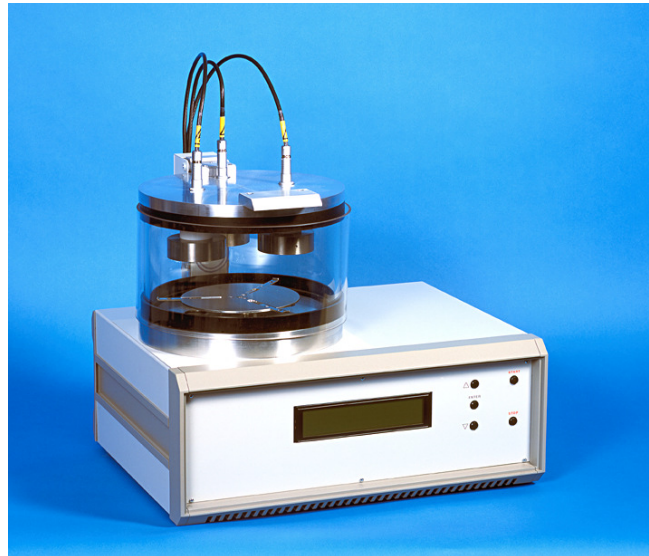




Quorum Technologies

K650X Sputter Coater Instruction Manual



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

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C E Declaration:

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

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.



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



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.



Output:

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

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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1. Description

The K650x system employs a Magnetron Target Assembly which enhances the efficiency of the process using low voltages, and giving a fine grain, cool sputtering, without the need to cool the target or the specimen stage.

There are three such target assemblies in the K650x, positioned to give coating over a large diameter which, together with a rotating sample table, ensures even depositions. This method allows standard targets to be utilised, and avoids the necessity of special large profile targets.

The Instrument is fitted with three 60mm Dia. x 0.1mm. Thick Gold quick change target giving optimum consumable cost performance.

The integrated instrument panel and plug-in electronics, maximise 'up-time' and, with user friendly designs, ensures satisfactory multi-user discipline.

The sputtering parameters can be pre-set, including the gas bleed needle valve, which has electromagnetic valve back-up. This together with automatic control, gives defined and repeatable film thickness depositions.

The sputtering head is interlocked, and the system can easily accommodate a K250 Carbon Coating Attachment.

The independent vacuum pump is controlled by the Instrument throughout the fully automatic coating cycle.

2. Installation

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 25 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.

2.1 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 K650X 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 7.4 Pump Plug wiring).

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

2.2 Connections.

Connections should only be made in accordance with instructions. Refer To: Appendix 7.1 Rear Panel Drawing **UNDER NO CIRCUMSTANCES SHOULD ANY OTHER CONNECTIONS OR OUTLETS/INLETS BE USED FOR ANY OTHER EQUIPMENT OR SERVICES.**

TITLE	FUNCTION
Rocker Switch/ Power Inlet/ Fuseholder	Main power on to Instrument.
Pump Out	Power out to pump controlled by Instrument
Gas Inlet	Process gas inlet supply from low pressure regulator.
Coating Output	HT output to cathode (target) sputtering head.
Fuse 2	H.T. Power Supply Fuse

For fuse ratings and voltages refer to: Appendix 7.3 Fuse Listings.

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:

Nominal 240	Max. Current 10A	200 - 264V	47Hz To 63Hz
Nominal 120	Max. Current 20A	90V - 132V	47Hz To 63Hz

Carry out process gas connections to rear panel (Refer To: Appendix 7.1 Figure 1) 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. Argon gas is recommended at a nominal pressure of 4 p.s.i.

If only one process gas is used, the gas inlet 1 and gas inlet 2 have an external 'T' piece with restrictor in the gas inlet 2. Gas inlet 2 can then be used for the restricted venting at the end of a run.

If two process gases are used then gas inlet 1 is used for purging, and gas inlet 2 would **not** have the 'T' piece, but would have the restrictor and gas inlet 2 can then be used for the restricted venting at the end of a run.

