



Quorum Technologies

# **Q150T S/E/ES Sample Preparation System Instruction Manual**



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Issue 5

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Issue	Date	Details	Revised By
1	03/06/10	Initial Issue	SRM
2	20/08/10	Glow discharge updates	SRM
3	31/01/12	Ramped profile, Aperture cleaning update, Aluminium coating	SRM
4	04/02/13	Gas supply, rod shaping instructions, outgassing	SRM
5	16/07/14	Addition of controlled pulse carbon and other corrections	SRM

## 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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## Health and Safety

Safety is very important when using any instrumentation. At Quorum, we endeavour to:

- Provide a safe working environment for our employees and customers
- Conduct our business responsibly, in a manner designed to protect the health and safety of customers, employees and the public at large, and to minimise any adverse effects on the environment.
- Review our operations regularly to achieve environmental, health and safety improvements in line with UK and European Community legislation.

All service work carried out on the equipment should only be undertaken by suitably qualified personnel.

**Quorum is not liable for any damage, injury or consequential loss resulting from servicing by unqualified personnel. Quorum will also not be liable for damage, injury or consequential loss resulting from incorrect operation of the instrument or modification of the instrument.**

### Control of Substances Hazardous to Health (COSHH)

The EC legislation regarding the "Control of Substances Hazardous to Health" requires Quorum to monitor and assess every substance entering or leaving their premises. Consequently, a completed Health and Safety Declaration form must accompany any returned goods (see Appendix -9.5.5 on page 89 for the form)

Without this declaration, Quorum 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.

### WEEE Compliance



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

For full details of our environmental policies, including WEEE, please visit <http://www.quorumtech.com/about-us/environmental-policy.html>.

### Conformity



This Equipment of this Design and manufacture and marked CE, conforms with the requirements of the European Directives EMC 2004/108/EC & LVD 2006 /95/EG.

### Quality



Quorum Technologies Ltd operates a quality management system in accordance with ISO 9001.

Certificate No: 3698/03

### Hazard Signal Words

This manual defines hazards using the following key words:

WARNING	<i>Potentially</i> hazardous situation or unsafe practice that, if not avoided, <i>could</i> result in death or severe injury.
CAUTION	<i>Potentially</i> hazardous situation or unsafe practice that, if not avoided, may result in minor or moderate injury or damage to equipment.

### 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.

### Intended Use

This instrument is designed for laboratory use only and is not intended for use in a production environment.

# 1 Introduction

## 1.1 General Description

The **Q150T** system is a versatile sputter coater/turbo evaporator (see **Figure 1-1**) for preparing specimens for examination by electron microscopy.

With a comprehensive selection of easily interchanged inserts and sample stages, the Q150T can be used to:

- Sputter coat samples using targets such as Chromium or Gold.
- Evaporate support films and replicas for TEM and X-Ray analysis and conducting coatings for SEM using 3mm or 6mm carbon rods or cords.
- Evaporate metals upwards or downwards from a wire basket or molybdenum boat arrangement.
- Clean aperture strips.

There are three models in the Q150T range:

**Q150T S**      Sputter coater version only.

**Q150T E**      Carbon/metal evaporation version only.

**Q150T ES**    Combined system with interchangeable inserts for sputter coating or carbon/metal evaporation.

The instrument is fully adaptable to a wide range of specimens and offers easy loading and unloading of samples. The changeover between sputtering and evaporation inserts is simple. The system is fully automated with a user defined *profile* controlling the pumping sequence, preheating, outgassing, the time and number of evaporation/sputter bursts, and the current used during the process.

The Q150T can be fitted with a film thickness monitor (FTM), which measures the coating thickness on a crystal in the chamber, to control the coating applied to the sample. For example, the Q150T can automatically terminate a coating cycle when the required thickness has been achieved.



**Figure 1-1.      Front view of the Q150T**

The Q150T features a turbo molecular pump backed by a rotary vacuum pump and controlled by the instrument throughout the fully automatic coating cycle.

The system is fitted with a vacuum shutdown system allowing the instrument to be pumped down and switched off, with the chamber left under vacuum.



## **1.2 Sputter Coating**

Sputter Coaters are used in Scanning Electron Microscopy to provide an electrically conductive thin film representative of the surface topography of the specimen to be viewed, such films inhibit 'charging', reduce thermal damage, and enhance secondary electron emission.

The Q150T S and Q150T ES employ a magnetron sputter target assembly. This enhances the efficiency of the process using low voltages and giving a fine-grain (order of 0.5nm Cr grain size), cool sputtering. The unit features a rotating sample table ensuring even depositions (typically 5nm). It uses standard targets, avoiding the necessity of special large profile targets. The instrument is fitted with a 57mm diameter quick-change target (the sample chamber is 165mm in diameter) giving optimum consumable cost performance. Alternative target materials are available.

A shutter assembly is fitted as standard, which allows sputter cleaning of oxidising targets.

## **1.3 Carbon Coating**

Carbon films, because of their mechanical stability, good electrical conductivity, and low background signal are commonly used to prepare samples for Electron Microscopy (EM).

Thin films of about 5 nm (50Å) are used for particle support and as an isolating layer in autoradiography. Thicker films are used in Scanning Electron Microscopy (SEM) also for support, in addition to coating for X-Ray Microanalysis. In general, there is a need for all these films to be fine grain, even coating, with uniform and reproducible film thickness.

