2003</td>
<td>Revision</td>
<td>JB</td>
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<tr>
<td>4</td>
<td>30/03/2004</td>
<td>Paragraph added – Flow Restrictor</td>
<td>HJR</td>
</tr>
<tr>
<td>5</td>
<td>22/07/2005</td>
<td>Rear Panel fuse Number corrected</td>
<td>PRM</td>
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<tr>
<td>6</td>
<td>05/08/2005</td>
<td>Carbon rod shaping procedure added</td>
<td>PRM</td>
</tr>
<tr>
<td>7</td>
<td>14/03/2006</td>
<td>Image added showing connections with K150X</td>
<td>HJR</td>
</tr>
<tr>
<td>8</td>
<td>01/08/2007</td>
<td>Manual format changed to new layout, new sections and index</td>
<td>JLS</td>
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<tr>
<td>9</td>
<td>14/04/2008</td>
<td>Pulse drive changes to table 6 and section 6.2 ref: ECR 909</td>
<td>JLS</td>
</tr>
</tbody>
</table>

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 Ltd.

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2 Health and Safety

Safety is very important when using any instrumentation.

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.

2.1 Control of Substances Hazardous to Health (COSHH)

The E.C. 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 Health and Safety Declaration form completed. (Appendix -7.4.5 for the form)

Without this declaration Quorum Technologies reserves the right not to handle the substance/item. Also in accordance with E.C. regulations we will supply on request hazard data sheets for substances used in our instruments.

2.2 WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC.

Figure 2-1: WEEE Directive Symbol

For full details of our environmental policies including WEEE please visit http://www.quorumtech.com/environmental_policy.htm
2.3 Conformity

This Equipment of this Design and manufacture and marked CE, conforms with the requirements of the European Directives EMC 89/336/EEC & LVD 73/23/EEC.

2.4 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.

2.5 Fail Safe

This Equipment will “fail safe” in the presence of excessive RF, Electrostatic Discharge or Mains Transients. While a loss of function could occur under extreme circumstances the Equipment's operation will be fully recoverable under normal operating conditions.
3 Description

3.1 K950X Turbo Evaporator

The K950X uses a turbo pump, backed up by a rotary pump, the complete pumping sequence being under fully automatic control. A variable control is available to pre-heat, and outgas the evaporating material, and adjust the current using variable evaporation, while the use of full instantaneous evaporate allows burst evaporation under user control, the number of bursts may be user programmable.

The rotary specimen table can be tilted, and can facilitate a range of specimens.

Alternative stages are available for the K950X and likewise Alternative heads can be fitted for aperture cleaning or metal evaporation.

The normal venting is by restriction to avoid specimen disturbance with the system being fully interlocked.

The turbo pump can be mounted on any axis, and is ‘shutdown’ safely to atmosphere.

Figure 3-1: K950X Turbo Evaporator
3.2 Specifications for the K950X Turbo Evaporator

<table>
<thead>
<tr>
<th>Instrument Case</th>
<th>450mm Wide x 350mm Deep x 175mm High (Overall height with Work Chamber 750mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Chamber</td>
<td>'Borosilicate Glass over all sizes 165mm Dia x 125mm High</td>
</tr>
<tr>
<td>Safety Shield</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td>Aluminium Base</td>
<td>110mm Dia x 115mm High</td>
</tr>
<tr>
<td>Weight</td>
<td>28Kg</td>
</tr>
<tr>
<td>Carbon Source</td>
<td>3.2mm Dia Rods</td>
</tr>
<tr>
<td>Rotating Stage</td>
<td>60mm Dia. Adjustable Tilt 0-90°. Spacing to electrodes 130mm</td>
</tr>
<tr>
<td>Vacuum Gauge</td>
<td>ATM - 1 x 10⁻² - 1 x 10⁻⁵</td>
</tr>
<tr>
<td>Operating Vacuum</td>
<td>1 x 10⁻² to 1 x 10⁻⁵</td>
</tr>
<tr>
<td>Ammeter Gauge</td>
<td>0 – 50 Amps</td>
</tr>
<tr>
<td>Low Voltage Select</td>
<td>0 – 5V – 15V – 25V</td>
</tr>
<tr>
<td>Outgas Current</td>
<td>0 – 25 Amps</td>
</tr>
<tr>
<td>Turbomolecular Pump</td>
<td>50L/Second</td>
</tr>
<tr>
<td>Electrical Supply</td>
<td>220/240 Volts 50Hz (8 amp Max. including pump)</td>
</tr>
<tr>
<td>Services</td>
<td>Argon – Nominal 4psi</td>
</tr>
<tr>
<td>Rotary Backing Pump</td>
<td>Two Stage Vacuum Pump No.2, 35L/Min complete with Vacuum Hose and Oil, Mist Filter 2m³/Hr</td>
</tr>
</tbody>
</table>

Table 1: Table of Specifications

3.3 K150X FTM Option

The K950X can be used with a film thickness monitor, which measures the thickness of coating deposited on a crystal in the chamber, and hence calculates the thickness deposited on the sample to give qualitative repeatable coatings. With the K950X the FTM can only be used in MANUAL mode. In manual mode the FTM is enabled so that it can count the deposition and is disabled at the end of the coating process.

NOTE: When used with the K950X the FTM cannot be used to terminate the coating automatically. For further information see the K150X manual.

Figure 3-2: Connections between K950X and the K150X
4 Installation

**WARNING – MAINS LEAD**
This Equipment must be Earthed and fitted with the correct lead for the country of operation. This will normally be achieved from the correct mains supply socket.