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 7.4 7.7 World wide Electrical Supplies.

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.

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

An Oil Mist Filter with metal adapter should be fitted to outlet of vacuum pump (See Section 6 6. SPARES AND ACCESSORIES for a suitable type).

2.2 Connections.- Continued.

Check that the vacuum pump is filled with correct oil (See Section 6 Spares & Accessories 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.

Ensure that the HT connector to the lid is pushed firmly in place.

WARNING: The Instrument should **NOT** be operated with **ANY** of the HT leads disconnected.

2.3 Initial Operating checks

(These should be made having become familiar with the controls. Refer to Section 3.3. Operation)

ALL SUPPLIES ARE CONTINUOUSLY RATED WITH THE EXCEPTION OF THE H.T. SUPPLY, WHICH IS RATED AT 50%.

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

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

Settings: 25mA,    00:02:00  H:M:S
```

Check process gas by pressing the STOP button. The process gas cylinder output gauge will drop slightly. The **K650x** lid will lift 'slightly' when chamber fills with gas.

When the display has returned to the initial layout as above press the START key. The chamber vacuum reading should achieve 5×10^{-1} mbar within 1 minute, and 1×10^{-1} mbar (the bleed trip point) within 2 minutes.

```
Bleeding Gas into Chamber
Time Remaining 00:00:14  H:M:S

Vacuum : 2x10-1 mbar
```

Providing Pump Hold is NOT enabled (See Section 3.3.4 Pump Hold Feature) the gas bleed portion of the cycle will commence. The screen display should look like that shown below. If necessary, adjust needle valve at rear of Instrument to achieve a stable vacuum of 1×10^{-1} mbar.

When the bleed time has expired the coating will commence. A Blue plasma with the required current level should be observed. The display should look like that below. Allow the coating to automatically time-out and vent the chamber to atmosphere. The instrument should complete the automatic cycle, coating at 75mA for 2 minutes (which are default settings) at a vacuum 1×10^{-1} mbar which may initially need to be adjusted.