The most common form of deposition is from resistance heated carbon rods. The rods are shaped to achieve high current density with sufficient temperature to cause evaporation. Carbon filaments can also be used, which at high temperature burn quickly, from which has evolved the terminology: Carbon 'Flash' Evaporation. The resulting short coating times and reduced total power input distinguishes it from the somewhat longer process of carbon rod evaporation.

Q150T E and ES models feature a multi-change head system for Carbon rod, Carbon fibre and metal evaporation.

## **1.4 Metal Evaporation**

By vaporizing a metal film onto a sample, it is possible to enhance the topographic detail for high resolution analyses by TEM or SEM. This technique is particularly useful in the analysis of biological specimens. The metal evaporant, usually a wire of, for example, platinum or gold, is heated and vaporised by a filament (typically made of tungsten).

For downwards evaporation, evaporants usually in the form of wire: e.g gold, platinum, aluminium, etc are placed directly onto the filament. For upwards evaporation, the evaporant is placed in a 'boat' (typically made of molybdenum or tungsten).

The Q150T E and ES can be configured for metal evaporation in an upwards or downwards direction.

## **1.5 Aperture Cleaning**

In its metal evaporation configuration, you can use a Q150T E or Q150T ES to clean aperture strips and other electron microscope components. With the component placed in a molybdenum boat, it can be heated to evaporate contaminants.

## 2 Installation

It is important that this equipment is installed by skilled personnel in accordance with these instructions. Failure to do so may result in damage or injury. 'If in doubt - ASK'.

### 2.1 Pre-installation

Identify a suitable location for the unit:

- Mount the unit on a bench or the recommended trolley. The total weight of the system is 33.4 kg.
- The environment should have an ambient temperature range of 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.

#### 2.1.1 Required Services

##### Argon

Supply for sputtering should be N4.8 (Zero Grade) 99.998% purity capable of supplying 3 litres/min at 4 psi. The regulator should be set at 4 psi.

The system is supplied with 3m plastic tubing 3mm I.D. x 6mm O.D. from a quick release connector on the rear of the unit. It is the customer's responsibility to connect this tube to the pressure regulator from the gas bottle or plant supply. Typically a system will use approx. 0.2 litres of Argon for a 4 minute sputter cycle (plus up to 4 litres if argon is also used for purging and venting).



*If bottle supply is adjacent it can be isolated locally, if not or plant supply, local isolation valves should be fitted.*

##### Nitrogen

Supply for purging should be N4.8 (Zero Grade) 99.998% purity capable of supplying 3 litres/min at 4 psi. The regulator should be set at 4 psi.

The system is supplied with 3m plastic tubing 3mm I.D. x 6mm O.D. from a quick release connector on the rear of the unit. It is the customer's responsibility to connect this tube to the pressure regulator from the gas bottle or plant supply. Typically a system will use up to 4 litres when Nitrogen is used for purging and venting.



*If bottle supply is adjacent it can be isolated locally if not or plant supply, local isolation valves should be fitted.*



*Pressure Regulators are Customer Supply, Nitrogen is recommended for Purging for Economy, Argon must be provided for Sputtering, it can also be used for Purging in the event of Nitrogen purge gas not readily available.*

*Typical regulators suitable for Argon and Nitrogen are the C106X/2 series available from BOC*

*<http://www.boconline.co.uk/en/products-and-supply/specialty-equipment/regulators/two-stage-regulators/c106x2-series/c106x-2-series.html>*

##### Electrical supply

90-240V, 50/60Hz, 1350VA, including pump.

##### Vacuum Pump

Pump No 3 complete with Vac. Hose & Oil Mist Filter 35 litre/min 2m<sup>3</sup>/hr.

## 2.2 Unpacking

1. Remove the Instrument from its packing and place it in its operational position.

**CAUTION**

**Don't try to lift the unit by yourself: it weighs 33.4kg. Get someone to help you move it.**

2. Carry out a visual inspection to check for any signs of transit damage.
3. Remove the Accessories Pack, and check contents against Q150T Accessories Pack shipping list.

**CAUTION**

**Do Not attempt to lift the lid from the chamber. Unlatch the grey top cover and remove the 2 transit screws retaining the top plate assembly. The set screw and the transit plate should be retained with the instrument accessories in case further transit of the instrument is necessary.**

4. Ensure that all areas of the Instrument are free of loose packaging material. Check specifically the instrument chamber, glass cylinder, and gaskets. (Do not use vacuum grease on gaskets).
5. If your unit includes a vacuum pump, carry out preliminary checks in accordance with the manufacturer's recommendations.



*If you are intending to use an existing or alternative vacuum pump, and have any difficulty with these connections, please contact our technical support.*