**WARNING – EARTH CONNECTOR**
This Equipment is normally supplied from 3-pin supply including Earth. If only 2-pin supply is available a separate Earth must be fitted. The supplementary Earth stud can be used to facilitate this requirement.

It is important that this equipment is installed and operated by skilled personnel in accordance with these instructions. Failure to do so may result in damage, and impair protection provided.

‘If in doubt - ask’.

A suitable location should be provided for the unit - either operated on a bench or the recommended trolley. The total weight of the system is 28 Kg. The system operating environment ambient temperature range is 15°C to 25°C in a non-condensing relative humidity of not more than 75%. Sufficient ventilation is required, and positioning should be out of direct sunlight. The system is rated for continuous operation other than those supplies specified.

4.1 Preliminary Checks

Remove Instrument from packing and place on appropriate operational position. Carry out visual inspection for any signs of transit damage.

Remove Accessories Pack and check contents against K950X Accessories Pack Shipping List.

Ensure that all areas of the Instrument are free of loose packaging material. Check specifically the Instrument chamber, glass cylinder, and ‘L’ gaskets. (Do not use vacuum grease on gaskets.)

Where a vacuum pump has been supplied, carry out preliminary checks in accordance with manufacturers recommendations. (Refer to: Appendix 7.2 Pump Wiring Diagram)

**NOTE:** If you are using existing or alternative vacuum pump, and have any difficulty with connections, please seek advice.
4.2 Connections

Connections should only be made in accordance with instructions. Refer to Figure 4-1: K950X Rear Panel.

**Table 2: K950X Rear Panel Connections**

<table>
<thead>
<tr>
<th>TITLE</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocker Switch/ Power Inlet/</td>
<td>Main power on to Instrument.</td>
</tr>
<tr>
<td>Fuseholder</td>
<td></td>
</tr>
<tr>
<td>Pump Out</td>
<td>Power out to pump controlled by Instrument</td>
</tr>
<tr>
<td>Gas Inlet</td>
<td>Process gas inlet supply from low-pressure regulator.</td>
</tr>
<tr>
<td>Turbo Pump connector</td>
<td>Provide power and signals to and from Turbo Pump and its controller</td>
</tr>
<tr>
<td>Coating Outputs</td>
<td>LT outputs to coating electrodes.</td>
</tr>
<tr>
<td>Red</td>
<td>25V</td>
</tr>
<tr>
<td>Green</td>
<td>15V</td>
</tr>
<tr>
<td>Blue</td>
<td>5V</td>
</tr>
<tr>
<td>Black</td>
<td>0V</td>
</tr>
</tbody>
</table>

**NOTE:** A dry inert process gas may be used to improve contamination. However, satisfactory results can be achieved with air.

For fuse ratings and voltages refer to: Section 6.5 Fuze Ratings.

**NOTE:** Any other items on rear panel not listed are for common manufacturing and are not available for this Instrument.

**NOTE:** A single phase AC supply with Earth is required - selected to the correct voltage for the country of operation, either nominal 240V or nominal 120V. The voltage and frequency range is:

<table>
<thead>
<tr>
<th>Nominal 240</th>
<th>Max. Current 10A</th>
<th>200 - 264V</th>
<th>47Hz To 63Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal 120</td>
<td>Max. Current 20A</td>
<td>90V - 132V</td>
<td>47Hz To 63Hz</td>
</tr>
</tbody>
</table>

**Table 3: K950X Power Requirements**
If required carry out vent gas connections to rear panel (Refer To: Figure 4-1: K950X Rear Panel) with tubing and connectors provided. The connector is push-fit and will 'snap' into a locked position. It can be released by depressing the metal tongue. Dry Nitrogen gas is recommended at a nominal pressure of 4psi.

The electrical input to the Instrument is made with the power lead provided. The Instrument connection is standard and the lead is fitted with the appropriate plug for the country of operation.

Ensure the plugs are firmly located. Check the voltage is correct voltage for country of operation, which should correspond to the voltage label on the Instrument. The appropriate electrical supplies for countries are given in Appendix 7.1.

The vacuum connection is made by 1 Metre length of vacuum hosing. This is a push-on fit to the Instrument. Ensure that this is firmly in place to the full length of the vacuum connector.

**WARNING – PUMP OUTPUT**

This is for the pump supply only and is the mains voltage at a maximum of 8 Amps.

---

**NOTE:** If you are using existing or alternative vacuum pump, and have any difficulty with connections, please seek advice.

An Oil Mist Filter with metal adapter should be fitted to outlet of vacuum pump (See Section 6.3, Spares for a suitable type).

Check that the vacuum pump is filled with correct oil (See Section 6.3, Spares for suitable type). If the vacuum pump is fitted with an ON/OFF switch, ensure that it is left in the ‘ON’ position, as the Instrument will carry out required control.

### 4.3 Evaporation Source Connections

Ensure that the LT connectors to the lid and rear panel, and the shutter supply connector are firmly in place. See below

**IMPORTANT:** If unit is supplied with the auxiliary aperture cleaning head, or metal evaporation head then the Low Tension (L.T.) Leads should be connected to the correct output terminals.