```
Coating Sample at 25 milliamps

Vacuum      Current      Time Remaining
1x10-1 mbar   75 mA      00:01:38 H:M:S
```

NOTE: The sputter cycle is rated for a Max. 100mA for 5 minutes, with a duty cycle of 50%. (Off time - 5 minutes.)

3. Operation

These are the controls by which the instrument is operated. Refer to Appendix 7.2 Front Panel Drawing

Front Panel Controls	
Start	The start button initiates the control sequence.
Stop	The stop button stops the current cycle when the instrument is running. Or cancels the current selection when editing values:-
Up, Down.	These buttons either increment or decrement the value of the current variable when in the change parameters menu.
Enter	This button accepts the current value when in the change parameters menu.

3.1 Setting Operating Parameters

There are a number of user programmable options that can be altered by the front panel keys. These are as the following table. Note the variables in *italics* are only applicable to the internal film thickness module if one has been factory fitted.

Parameter	Allowable Values	Description
Coating Current	0 - 100 mA in 5 mA Steps	Plasma Current, default value 75mA
Coating Time	0 - 4 Minutes in one second steps	Time for the coating, default 2 Minutes
FTM enabled	Yes / No	This value determines whether the software monitors the STOP signal from the FTM. If it is enabled and there is no FTM connected the coating will stop immediately.
FTM Type	Internal/External	If an Film Thickness Monitor is fitted this tell the software which type to monitor
<i>FTM Mode</i>	Manual Automatic	Manual monitors coating thickness for the full coating time period automatic terminates coating at a pre determined thickness
<i>Material Density</i>		This is the density of the coating material being used. It's value is units of $g\ cm^3$.
<i>FTM Terminate</i>	0- 999.9 nm	This is the deposition thickness which when exceeded will cause the FTM to assert the coater STOP signal, if and only if the FTM is in AUTO, mode
<i>FTM Tool Factor</i>	0-	This is a factory set variable that is used to account for the difference in positions from the target between the crystal and the sample, It can be adjusted by the same method as for the terminate values.
Pump Hold Enabled	Yes / No	Whether extra pumping is enabled or not. Default - No
Pump Hold Time	0 - 8 Hours in 5 Seconds Steps	How long extra pumping will last, default 10 Minutes
Stage Rotate Enabled	Yes / No	Rotate the specimen stage during the coating, default - No

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.

3.2 To Check Or Modify Parameters:

From the main menu press the ENTER to select the change parameters menu. The screen below should appear on the L.C.D.

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.

3.3 Cycle Sequence

Below is a sequence of events for a typical coating cycle. Assuming the default values have not been altered and the instrument has been set up as instructions under Section 2 2.3 Initial Operating checks

The suggested parameters which should be satisfactory for general applications are as listed.