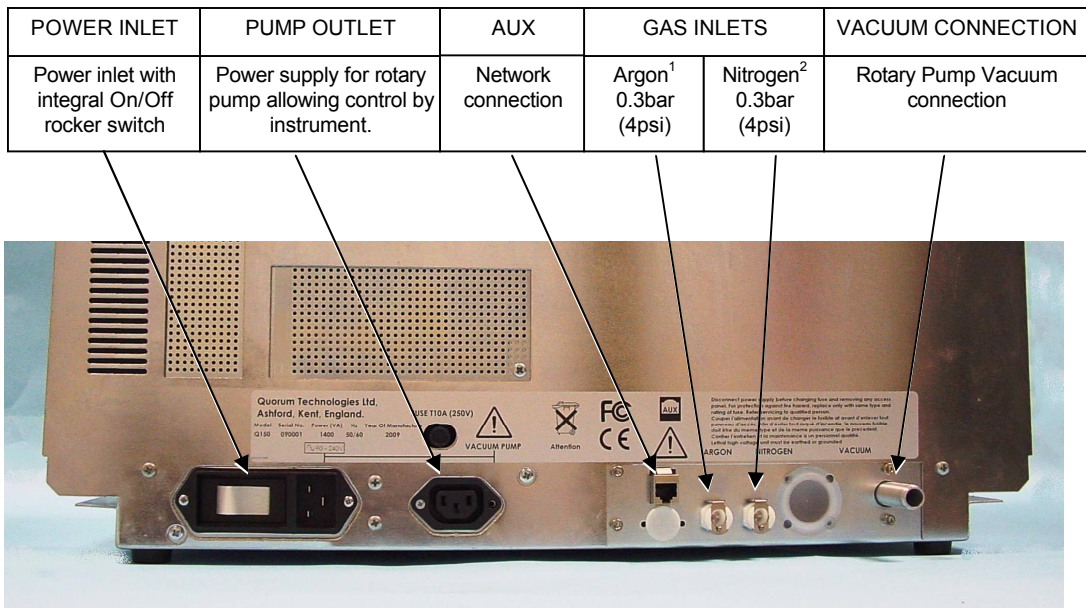
## 2.3 Connections

Installation consists of the following steps:

- Connect gas supplies (see below).
- Make electrical connections (see page 13).
- Connect the vacuum pump (see page 15).
- Install the sample stage (see page 16).

If you want to install a different insert than that supplied with your instrument, please see page 54. If you have ordered a Q150T ES, the instrument will be fitted with the sputter insert, unless you have specifically requested another configuration.

Figure 2-1 shows the location of connectors and switches on the rear panel of the Q150T.



**Figure 2-1. Q150T Rear Panel**

- (1). S versions only
- (2). If using air instead of Nitrogen, fit filter part no. 12842 see "Gas Connections", below.



### WARNING

**UNDER NO CIRCUMSTANCES SHOULD ANY OTHER CONNECTIONS OR OUTLETS/INLETS BE USED FOR ANY OTHER EQUIPMENT OR SERVICES.**

### 2.3.1 Gas Connections

1. Connect a suitable argon supply at a regulated input of 0.3bar (4psi) to the quick connect *Argon* gas connector on the rear panel (see **Figure 2-1**). If you prefer, you can use argon for both process and purge supplies. (recommended if coating with oxidising targets). To do so, install a 'T' piece across both gas inlets.
2. Connect a suitable nitrogen supply at a regulated input of 0.3bar (4psi) to the quick connect *Nitrogen* connector on the rear panel. Air may be used in place of nitrogen for venting (not recommended for oxidising targets) but it is important to fit the filter (part no. 12842) to prevent ingress of dust (see Figure 2-2). **Failure to connect this filter could prevent the system venting at the end of a cycle.**

Connectors are push-fit and will 'snap' into a locked position. To release a connector, depress the metal tongue.



Figure 2-2. Gas connectors with filter (part no. 12842) fitted to purge gas inlet

### 2.3.2 Electrical Connections

1. Connect the instrument to a suitable earthed single-phase ac supply using the supplied cable. The lead should be fitted with the appropriate plug for your country. Ensure the plug is firmly located.



#### **WARNING – EARTH CONNECTION**

This Equipment must be Earthed and fitted with the correct lead for the country of operation. This Equipment is normally supplied from 3 pin supply including Earth.



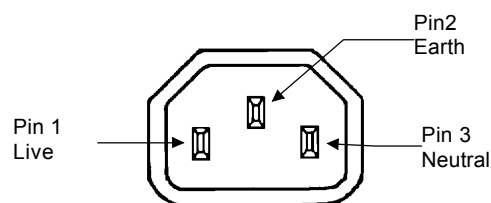
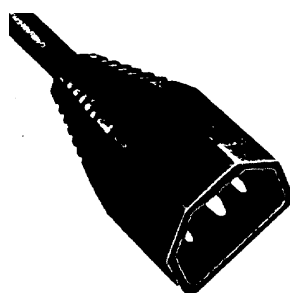
For fuse information, refer to Table 32.

2. Connect the rotary pump power lead to the Pump Output connector on the rear panel (see **Figure 2-3**). If the rotary pump has its own switch, ensure that this is set to the 'On' position.



#### **WARNING – PUMP OUTPUT**

Check that the Power Output is suitable for the rotary pump. The Pump Output is intended for connection to the pump supply only and provides the electrical supply voltage at a maximum of 4 Amps.



PIN	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

**Figure 2-3. Power outlet lead wiring**

### 2.3.3 Aux Network Connection

To link the Q150T to your network, use a standard CAT5/5e cable with RJ45 network connectors to connect the AUX Network port directly to your computer's network port or a network hub/switch.

### 2.3.4 Vacuum Connections

1. If you are using an existing or alternative vacuum pump, and have any difficulty with connections, please ask for advice.
2. If the instrument is NOT going to be vented into an extraction system, fit an Oil Mist Filter with metal adapter to the outlet of the vacuum pump. Please refer to the manufacturer's instructions.
3. Ensure that the vacuum pump is filled with the correct oil.
4. If the vacuum pump is fitted with an on/off switch, ensure that it is set to the 'on' position to allow the instrument to control its power supply.
5. Connect the flexible vacuum hose to the spigot on the rear panel using the hose clip provided. This is a push-on fit to the Instrument. Ensure that this is firmly in place to the full length of the spigot.