<table>
<thead>
<tr>
<th>CONNECTION</th>
<th>INSTRUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Carbon Rod Coating</td>
<td>Connect leads between Red &amp; Black. (Outgas control volts gives variable 0 to 25V. Evaporate control gives fixed 25v.)</td>
</tr>
<tr>
<td>For Aperture Cleaning Molybdenum Boats Quorum Technologies B5228</td>
<td>Connect leads between Blue &amp; Black. (Outgas control volts gives variable 0 to 5V. Evaporate mode should be set to <strong>Variable</strong> to give variable 0 - 5V</td>
</tr>
<tr>
<td>For Basket Evaporation Tungsten Type Quorum Technologies B5230</td>
<td>Connect leads between Green &amp; Black. (Outgas control volts gives variable 0 to 15V. Evaporate mode should be set to <strong>Variable</strong></td>
</tr>
</tbody>
</table>

**Table 4: Evaporation Source Connections**

The outgas and evaporate will operate in both modes.
4.4 Initial Operating Checks

(These should be made having become familiar with the controls. Refer to Section 5 Operation)

ALL SUPPLIES ARE CONTINUOUSLY RATED WITH THE EXCEPTION OF THE L.T. SUPPLY - SEE NOTES BELOW.

The following checks are carried out without an evaporation source between the electrodes.

Check that the voltage shown in the power inlet configurable fuse holder and the voltage Label(s) on the rear of the instrument are correct before connecting the power cable. If there is any doubt please contact your supplier.

Switch power on with rocker switch located on rear panel of Instrument. The LED in the STOP switch should illuminate showing power to the instrument, and the LCD should show the following display:

```
Press ENTER to change parameters
Press START to run when ready
```

Check process gas by operating vent-stop. The process gas cylinder output gauge will drop slightly. The K950X lid may lift 'slightly' when chamber fills with gas.

NOTE: If only using air, listen for valve operating.

When the display has returned to the initial layout as above press the START key. The rotary pump will start and the chamber vacuum reading should achieve $5 \times 10^{-1}$ mbar within 1 minute maximum (the outgas trip point). When the vacuum trip point has been met, pumping will continue for a further 5 minutes to improve the vacuum and ensure that the turbo pump has reached full speed.

```
Pumping to 5x10^-1 mbar
Vacuum : 8x10^-1 mbar
```

Providing Pump Hold is NOT enabled (see Section 5.3 Pump Hold Feature) the outgas portion of the cycle will commence. The screen display should look like that shown below.

```
Press UP key to outgas,
DOWN key to Evaporate,STOP key to exit
Vacuum: Turbo
High Vacuum 100 %
```
If the coating material requires out-gassing, press the UP key and the screen will appear as below. The variable control is ‘calibrated’ from 0 - 75Amps, regardless of the evaporation source or the output terminals used.

<table>
<thead>
<tr>
<th>Outgassing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Remaining</td>
</tr>
<tr>
<td>Vacuum: Turbo Demand Current</td>
</tr>
<tr>
<td>High Vacuum</td>
</tr>
</tbody>
</table>

Increase the current slowly and the demand and actual current should increase accordingly, provided that the source and output voltage will allow.

When the outgas time has expired the menu above will re-appear. This allows either further out-gassing, or evaporation.

Press the DOWN key to evaporate. Depending on the mode of evaporation selected, the screen will change to the evaporate screen. The default mode is a single full power pulse to ‘flash’ carbon rods.

**NOTE:** The carbon variable (outgas) control is rated for a maximum 20A for 2 minutes, with a duty cycle of 25% (off time ~ 4 minutes) the carbon ‘flash’ (full power) is rated for full power for 5 seconds, with a duty cycle of 2% (off time ~ 4 minutes.)

**CAUTION**

The electrodes become very hot during the coating process and may cause burns.

When evaporation has been achieved press the STOP key to stop pumping and vent the system.

### 4.5 Setting Up Outgas Current

It may be good practice to set up the outgas current in advance of coating a sample. To do this the above procedure is adopted. However, the carbon evaporation source should be placed between the electrodes. See Section 5.5.2 for setting carbon rods.

Turn outgas control knob to minimum and insert source between the electrodes. Start a cycle as normal. When the outgas portion of the cycle is reached adjust the current until the source can be observed glowing red-hot. Note the vacuum may fall away slightly.

Make note of settings for future reference, repeat for other sources as required.

Having initially found out settings, these can be set in advance for subsequent operations of the unit.
5  **Operation**

These are the controls by which the instrument is operated.

![Figure 5-1: K950X Front Panel](image)

### Table 5: K950X Front Panel Commands

<table>
<thead>
<tr>
<th>MENU</th>
<th>OPERATION FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP KEY</td>
<td>Whilst a parameter is displayed increments its value by the increment amount.</td>
</tr>
<tr>
<td>DOWN KEY</td>
<td>Whilst the parameter is displayed decrements its value by the increment amount.</td>
</tr>
<tr>
<td>ENTER KEY</td>
<td>Pressing this key will accept the current value of the parameter and proceed to the next parameter or accept a set up</td>
</tr>
<tr>
<td>START KEY</td>
<td>Starts the process using the parameters accepted by the operator.</td>
</tr>
<tr>
<td>STOP KEY</td>
<td>Stops the process at any point during the cycle. (L.C.D. displays user aborted cycle.)</td>
</tr>
</tbody>
</table>
5.1 Setting Operating Parameters