1. Needle valve (bleed) adjustment set to give 1×10^{-1} mbar with process gas (Argon) at a nominal 4 p.s.i. (Approx. 0.3 bar)
2. Deposition current at 75mA. (Default)
3. Deposition time 2 minutes. (Default)

A typical coating achieved using these settings should be approximately 15nm (150 Angstroms).

NOTE:

These conditions for coating thickness can be more readily determined by referring to the **K650x** Deposition Chart, (Appendix 7.5) allowing for any differences in the spacing of any stub and specimen height when reading final settings.

After the pressing the START key the following will happen:

- The rotary pump will start and commence the pump down
- When the bleed trip point has been reached, if pump hold is not enabled (see below) the bleed valve will operate, and chamber vacuum will stabilise for 15 seconds at 1×10^{-1} mbar. (Dependent upon needle valve setting)
- Coat will operate at deposition current of 75mA.
- Coating will stop and the vent valve will open and the chamber will vent to atmosphere
- If further purging is required, the vent-stop can be operated by pressing the STOP button while the instrument is idle.

NOTE

The STOP button can be pressed at any time during a cycle to abort the process.

3.4 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. The vacuum should eventually achieve better than 7×10^{-7} mbar.
2. If it is required to use a K250 for carbon 'flash' evaporation. If this is the case, then select Pump Hold and select a fairly long time, perhaps longer than 30 minutes. The **K650x** is now used as a vacuum chamber for carbon head. Using Carbon String or Cord, outgas vacuum of 1×10^{-7} mbar, and evaporation vacuum of 7×10^{-7} mbar or better. After completion of the carbon flash Stop on the **K650X**.

NOTE: For full details consult separate K250 Instruction Manual

When Pump Hold is enabled, the instrument will pump to the bleed trip point as normal, 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.

4. SPUTTERING PROTOCOLS

The following is only a brief outline and guide. For further details consult Section 8.8. References.

The **K650x** is primarily to provide conductive metal coatings for SEM microscopy. In such applications it would be common to use Aluminium Specimen Stubs. 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 achieved, it may be advantageous to use adhesives which are electrically conductive. Silver Dag, a Silver Loaded Conductive Paint is commonly used, but 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 tape can be used. In both cases the mounting medium is of low profile. The coating should be sufficient to make electrical contact with the specimen and stub. If this is not the case, it may be necessary to bond using one of the previously mentioned conducting adhesives.

While the standard settings for Sputter Coating, mentioned in Section 3.3. Operation, may be satisfactory for most SEM applications (giving typically 15nm (150 Angstroms) settings: 75mA. 45mm. 2mins), these can be optimised depending on the specimen. The objective being to obtain as thin and continuous conductive coating as possible to avoid obstructing detail, while giving specimen stability and avoiding charging.