*A rotating vacuum spigot is available for more convenient hose connection in installations where the instrument is to be located close to a back wall (see page 69).*



### 2.3.5 Fitting the Standard Stage

The Q150T is supplied with a standard stage (10067). For installation instructions for other stages, see page 54. To install the standard stage:

1. Ensure that the instrument is vented and in standby mode.
2. Open the top cover fully so it rests against its backstop.
3. If there is already a stage in place, remove it by lifting carefully upwards.
4. Fit the standard stage by locating its shaft into the top of the stage rotation drive spigot protruding from the baseplate and with a twisting motion pushing it gently down until the collar around the shaft rests on top of the drive spigot (see below).

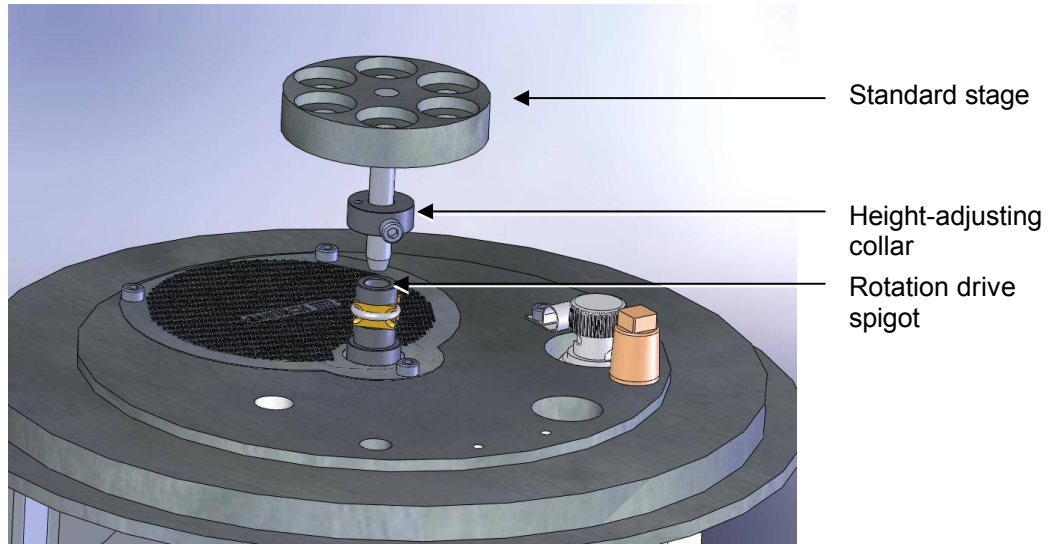


Figure 2-4. Fitting the standard stage



*You can adjust the height of the stage above the base plate by moving the collar up or down the shaft. Unfasten the M3 screw with a hexagonal key, slide the collar to the required position and retighten the M3 screw.*

*For maximum distance between the stage and the target, remove the collar so that the underside of the stage rests on the top of the drive spigot. To reduce the distance between the stage and target, fit the stage with the alternative long shaft (10214 – supplied with stage).*

*When using small 1/8" pin stubs, it is advisable to unscrew the stage and fit it upside down for easy access to the stub.*

**Note that the Q150T's default tooling factors are based on a stage height of 60mm from the base plate.**

### 2.3.6 Optional Connections

For full connection details of optional units, where provided, please refer to separate instructions. Any other connections on the rear panel not listed are for common manufacturing and are not available for this instrument.

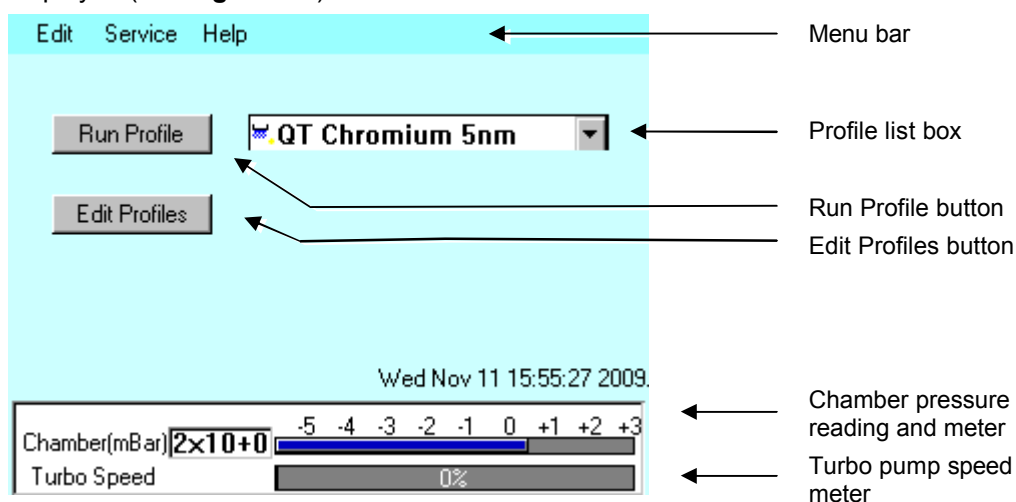


### 3 Operation

This chapter describes the basic operation of the Q150T. For more advanced use, please see **Working with Profiles** on page 21 and **Application Guidelines** on page 28.