There are a number of user programmable options that can be altered by the front panel keys. These are shown in the following table.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>ALLOWABLE VALUES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaporate Mode</td>
<td>Single Pulse</td>
<td>Single pulse puts full power to the electrodes, for the selected time. Multi-pulse allows multiple operations as above, the number of operation selectable Variable allows continuously variable current via the front panel control</td>
</tr>
<tr>
<td></td>
<td>Multi-Pulse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variable</td>
<td></td>
</tr>
<tr>
<td>Outgas Time</td>
<td>0 - 60 Seconds</td>
<td>Default value is 30 Seconds, this applies to all modes of evaporation</td>
</tr>
<tr>
<td>Evaporate Time</td>
<td>0-3000mS in 100mS steps</td>
<td>Time allowed for the evaporation of the cord. This time applies to single pulse or each pulse when multi pulse is used. The default value is 2000mS Default - 2 Seconds</td>
</tr>
<tr>
<td>No. Evap. Pulses</td>
<td>1-20</td>
<td>This is the number of full power pulses applies to the source in multi-pulse mode Default - 2</td>
</tr>
<tr>
<td>Variable Evap. Time</td>
<td>0-3 Minutes</td>
<td>This is the time used for evaporation with variable evaporate mode.</td>
</tr>
<tr>
<td>Pulse Drive</td>
<td>1 – 240 units</td>
<td>Sets the starting output voltage of the Evap Pulse. Leave set at the Default of 200 unless specifically advised otherwise by manufacturer. Can affect reliability of coater. See trouble shooting section 6.2</td>
</tr>
<tr>
<td>Pump Hold Enabled</td>
<td>Yes/No</td>
<td>Whether extra pumping is enabled or not. Default - No</td>
</tr>
<tr>
<td>Pump Hold Time</td>
<td>0-8 Hours in 5 Seconds Steps</td>
<td>How long extra pumping will last. Default - 10 Minutes</td>
</tr>
<tr>
<td>Vent Time</td>
<td>0-4 Minutes in 5 Seconds Steps</td>
<td>Time allowed to vent the chamber at the end of the cycle</td>
</tr>
<tr>
<td>Stage Rotate Enabled</td>
<td>Yes/No</td>
<td>Rotate the specimen stage during the coating. Default - Yes</td>
</tr>
</tbody>
</table>

Table 6: Setting Operating Parameter Table

When options are modified, the software will by default save these so that they are in force the next time that the instrument is powered up.
5.2 To Check or Modify Parameters

From the main menu press the **ENTER** to select the change parameters menu. The parameters are subdivided into sections to allow quicker access. The screen below shows the sections available. Use the arrow keys to navigate between the sections and press the **ENTER** key when the desired section is highlighted by the arrows.

```
UP or DOWN key to ALTER
ENTER to accept, STOP to return
> Evaporate <          FTM
> Cycle                Miscellaneous
```

Once selected the screen below should appear on the LCD

```
UP or DOWN key to ALTER
ENTER to accept, STOP to return
> Variable Name        Current Value
```

For most parameters the value is shown along with the variable name. Use the **UP** or **DOWN** arrow keys to amend the value as required. When the required value is shown press the **ENTER** key to accept. To exit from the parameter editing menu press the **STOP** key.

5.3 Pump Hold Feature

The Pump Hold feature is used for one of two conditions.

1. If it is required to outgas a specimen more than would be possible during the normal automatic cycle, then select Pump Hold as enabled in the parameter menu. This will inhibit the cycle from continuing until either, a key is pressed, or the stored Pump Hold time elapses, whereby the cycle will continue in the normal manner.

2. If it is required to use a K350 for sputter coating, then select Pump Hold and select a fairly long time, perhaps longer than 30 minutes. The K950X is now used as a vacuum chamber for sputtering head. After sputtering has completed press the Stop button on the K950X.

**NOTE:** For full details consult separate K350 Instruction Manual

When Pump Hold is enabled, the instrument will pump to the bleed trip point as normal, and then the pump hold feature becomes active. The display should look like that below.

```
Pump Holding, Press a key to continue
Time Remaining: 00:04:36 H:M:S
Vacuum: 8x10^-2 mbar
```

The pump hold time has a default value of 10 minutes but can be programmed for up to 8 hours. As stated above the instrument will continue pumping until either the time elapses or, a key is pressed. The cycle will then continue as normal.
5.4 Coating Protocols

The following is only a brief outline and guide. For further details consult References Section 7.3.

The K950X is primarily to produce relatively 'fine' coatings. Operating with rotating table, the coatings are omni-directional, coating uneven surfaces.

In such applications it would be common to use Carbon mounts. These may be a range of carbon stubs replicating the more common Aluminium, or carbon discs mounted on Aluminium stub.

The main classification of specimen types is between 'bulk' and 'particulate'. In the case of 'bulk' specimens a good bonding to the stub is required. In addition, although an omni-directional coating is expected, the under-side of a very irregular specimen may not receive a good coating. Suitable adhesives, which are electrically conductive, can be used with effect. Silver Dag, a Silver loaded conductive paint, is commonly used, with Graphite Dag as an alternative specifically for X-ray work. To achieve a somewhat more substantial bonding, Silver loaded epoxy, which has good strength and electrical conductivity, is advantageous.

In the case of 'particulate' specimens, depending on the nature, again a thin layer of Silver Dag is suitable with the specimens 'sprinkled' on it. Alternatively, a cyanoacrylate or double-sided adhesive tape can be used.

In both cases the mounting medium is of low profile. The carbon coating should be sufficient to make electrical contact with the specimen and stub. If this is not the case, such as specimens on glass slides/coverslips, it may be necessary to bond using one of the previously mentioned conducting adhesives.