For very irregular specimens a slightly thicker coating may be required if charging is observed. While various settings such as time and spacing can be altered, we would recommend increasing the coating time, while maintaining the sputtering current and distances. (Giving typically 21nm (210 Angstroms) settings: 20mA. 45mm. 3mins.)

For less irregular specimens and thinner coatings for fine detail, where charging does not appear as significant, then reducing the sputtering current would be the preferred method. (Giving typically 10nm (100 Angstroms) settings: 15mA. 45mm. 2 minutes.)

The heat input from sputtering with the **K650X** is very small. If it is considered the specimen is heat sensitive, then a low sputtering current, with longer time to achieve the necessary coating thickness is recommended, while maintaining maximum specimen spacing. It is not considered necessary, with the low thermal input and low sputtering voltage, to pre-cool the specimen stage. Assuming the specimen is stable at room temperature.

The low sputtering voltage is to achieve low thermal input, and high resolution, small grain size coatings. Typically the grain size of Gold is of the order of 2nm (20 Angstroms). However, as we normally require somewhat thicker coatings to achieve electrical conductivity the final resolution will be somewhat less.

Alternative target materials may suggest smaller grain size, Gold/Palladium is the order of 1.7nm (17 Angstroms), there may not necessarily be a recognisable gain in high resolution, and such coatings may be susceptible to cracking. Careful consideration should be given when using alternative material, Gold having proved particularly successful for the majority of SEM work when utilised in Instruments such as the K650x.

5. Service and Maintenance

5.1 Maintenance

Procedure	Weekly/Monthly
Clean the glass chamber and the 'L' gaskets as required using velin tissue and foam cleanser (See Section 6), or similar. Do not use vacuum grease on 'L' gaskets.	Monthly
Check vacuum pump oil level. Change oil every 6 months using 1 litre of Supergrade 'A'. (See Section 6).	Monthly
Check Oil Mist Filter for saturation. Change every 6 months, or more regularly as required. (See Section 6. SPARES AND ACCESSORIES for suitable part) (This is a disposable plastic filter and cannot be reactivated.)	Monthly
Check the condition of the target material. The wear will depend on use. This is mainly over an outer annulus, accounting for some 70% of the surface area. When the backing plate shows at the edges, it may still be used. When this becomes excessive and sputtering is affected, the target should be replaced	Monthly
Regularly inspect electrical power cords and plugs for general condition	Regularly

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

NOTE: A replacement target exchange service is offered for precious metal recovery. On return of your original target backing plate, a discount made against your new purchase.