#### 3.1 Switching On for the First Time

1. Ensure that you have completed the installation as described in the previous sections.
2. Switch the instrument on using the rocker switch located on the rear panel. The front panel LCD display should illuminate and show the initialising message.
3. Once the instrument hardware and software has initialised, the standby screen is displayed (see **Figure 3-1**).



**Figure 3-1. Standby screen**

##### 3.1.1 The Standby screen

The Standby screen has three main parts:

- A menu bar with **Edit**, **Service** and **Help** categories (see page 42).
- **Run Profile** and **Edit Profile** buttons and a profile selector. Operate the instrument simply by selecting a profile and tapping on the **Run Profile** button.
- Pumping/vacuum information display: Chamber pressure reading and meter, and a turbo speed indicator.

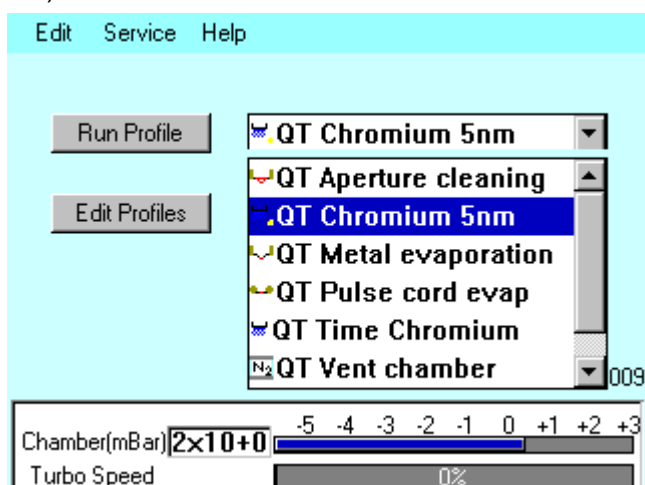
## 3.2 Running a Profile

Before you can run a profile, ensure you have:

- Completed the installation as described on page 10.
- Switched on the instrument (see section 17).
- Loaded a sputter/coating target or loaded an evaporation source (see page 54).

To run a profile:

1. Load your sample onto the center of the sample stage.
2. Close the top cover assembly and press it firmly down to secure the latch.
3. Tap on the down arrow button to open the dropdown list of profiles (see **Figure 3-2**).



**Figure 3-2.** Selecting a profile

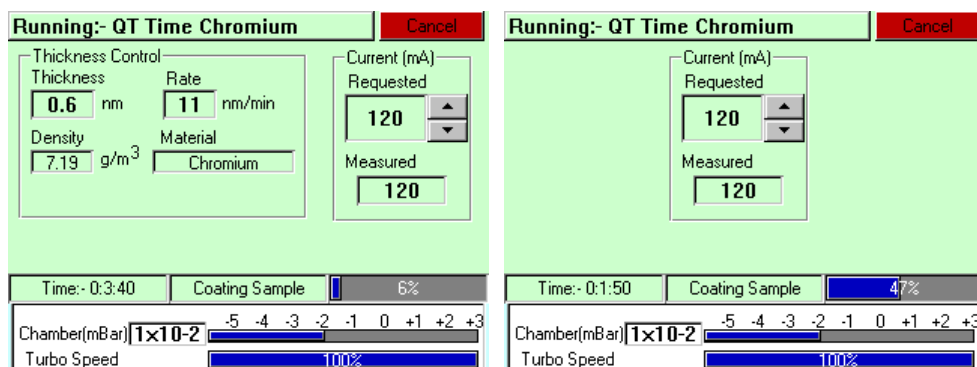
4. The Q150T has several default profiles for common tasks as shown in Table 1. Tap on the name of the profile you want to run.

**Table 1 Q150T Default Profiles**

PROFILE NAME	PURPOSE
QT Time Chromium	Sputter coating run using Chromium target (see page 28)
QT Chromium 5nm*	Sputter coating run using Chromium target terminated by FTM at a coating thickness of 5nm (see page 28)
QT Metal evaporation	Coating using metal evaporator (see page 31)
QT Aperture cleaning	Default profile for aperture cleaning (see page 40)
QT Pulse rod evap	Evaporation using carbon rods (see page 32)
QT Pulse cord evap	Evaporation using carbon cord (see page 32)
QT Controlled pulse	Evaporation using FTM termination of carbon cord (see page 32)
QT Vent chamber	Vent sample chamber
QT Vacuum shutdown	Pumps chamber to 1mBar to allow shutdown under vacuum

\* Profile only present on systems equipped with FTM.

5. Tap on the **Run Profile** button. The Q150T starts pumping the sample chamber. The progress of the run is shown through a series of on-screen messages (Figure 3-3).