The standard rotating table is 60mm diameter with 6 locating positions for most popular SEM stub sizes. Available from Quorum Technologies is a grid holder stub for holding 3mm TEM grids while carbon coating. A rotating table is available specifically for asbestos samples, which have been mounted on glass slides as the table has recess for 25x75mm or 50x75mm slides, 15 to 20nm (5 to 7 one second evaporation bursts).

Thickness Guidance Chart for Carbon.

This is for Carbon on Polished Brass

<table>
<thead>
<tr>
<th>THICKNESS IN NM</th>
<th>COLOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Orange</td>
</tr>
<tr>
<td>20</td>
<td>Indigo Red</td>
</tr>
<tr>
<td>25</td>
<td>Blue</td>
</tr>
<tr>
<td>30</td>
<td>Bluish Green</td>
</tr>
<tr>
<td>35</td>
<td>Green Blue</td>
</tr>
<tr>
<td>40</td>
<td>Pale Green</td>
</tr>
<tr>
<td>45</td>
<td>Silver Gold</td>
</tr>
</tbody>
</table>

Table 7: Thickness Guidance Chart for Carbon

Typically for a K950X at 150mm spacing target to electrodes, this is a 1 second pulse of 3mm Carbon Rods shaped with a spigot and giving 15nm.

Figure 5-2: Graph of Expected Coating Thicknesses
5.5 **Coating a Specimen**

The sequence of events for a typical coating run. Assuming the Instrument has been set up as Instructions under Section 4

5.5.1 **Setting the Carbon Gun**

The Carbon gun assembly is a “Bradley” type which uses a 3mm rod size as standard but can also accommodate 6mm rods when fitted with the necessary adaptors.

The rod head is held by a quick release catch this enables easy exchange between the various head types.

The carbon rods are held in place by thumb screws for quick changes.

One terminal is fixed and the other allows movement of the rod. The mass of the terminals helps prevent excessive heating of the terminals.

The rods are sharpened to a spigot shape necessary to give the correct evaporation parameters. A carbon rod shaper is provided as standard with the system. This method is recommended because this will ensure consistent results and should protect the system from damage due to mis operation.

The low voltage connections are via the two terminals in the lid. Electrical connection between the rods is maintained by a compression spring configured so that it will limit the amount of compression that can be applied to the rods.

![Carbon Gun Assembly](image-url)
5.5.2 Setting the Carbon Gun for Operation

The carbon rods should be shaped as described below before each evaporation. Do not expect to achieve consistent results if the rod is used more than once without reshaping.

![Figure 5-4: Carbon Rods](image1.png)

**Figure 5-4: Carbon Rods**

![Figure 5-5: Positioning Carbon Rods](image2.png)

**Figure 5-5: Positioning Carbon Rods**

**Procedure**

1. The first rod “A” should be 30mm long having the contact face flattened using fine emery paper 600 Grade. Ensure the face is perpendicular to the axis of the rod.

2. This rod should then be fitted to the fixed terminal projecting through by 12 mm as shown in the diagram Figure 5-5, tighten clamp screw “D” gently to hold the rod in position.

3. The second rod “B” should be prepared with a 1.6mm Diameter spigot using the carbon rod shaper provided. Ensure the spigot is 4.5mm (Figure 5-5) long.

4. Rod “B” should be inserted into the copper sleeve “C” so that the spigot end touches the flattened end of rod “A” while simultaneously compressing the spring
until the gap between the circlip and the bracket is 4mm (Figure 5-5) then tighten clamp screw E gently to hold the rod in the final position as shown on Figure 5-5. The actual lengths shown above are not critical but this it is important to ensure the gap between the circlip and the bracket is less than the length of the spigot, this will ensure that the full diameter of the rod will not touch at the end of the evaporation cycle and cause excessive current is drawn from the power supply.

Figure 5-6: Carbon Gun Components

1. The suggested parameters, which should be satisfactory for general applications, are as listed:
   a. Shaped Carbon rods.
   b. Outgas select. Out-gassing for 30 seconds (default) at Red heat.
   c. Process gas (if nitrogen used) at 4psi.
   d. Evaporation 1-second pulses.
   e. Typical coating thickness: (5 pulses for 25 nm / 1 second pulse for 5 nm).

2a. Attach the Lid assembly fitted with the carbon rods and ensure quick release clamps are locked closed and the Low tension leads are connected

2b. Press the START key.

2c. When the outgas/evaporate menu appears, select outgas by pressing the UP key and increase the front panel variable control Red heat for 30 seconds (approx. 20 Amps). De-select outgas - by pressing the STOP button or wait for the time to expire.

2d. Operate Evaporate by pressing the DOWN key from the outgas/evaporate menu to achieve a coating.
2e. The specimen table rotation can be selected off’ or on, depending on coating requirements. For omni-directional coating the specimen table rotation would normally be selected.

2f. Stop rotary and turbo pumps by pressing -stop. The venting system is restricted to avoid specimen disturbance.

2g. To repeat a run. Remove the quick release lid assembly and reshape and reset the carbon rods.

| CAUTION |
| Avoid touching electrodes immediately after an evaporation as they may still be hot |

Remove specimen before removing any carbon debris, and cleaning terminals with ‘toothbrush’ or similar. Take care not to have any debris in chamber, or on 'L' gasket seals, by using a dust-off or similar.