5.2 To Change the Target.

Firstly disconnect the instrument from the mains and remove the power cord. Now loosen the two small Allen screws around the circumference of the target holder using the Allen key provided with your spares kit. These locate into a 'V' groove in the target circumference, the target can then be removed. Replace with the new target, ensuring that the screws are tightened equally and firmly into the 'V' groove to ensure good electrical and mechanical connection.

NOTE: Consumable items can be obtained from Emitech or approved Distributor. Only Emitech recommended items should be used. For technical assistance and advice - contact Emitech.

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Ashford,
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**If approved Distributor not known - please contact Emitech direct for details.

5.2 Troubleshooting the K650X

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

IMPORTANT: Depending on nature of problem, disconnect power cord **BEFORE** carrying out any servicing activities.

Check electronic supplies: The LED in the STOP switch should be on at power up.

Check fuses: Refer to Appendix 7.3 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 Allen screws to target and connections.

Check correct conditions for sputtering have been set. (i.e. vacuum and gas pressure)

Check all connections.

Check that the L.C.D. is showing the correct display.

Check Pump Hold Enabled is set to NO.

In the event of all checks proving negative, please contact Emitech, 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 Emitech or approved Distributor. Only Emitech recommended items should be used. For technical assistance and advice - contact Emitech.

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6. SPARES AND ACCESSORIES

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

6.1 Spares

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

Spares For K650x Sputter Coater	Catalogue Number	Quantity
Glass Cylinder 9"	G6262	Each
'L' Gaskets to suit	G6263	Pair
Oil Mist Filter	O7803	Each
Supergrade 'A' Rotary Pump Oil	O7802	1 Litre
Targets - 60mm. Dia x 0.1mm Thick Bonded to target holder. Ex-stock delivery**		
Gold Target	TK8842	x3
Gold/Palladium Target(80/20%)	TK8843	x3
Platinum Target	T8844	x3

** For special Targets please enquire.

Useful Accessories For K650x Sputter Coater	Catalogue Number	Quantity
Amberclens Foam Cleanser	C5427	Each
Conductive Paint	A5001	3g. Bottle
Silver Loaded Epoxy	A5002	2x15g.
Cyanoacrylate Adhesive Grade C2	A5003	5x5g.
Cyanoacrylate Adhesive Grade C4	A5004	5x5g.
Cyanoacrylate 'Superglue'	A5005	3g. Tube
Double Sided Tape	T8803	20 m. Roll

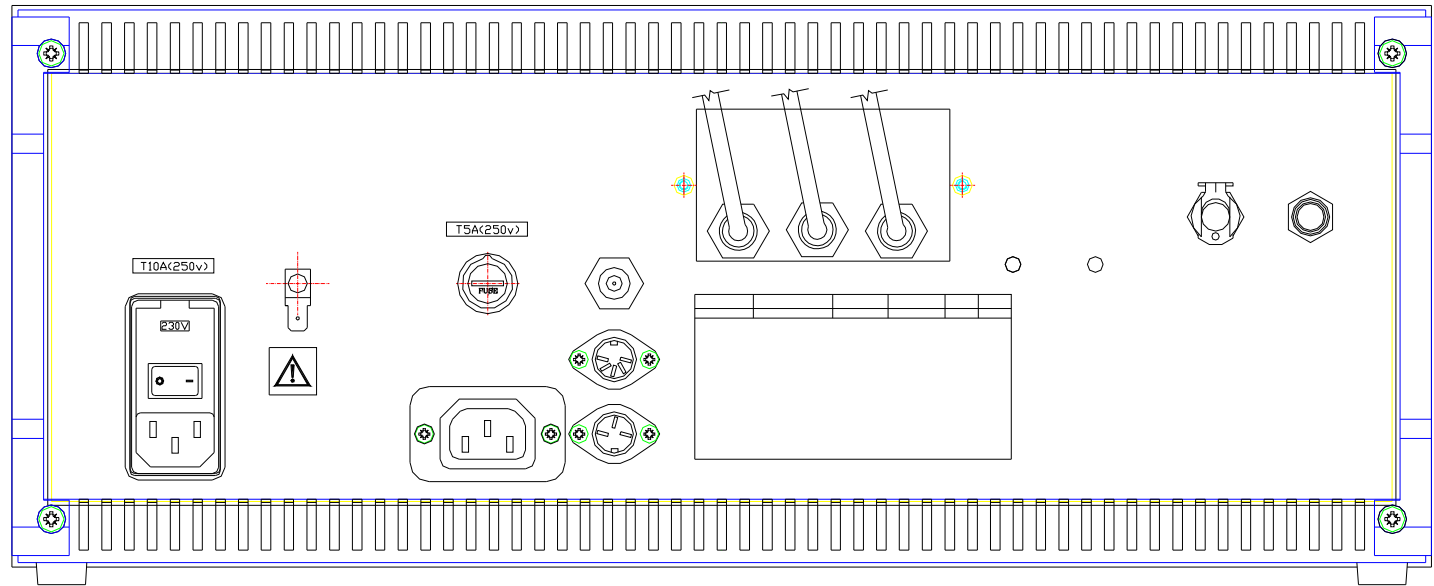
Useful Accessories for K650X Sputter Coater.

A comprehensive supply of S.E.M. specimen stubs in machined Aluminium to suit most makes of S.E.M.

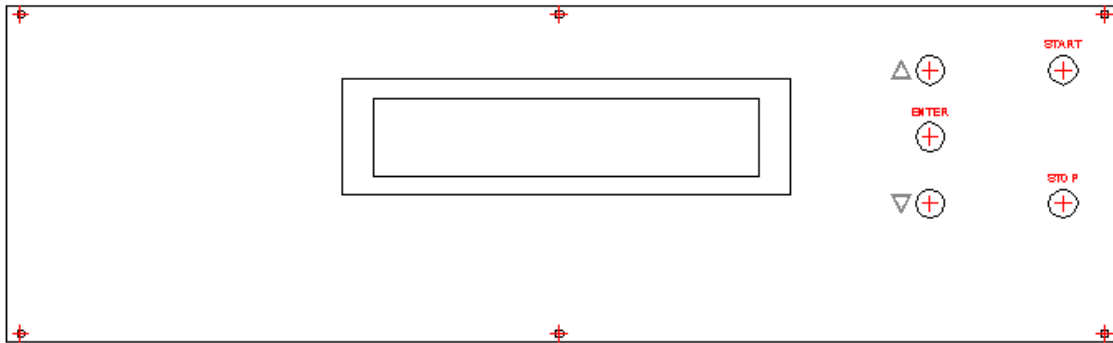
Description	Catalogue Number	Quantity
Amray		
½" Dia Pin Stub	S8620	Pack 10
1" Dia Pin Stub	S8621	Pack 10
Cambridge		
½" Dia Pin Stub	S8622	Pack 10
1" Dia Pin Stub	S8623	Pack 10
1¼ Re-entrant Base Stub	S8624	Pack 10