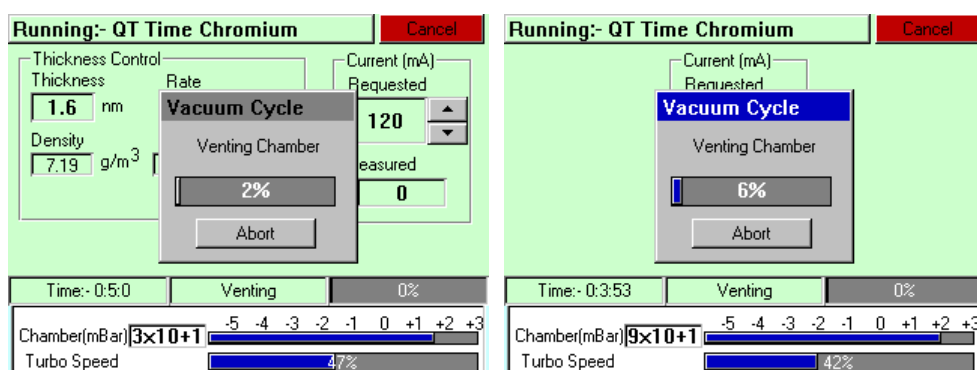


**Figure 3-3.** A run in progress: with FTM installed (left) and without FTM (right).

6. If you want to stop a run while it is in progress, tap on the **Cancel** button.
7. At the completion of the run, the Q150T begins to vent the chamber (see **Figure 3-4**). If you want to record thickness control or current information, make a note of it now. When the chamber has been vented, the display reverts to the standby screen (see **Figure 3-1**).



*Future versions of the Q150T software will allow logging of thickness control and profile parameters through the instrument's network communication capabilities.*



**Figure 3-4.** Venting the chamber: with FTM installed (left) and without FTM (right).

8. When the chamber has been completely vented, the display reverts to the standby screen. You can now remove your sample and set up another run.

### 3.3 System Settings

The operation of the Q150T is controlled by its profile parameters. However, there are several *system parameters*, which can be changed without altering the profile. A system-set parameter overrides the corresponding setting specified in the active profile. You can make the new setting apply just to runs using the active profile or to all runs, irrespective of the choice of profile.

To change a system parameter:

1. Open *Profile Editor*: from the standby screen, tap on the **Edit Profile** button or choose **Edit | Profiles** from the menu bar.
2. Tap on the **+** sign to the left of the currently active profile (see Figure 3-5 - left).

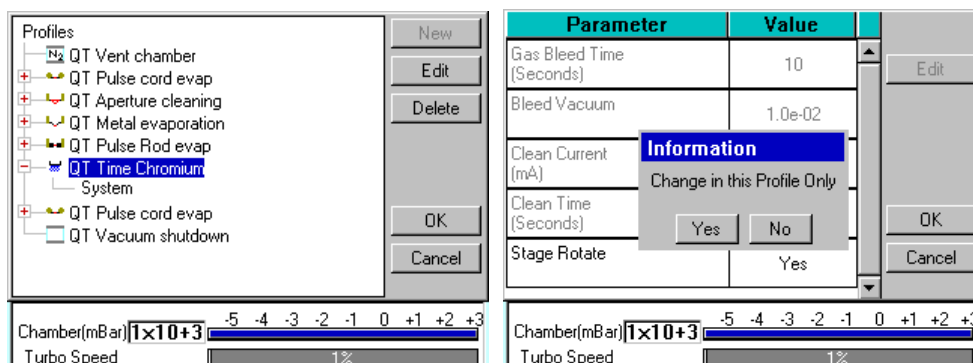


Figure 3-5. Listing system properties for a profile

3. Tap on *System*. *System Property Editor* is displayed (see Figure 3-5 - right).
4. You are prompted to confirm whether the changes are to be applied to runs using this profile only or to all runs. Tap on the **Yes** button to apply changes to the active profile only, or **No** to apply the change to all runs.

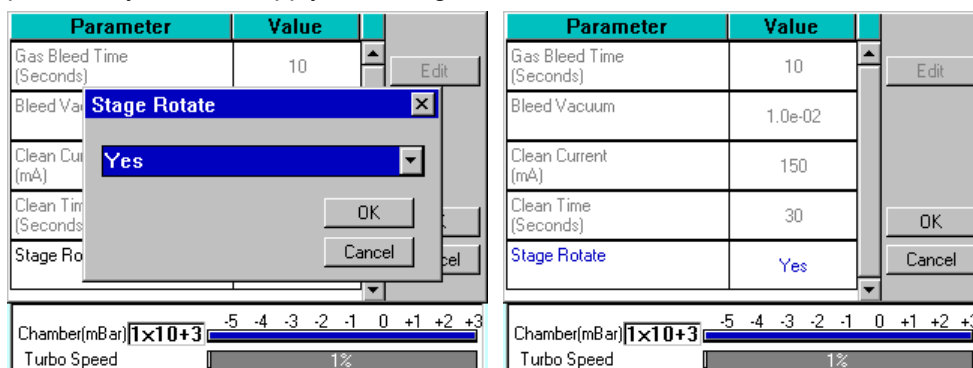


Figure 3-6. Changing the Stage Rotate system property

5. Tap on the value of the system property you want to change (in this case, *Stage Rotate*). Amend the setting as required and confirm the change by tapping on the **OK** button. Tap on the **Cancel** button to cancel any change (see Figure 3-6).
6. Altered system parameters are shown with blue text.
7. Tap on the **OK** button to exit the *System Property Editor*.

## 4 Working with Profiles

The operation of the Q150T is controlled by a profile. This describes the sequence of operations in sputter coating or evaporation cycles. You can also create profiles to carry out simple operations such as pumping or venting the sample chamber. Many of the basic operations such as pumping, outgassing or venting the chamber occur automatically as does the sequence in which they occur.

The Q150T is supplied with several default profiles to perform the basic and most common operations (see Table 1). To make your own profiles, customised for your specific applications, you can:

- Edit an existing default profile
- Create a new profile

### 4.1 Editing the Active Profile

To edit the profile currently selected on the standby screen, tap on the **Edit Profile** button. The editable parameters of the selected profile are displayed (see **Figure 4-4**).