5.5.3 Aperture Cleaning (Accessory)

The aperture cleaning head replaces the carbon Head and can be fitted by loosening the thumbscrews on the lid, which will release the catch holding the head. The aperture cleaning head fits into the outer ring similar to the carbon head and the 2 spring release catches are locked again by the thumbscrews. (Ensure 'O' ring is in position.) It is recommended a clean glass cylinder be used for aperture cleaning. A molybdenum boat, which holds the apertures, is fixed between the terminals.

1. The high current leads must be changed from Red/Black for carbon coating to Blue/Black for aperture cleaning 0-5V) and the evaporate mode should be selected to VARIABLE. The vacuum control sequence is as described for carbon coating.

2. Load the apertures into the boat before fitting the head as described above.

3. Start the unit with START key as for normal operation.

4. Once the outgas/evaporate menu is displayed, the evaporate can be used by pressing the DOWN key. The variable control can be used to change the current to the molybdenum boat, slowly increasing to Red heat for 30 seconds, then a short 5-second period at White heat. After venting the aperture cleaning head can be removed.

| CAUTION |
| Terminals will be HOT |


5.5.4 **Metal Evaporation Head Assembly**

The high current leads must be changed to **Green/Black** for Evaporation (0-15V).

a. Load basket with material to be evaporated.

   N.B. The basket leads should be cut to length and clamped securely between the electrodes. Supplied as standard with Tungsten Basket Quorum Technologies Reference B5230.

b. Ensure front panel variable control is at minimum.

c. Select evaporate mode to **Variable** then press the **START** key.

d. Wait until outgas/evaporate menu is shown then if required outgas the material to be evaporated, then evaporate the material.

5.6 **Variable Flow Restrictor**

The Chamber vent on the K950X is fitted with a variable flow-regulating valve. This has been factory set to give an approximate vent time of 90 seconds. Should it prove necessary to alter this venting time, the regulator can be adjusted by means of the knurled knob found to the rear left of the instrument.
6 Service and Maintenance

For technical and applications advice plus our on-line shop for spares and consumable parts visit www.quorumtech.com

CAUTION
Ensure mains electrical power is off during any maintenance and service activities

6.1 Maintenance

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean the glass chamber and the 'L' gaskets as required, using Velin tissue and foam cleanser (See Section 6.3), or similar. Do not use vacuum grease on 'L' gaskets.</td>
<td>Monthly</td>
</tr>
<tr>
<td>In addition to inter-run removal of debris, regular cleaning of the electrodes and surrounding area is recommended. A foam cleanser can be used to clean electrodes, PTFE (plastic) parts, and chamber lid. The electrodes may be lightly polished using &quot;Wenol&quot; or similar. Particular attention should be paid to the spring loaded contact by removing the 'hard' deposits with a 'stiff' brush.</td>
<td>Weekly</td>
</tr>
<tr>
<td>Depending on frequency of use, if by examination the spring loading appears to be losing tension and electrical contact, the springs should be changed. (a spare set of springs and electrode 'O' rings, with assembly sketch, is provided with the Instrument in the free issue kit)</td>
<td>Monthly</td>
</tr>
<tr>
<td>Check vacuum pump oil level.</td>
<td>Monthly</td>
</tr>
<tr>
<td>Change oil every 6 months, using 1 litre of Supergrade 'A' (See Section 6.3)</td>
<td>6 Monthly</td>
</tr>
<tr>
<td>Check Oil Mist Filter for saturation. Change every six months, or more regularly as required. (See Section 6.3.) (This is a disposable plastic filter and cannot be reactivated.)</td>
<td>6 Monthly</td>
</tr>
<tr>
<td>Inspect electrical power cords and plugs for general condition.</td>
<td>Regularly</td>
</tr>
</tbody>
</table>

Table 8: Preventative Maintenance

NOTE: Consumable items can be obtained from Quorum Technologies or approved Distributor**. Only Quorum Technologies recommended items should be used. For technical assistance and advice - contact Quorum Technologies.
6.2 Troubleshooting the K950X

Routine service should not be necessary. In the event of non-operation, carry out the following checks.

**CAUTION**
Ensure mains electrical power is off during any maintenance and service activities

- Check electronic supplies: The LED in the STOP switch should be on at power up.
- Check fuses: Refer to 6.5 for Fuse Listings
- Check vacuum pump: Local switch should be in 'On' position.
- Check chamber seating for vacuum leaks.
- Check operating conditions of Instrument controls.
- Check evaporation source is making good contact.
- Check correct conditions for outgas have been set.
- Check all connections.
- Check that the LCD is showing the correct display.
- Check Pump Hold Enabled is set to NO.

In the event of the unit apparently operating but insufficient coating appearing on sample:
- Check above points and check that Pulse drive parameter is set to default of 200 if still unable to coat sufficient thickness, please contact Quorum Technologies, for additional advice.

In the event of all checks proving negative, please contact Quorum Technologies, or your local Distributor.

An Advance Delivery Modular Exchange Service Scheme is operated for the complete single module control electronics.
This can normally be customer installed in accordance with instructions provided.

**NOTE:**
Spare items can be obtained from Quorum Technologies or approved Distributor. Only Quorum Technologies recommended items should be used. For technical assistance and advice - contact Quorum Technologies.
6.3 **Spares**

The following are available from Quorum Technologies, or your local distributor, and are featured in more detail in the current Quorum Technologies Consumables Catalogue. Copies can be sent on request.