1¼ Dia x ¾" High Stub	S8625	Pack 10
Camscan		
½" Dia Pin Stub	S8622	Pack 10
1½" Dia Pin Stub	S8626	Pack 10
Etec		
½" Dia pin stub	S8622	Pack 10
Hitachi		
15mm Dia x 6mm Stub	S8627	Pack 10
25mm Dia x 6mm Stub	S8628	Pack 10
32mm Dia x 10mm Stub	S8629	Pack 10
I.S.I.		
15mm Dia x 10mm Stub	S8631	Pack 10
15mm Dia x 15mm Stub	S8632	Pack 10
Jeol		
10mm Dia x 5mm Stub	S8633	Pack 10
10mm Dia x 10mm Stub	S8634	Pack 10
15mm Dia x 10mm Stub	S8631	Pack 10
15mm Dia x 15mm Stub	S8632	Pack 10
12.5mm Dia x 10mm Stub	S8635	Pack 10
12.5mm Dia x 5mm Stub	S8636	Pack 10
Philips		
½" Dia Pin Stub	S8622	Pack 10
1" Dia Pin Stub	S8623	Pack 10

7. Appendices

7.1 Rear Panel Drawing



7.2 Front Panel Drawing



7.3 Fuse Listings

Fuse Listing - 230 Volts

Title	Rating	Function
Fuse 1 (1.25" X 0.25")	T 10A Ceramic Anti-Surge	Main Power, located in inlet unit.
Fuse 2 (1.25" X 0.25")	T 3.15A Ceramic Anti-Surge	Internal HT supply PCB

Fuse Listing - 115 Volts

Title	Rating	Function
Fuse 1 (1.25" X 0.25")	T 15A Ceramic Anti-Surge	Main Power, located in inlet unit.
Fuse 2 (1.25" X 0.25")	T 5A Ceramic Anti-Surge	Internal HT Supply PCB

T10A is preferred fuse.

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

Fuse Standard IEC 127, CEE4.

Fuse Standard CSA C22.2/UL 198G *

Replacement fuses can be supplied by QUORUM, or the approved distributor.**

Quorum Technologies Ltd.,

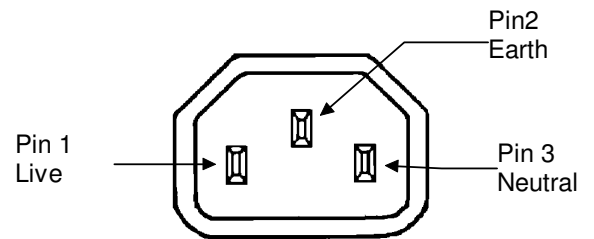
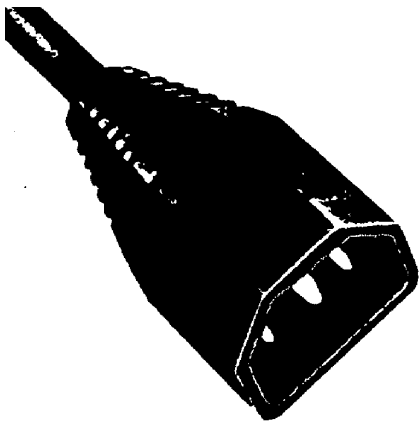
South Stour Avenue, Ashford, Kent, England TN23 7RS.

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FAX: 01233 640744 (+44 (0)1233 640744)

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

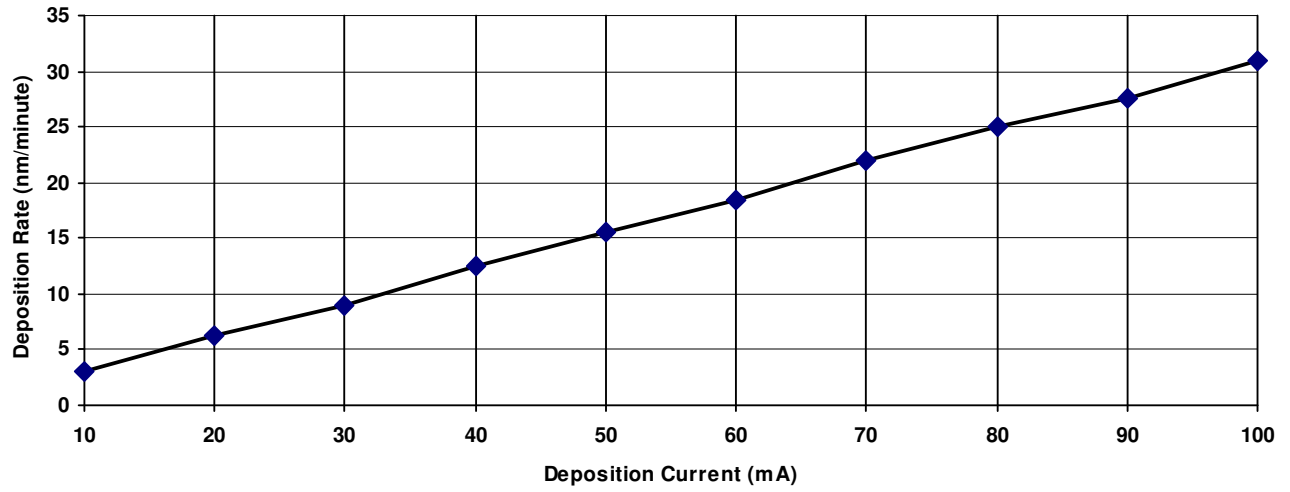
7.4 Pump Plug wiring



	UK and Europe	U.S.A. and Canada
Pin 1 (Live or Hot)	Brown	Black
Pin 2 (Earth)	Green / Yellow	Green
Pin 3 (Neutral)	Blue	White

7.5 Graph Showing Expected Sputtering Rate

Sputtering Deposition Rate Using Gold
(Using Argon @ 1×10^{-1} mbar, target to sample spacing = 30mm)



7.6 K150X FTM Option

The **K650X** can be used with an external 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.

The FTM can be used in two modes, AUTO or MANUAL. In manual mode the coating runs for the pre-selected time and the FTM is enabled so that it can count the deposition and disabled at the end of the coating process.

In Auto mode the required deposition is selected on the FTM and a control signal is asserted to inform the **K650x** that AUTO mode has been selected. When the required amount has been deposited, a control line from the K150x to the **K650x** will be asserted which tells the coater to stop. The coating time is loaded with a value which acts as a time-out in the event of a fault with the FTM and no coating taking place.

By default the "FTM enabled" option is set to NO in the menu. If using an FTM set this option to YES. Connect the control lead to the 5 pin DIN socket at the rear of the **K650x** and the BNC lead to the BNC socket at the rear of the **K650x**.

For further information see the K150X manual.

7.7 World wide Electrical Supplies