Now refer to the **Editing Profile Parameters** section on page 24.

### 4.2 Profile Editor

To create, edit or delete any profile:

1. Select **Edit | Profiles** from the menu bar. *Profile Editor* is displayed (see **Figure 4-1**).

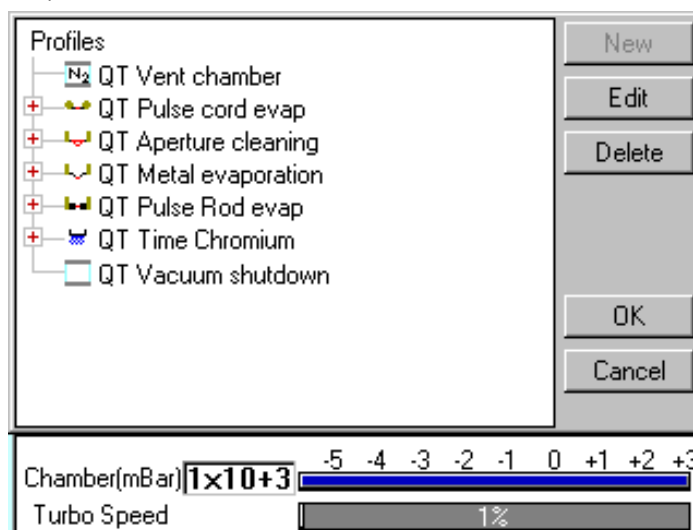












Figure 4-1. Profile Editor

In its main window, **Profile Editor** lists all existing profiles. To the left of each profile name, an icon denotes the type of profile (see Table 2).

**Table 2 Profile icons**

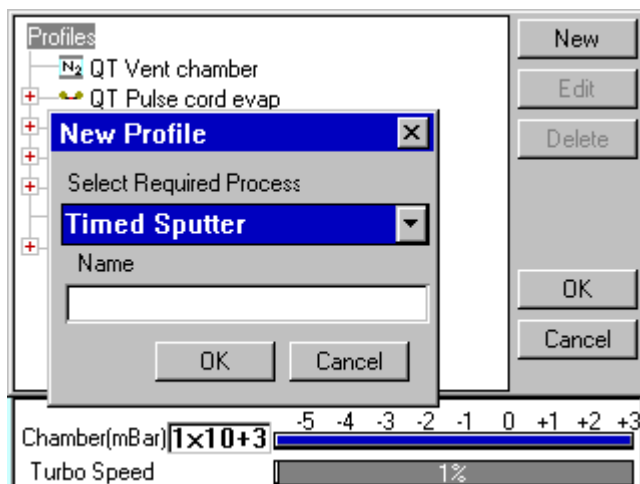
Icon	Profile/Process Type
	Timed sputter (see Table 24)
	FTM terminated sputter (see Table 24)
	Aperture cleaning (see Table 29)
	Metal evaporation (see Table 28)
	Pulse cord evaporation (see Table 25)
	QT Controlled pulse cord (see Table 26)
	Pulse rod evaporation (see Table 25)
	Ramped carbon
	Vacuum shutdown (see Table 30)
	Vent chamber

2. Tap on one of the buttons on the right side of the editor:
  - a. To create a new profile, tap on the **New** button (see **Creating a new profile**).
  - b. To edit a profile, tap on its name and then tap on the **Edit** button. The Profile's parameters are displayed (now see **Editing Profile Parameters**).
  - c. To delete a profile, tap on its name and then tap on the **Delete** button.

### 4.2.1 Creating a New Profile

To create a new profile:

1. With Profile Editor displayed, tap on *Profiles* at the root of the profile 'tree'.
2. Tap on the **New** button.
3. The *New Profile* dialog box is displayed (see **Figure 4-2**).



**Figure 4-2.** Creating a new profile

4. Choose the type of profile you want from the *Select Required Process* drop-down list).



See Table 2 for a list of all the available processes. Note that the processes listed are different for Q150T E, Q150T S and Q150T ES models.

5. Enter a name for the profile: tap in the *Name* field to display the on-screen keyboard (**Figure 4-3**) in the *Enter Name* dialog box.



**Figure 4-3.** Entering a new profile name

6. Tap on the **OK** button to confirm the changes to the profile. Alternatively, tap on the **Cancel** button to close the dialog box without creating a new profile.
7. The new profile is created using the default settings for the chosen process type.
8. Now refer to the *Editing Profile Parameters* section, below.

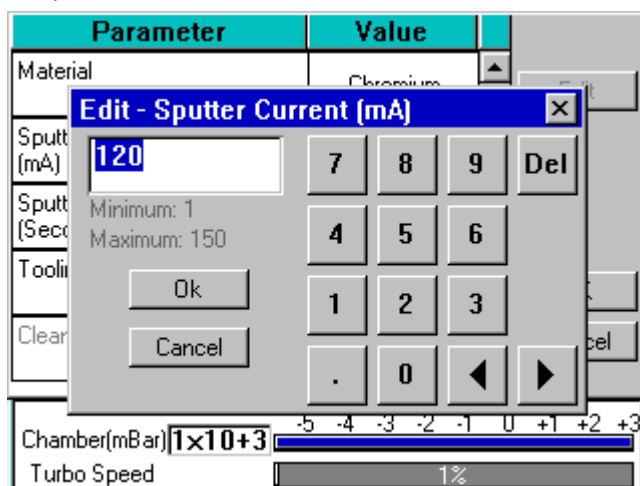
### 4.2.2 Editing Profile Parameters

1. To edit a profile, tap on its name in **Profile Editor** and then tap on the **Edit** button. A table showing the profile's parameters is displayed.
2. To edit a parameter, tap on its value (it is then highlighted in blue) and then tap on the **Edit** button.