<table>
<thead>
<tr>
<th>SPARES FOR K950X TURBO EVAPORATOR UNIT</th>
<th>CATALOGUE NUMBER</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon rods 3.05mm</td>
<td>C5422</td>
<td>x10</td>
</tr>
<tr>
<td>Glass Cylinder 6&quot;</td>
<td>G6260</td>
<td>Each</td>
</tr>
<tr>
<td>'L' Gaskets To Suit</td>
<td>G6261</td>
<td>Pair</td>
</tr>
<tr>
<td>Oil Mist Filter</td>
<td>O7803</td>
<td>Each</td>
</tr>
<tr>
<td>Supergrade 'A' R.P. Oil</td>
<td>O7802</td>
<td>1 Litre</td>
</tr>
<tr>
<td>Molybdenum Boats (Used on Aperture Cleaning Head)</td>
<td>B5228</td>
<td>1 x packet 10</td>
</tr>
</tbody>
</table>

**Table 9:** Spare Parts for the K950X

**NOTE:** Spare items can be obtained from Emitech or approved Distributor. Only Quorum Technologies recommended items should be used.

For technical assistance and advise - contact Quorum Technologies.

6.4 **Accessories**

The following are available from Quorum Technologies, or your local distributor, and are featured in more detail in the current Quorum Technologies Consumables Catalogue. Copies can be sent on request.

<table>
<thead>
<tr>
<th>USEFUL ACCESSORIES FOR K950X TURBO EVAPORATOR</th>
<th>CATALOGUE NUMBER</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver Conducting Paint</td>
<td>A5001</td>
<td>3g.</td>
</tr>
<tr>
<td>Silver Loaded Epoxy</td>
<td>A5002</td>
<td>2 x15g.</td>
</tr>
<tr>
<td>Tungsten Basket</td>
<td>B5230</td>
<td>Each</td>
</tr>
<tr>
<td>Lint Free Safe Wipes</td>
<td>C5408</td>
<td>200</td>
</tr>
<tr>
<td>Wenol Polish</td>
<td>C5424</td>
<td>100ml. Tubee</td>
</tr>
<tr>
<td>Amberclens Foam Cleaner</td>
<td>C5427</td>
<td>Each</td>
</tr>
<tr>
<td>Mini Tork Rolls</td>
<td>C5435</td>
<td>Each</td>
</tr>
<tr>
<td>Conducting Carbon (Cement Leit-C)</td>
<td>C5440</td>
<td>30g.</td>
</tr>
<tr>
<td>Thinner for Leit-C</td>
<td>C5441</td>
<td>30ml</td>
</tr>
<tr>
<td>Dust-Off 'Plus' Can Complete</td>
<td>C5454</td>
<td>Each</td>
</tr>
<tr>
<td>Dust-Off Refill for above</td>
<td>C5455</td>
<td>Each</td>
</tr>
<tr>
<td>Carbon Tabs</td>
<td>C5457</td>
<td>100</td>
</tr>
<tr>
<td>Carbon Conductive Adhesive Tape</td>
<td>T8885</td>
<td>20Mtr</td>
</tr>
<tr>
<td>Carbon Rod Shaper For 3mm Rods</td>
<td>S8651</td>
<td>Each</td>
</tr>
</tbody>
</table>

**Table 10:** Accessories for the K950X
6.5 Fuse Listings

Fuse listing for 230 Volt K950X

<table>
<thead>
<tr>
<th>TITLE</th>
<th>RATING</th>
<th>PART NUMBER</th>
<th>QTY</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuse 1</td>
<td>T 10A Ceramic (1.25&quot; X 0.25&quot;)</td>
<td>16020003</td>
<td>1</td>
<td>Main Power, located in inlet unit.</td>
</tr>
<tr>
<td>Fuse 2 (Internal)</td>
<td>T 10A Ceramic (1.25” X 0.25”)</td>
<td>16020003</td>
<td>1</td>
<td>L.T. Power supply fuse. Located in fuseholder on Evaporate Drive PCB.</td>
</tr>
</tbody>
</table>

Table 11:- Fuse Listing for the 230 Volt K950X

T10A is preferred fuse.
May be substituted for 10A Slo-Blo Ceramic Fuse - Non preferred.

Fuse listing for 115 Volt K950X

<table>
<thead>
<tr>
<th>TITLE</th>
<th>RATING</th>
<th>PART NUMBER</th>
<th>QTY</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuse 1</td>
<td>T 15A Ceramic (1.25&quot; X 0.25&quot;)</td>
<td></td>
<td>1</td>
<td>Main Power, located in inlet unit.</td>
</tr>
<tr>
<td>Fuse 2 (Internal)</td>
<td>T 15A Ceramic (1.25” X 0.25”)</td>
<td></td>
<td>1</td>
<td>L.T. Power supply fuse. Located in fuseholder on Evaporate Drive PCB.</td>
</tr>
</tbody>
</table>

Table 12:- Fuse Listing for the 115 Volt K950X

Fuse Standard CSA C22.2/UL 198G *
Replacement fuses can be supplied by Quorum Technologies or the approved distributor.**