Country	Voltage	Frequency
Australia	240V	50Hz
Brazil	115V / 230V	60Hz
Canada	115V	60Hz
Finland	230V	50Hz
France	230V	50Hz
Germany	230V	50Hz
India	230V	50Hz
Ireland	230V	50Hz
Israel	230V	50Hz
Italy	230V	50Hz
Korea (South)	230V	50Hz
Japan	115V	50 / 60Hz
Netherlands	230V	50Hz
Norway	230V	50Hz
Pakistan	230V	50Hz
Portugal	230V	50Hz
Scandinavia	230V	50Hz
Singapore	230V	50Hz
Spain	230V	50Hz
Taiwan	115V	60Hz
Turkey	230V	50Hz
United Kingdom	230V	50Hz
United States of America	115V	60Hz

8. References

1. **CRAIG, S. and HARDING G.L. (1981)**

Effects of Argon pressure and substrate temperature on the structure and properties of sputtered copper films.
J.Vac.Sci. Technol., 19, 205-215

2. **ECHLIN, P. BROERS, A.N. and GEE, W. (1980)**

Improved resolution of sputter-coated metal films.

Scanning Elect. Microsc. 1980; I,163-170

3. **PETERS, K-R. (1980).**

Penning sputtering of ultra thin metal films for high resolution Electron Microscopy.

Scanning Elect. Microsc. 1980; I, 143-154

4. **SCHILLER, S. HEISIG, U. and GOEDICKE, (1977).**

Use of the ring gap plasmatron for high rate sputtering

Thin Solid Films, 40, 327-334

5. **THORNTON, J.A. (1978).**

Substrate heating in cylindrical magnetron sputtering sources.

Thin Solid Films, 54, 23-31

6. **NOCKOLDS, C.E. MORAN, K. DOBSON, E. and PHILLIPS A.**

Design and operation of a high efficiency magnetron Sputter Coater.

Scanning Elect.Microsc. 1982. III 907-915

(Available on Request)

Safety information for the return of Preparation Equipment and Accessories.

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.

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'.

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.

Return Address:

F.A.O.: The Service Manager,
Quorum Technologies Ltd,
South Stour Avenue,
Ashford,
Kent. TN23 7RS.

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.

<p>1. Description of component</p> <p>- Equipment type/model: _____</p> <p>- Code No.: _____</p> <p>- Serial No.: _____</p> <p>- Invoice No. (if known) _____</p> <p>- Delivery Date.: (if known) _____</p>	<p>2. Reason for return:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>3. Equipment condition</p> <p>- Has the equipment been used? Yes/No</p> <p>- What type of operating medium was used?</p> <p>_____</p> <p>- Is the equipment free from potentially harmful substances? Yes/No</p> <p>(If Yes go to Section 5)</p> <p>(If No go to Section 4)</p>	<p>4. Process related contamination of Equipment/ Accessories.</p> <p>- Toxic Yes/No</p> <p>- Corrosive Yes/No</p> <p>- Explosive* Yes/No</p> <p>- Microbiological* Yes/No</p> <p>- Radioactive* Yes/No</p> <p>- Other harmful substances Yes/No</p>

* 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.

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: _____

Tel.: _____ Post Code: _____

Name: _____ Fax.: _____

Date: _____ Job Title: _____

Company Stamp: _____

9. Document History

Issue	Date	Details	Revised By
1	29/11/2000	Initial Issue for new instrument	PRM
2	26/7/01	Adjustable stage and FTM	PRM
3	12/07/02	Page 1 Photo added	RIS
4	22/8/05	Fuse Information amended	HR