** If an approved distributor is not known - please contact Quorum Technologies direct for details.
## Appendices

### 7.1 World Wide Electrical Supplies

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>VOLTAGE</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>240V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Brazil</td>
<td>115V/230V</td>
<td>60Hz</td>
</tr>
<tr>
<td>Canada</td>
<td>115V</td>
<td>60Hz</td>
</tr>
<tr>
<td>Finland</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>France</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Germany</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>India</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Ireland</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Israel</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Italy</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Korea (South)</td>
<td>230V</td>
<td>60Hz</td>
</tr>
<tr>
<td>Japan</td>
<td>115V</td>
<td>50 / 60Hz</td>
</tr>
<tr>
<td>Netherlands</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Norway</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Pakistan</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Portugal</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Scandinavia</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Singapore</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Spain</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Taiwan</td>
<td>115V</td>
<td>60Hz</td>
</tr>
<tr>
<td>Turkey</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>United States of America</td>
<td>115V</td>
<td>60Hz</td>
</tr>
</tbody>
</table>

Table 13:- Electrical supplies World Wide
7.2 Pump Plug Wiring

**WARNING – EARTH CONNECTOR**

This Equipment is normally supplied from 3 pin supply including Earth.
If only 2 pin supply is available a separate Earth must be fitted.
The supplementary Earth stud can be used to facilitate this requirement.

<table>
<thead>
<tr>
<th>PIN</th>
<th>UK AND EUROPE</th>
<th>U.S.A. AND CANADA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1 (Live or Hot)</td>
<td>Brown</td>
<td>Black</td>
</tr>
<tr>
<td>Pin 2 (Earth)</td>
<td>Green / Yellow</td>
<td>Green</td>
</tr>
<tr>
<td>Pin 3 (Neutral)</td>
<td>Blue</td>
<td>White</td>
</tr>
</tbody>
</table>

Table 14: Pump Plug Wiring
7.3 References

1. **HOLLAND, L.**
   “Vacuum Deposition of Thin Films.”
   *Chapman and Hall, London, 1970*

2. **ECHLIN, P.** and **SAUBERMANN, A.J.**
   “Preparation of Biological Material for X-Ray Microanalysis.”
   *SEM-1977, I, 621-637.*

3. **MUNGER, B.L.**
   “The Problem Of Specimen Conductivity In Electron Microscopy.”
   *SEM-1977, I, 481-490*

4. **PETERS, KLAUS-RUDIGER.**
   “Precise And Reproducible Deposition Of Thin And Ultra-thin Carbon Films By Flash Evaporation Of Carbon Yarn In High Vacuum.
   *J. Microscopy 1984 Vol 133 Pt 1, 17-25.*

5. **ECHLIN, P.**
   “Coating Techniques For Scanning Electron Microscopy And X-Ray Microanalysis.”
   *SEM, I, 1978.*

6. **CHATFIELD, ERIC J.**
   “Overview of measurement procedures for determination of asbestos fibres in building atmospheres.”
   *Published 1987 (E.J. CHATFIELD, Editor).*

(Available on request)
7.4 Return of Goods

Safety information for the return of Preparation Equipment and Accessories.

7.4.1 General Introduction:

The employer (user) is responsible for the health and safety of his employees. This also applies to all those persons who come into contact with the Preparation Equipment and Accessories either at the user’s or manufacturer’s premises during repair of service. The contamination of Preparation Equipment and Accessories has to be declared and the Health and Safety Declaration form completed. (Appendix -7.4.5 for the form)

7.4.2 Health and Safety Declaration

Those persons carrying out repair or service have to be informed of the condition of the components. This is the purpose of the ‘Declaration of Contamination of Preparation Equipment and Accessories.’

7.4.3 Despatch

When returning equipment the procedures set out in the Operating Instructions must be followed. For example:

- Drain the vacuum pumps.
- Neutralise the flushing with gas.
- Remove filter elements.
- Seal all outlets.
- Pack glass components safely.
- Pack loose attachments securely for example stages.
- Seal in heavy duty polythene or a bag.
- Despatch in suitable transport container.

7.4.4 Return Address:

F.A.O.: The Service Manager,
QUORUM TECHNOLOGIES,
Units 1 & 3 Eden Business Centre
South Stour Avenue,
ASHFORD,
Kent. TN23 7RS
### 7.4.5 Declaration of Contamination Form

#### Declaration of Contamination of Preparation Equipment and Accessories.

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.

<table>
<thead>
<tr>
<th>1. Description of component</th>
<th>2. Reason for return:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Equipment type/model: ____________________________</td>
<td>____________________________</td>
</tr>
<tr>
<td>- Code No.: ____________________________</td>
<td>____________________________</td>
</tr>
<tr>
<td>- Serial No.: ____________________________</td>
<td>____________________________</td>
</tr>
<tr>
<td>- Invoice No. (if known) ____________________________</td>
<td>____________________________</td>
</tr>
<tr>
<td>- Delivery Date. (if known) ____________________________</td>
<td>____________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Has the equipment been used? Yes/No</td>
<td>- Toxic Yes/No</td>
</tr>
<tr>
<td>- What type of operating medium was used?</td>
<td>- Corrosive Yes/No</td>
</tr>
<tr>
<td>- Is the equipment free from potentially harmful substances? Yes/No</td>
<td>- Explosive* Yes/No</td>
</tr>
<tr>
<td>(If Yes go to Section 5)</td>
<td>- Microbiological* Yes/No</td>
</tr>
<tr>
<td>(If No go to Section 4)</td>
<td>- Radioactive* Yes/No</td>
</tr>
<tr>
<td></td>
<td>- Other harmful substances Yes/No</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Chemical name and symbol</th>
<th>Danger class</th>
<th>Precautions associated with substance.</th>
<th>First aid measures in the event of an accident.</th>
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#### 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: ____________________________

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