*If a parameter is shown in grey text, you do not have the necessary user privileges to edit it. See page 49 for details.*

3. Change the value as required (see **Figure 4-4**). The instrument displays a dialog box for editing purposes, with either a numeric keypad or keyboard as required. The dialog box also shows the allowed values for the parameter.
4. Click on the **OK** button to confirm the change or on the **Cancel** button to restore the previous value.



**Figure 4-4. Editing Profile Parameters**

5. Edit other parameters as required.
6. On the Profile window, click on the **OK** button to confirm the changes to the profile or on the **Cancel** button to restore the previous values.

To see a list of the parameters used in profiles see page 78.



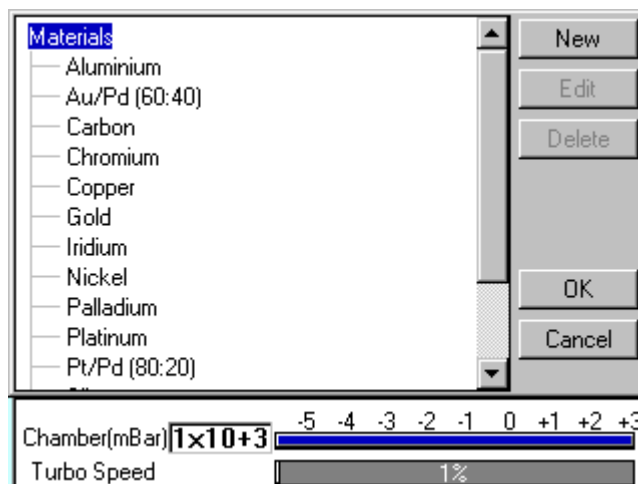
### 4.3 Materials

The software contains a database of the most common elements and alloys used in sputtering and evaporation applications (see Table 3). The choice of material is the first parameter in a Sputter Coating profile. The embedded density information is used to calculate film thickness.

**Table 3 Materials and their density**

Material	Density g/cm <sup>3</sup>
Aluminium	2.70
Carbon	2.25
Titanium	4.54
Chromium	7.19
Nickel	8.90
Copper	8.96
Silver	10.50
Palladium	12.02
Gold / Palladium (Au/Pd) (80:20 mix)	17.86
Tungsten	19.30
Gold	19.32
Platinum / Palladium (Pt/Pd) (80:20 mix)	19.56
Platinum	21.45
Iridium	22.40
User Defined allowable range	1.00 - 23.00

To create, edit or delete a new entry in the material database, select **Edit | Materials** from the menu bar. **Materials Editor** is displayed (see **Figure 4-5**).



**Figure 4-5. Materials Editor**

**Materials Editor** lists all the existing materials in the Q150T database and allows you to add new materials or edit existing material definitions.

### 4.3.1 Creating a New Material

To create a new material:

1. Select **Edit | Materials** from the menu bar. *Material Editor* is displayed (see **Figure 4-5**).
2. Tap on *Materials* at the root of the material 'tree'.
3. Tap on the **New** button. The *New Material* dialog box is displayed.
4. Enter a name for the profile: tap in the *Name* field to display the on-screen keyboard (Figure 4-6) in the *Enter Name* dialog box.
5. Tap on the **OK** button to confirm the changes to the material. Alternatively, tap on the **Cancel** button to close the dialog box without creating a new material.
6. The new material is created using the default settings for the chosen process type.
7. Now refer to the **Editing Material Parameters** section.

### 4.3.2 Editing Material Parameters

Each material is defined by the parameters shown in Table 4:

**Table 4 Material parameters**

Name	Default Value	Minimum Value	Maximum Value	Comment
Density	10	1	30	
Material Type	oxidising	noble	oxidising	
Sputter Current	50	1	150	
Clean Current	150	100	150	
Material Tool		0.1	10	
Sputter cleaning mode*	Timed			Specifies how the material will be cleaned. Options are: <b>Timed</b> Continuous sputter for fix time. <b>Pulse above</b> Cycle plasma until target voltage is above that specified in <i>Sputter stop cleaning at</i> <b>Pulse below</b> Cycle plasma until target voltage is below that specified in <i>Sputter stop cleaning at</i> Only used during pulse cleaning of target.
Sputter stop cleaning at (Volts)*	250	90	600	Target voltage that needs to be achieved before cleaning is completed and the coating starts. Only used during pulse cleaning of target.

\* Displayed for information only. Changes if required will need to be carried out by a Quorum agent.

To edit a material:

1. Tap on the material's name and then tap on the **Edit** button.
2. To edit a parameter, tap on its value (it is then highlighted in blue) and then tap on the **Edit** button.
3. Change the value as required. The instrument displays a dialog box for editing purposes, with either a numeric keypad or keyboard as required. The dialog box also shows the allowed values for the parameter.
4. When you edit a value, tap on the **OK** button to confirm the change or on the **Cancel** button to restore the previous value.
5. Edit other parameters as required.
6. Back in the Material Editor, tap on the **OK** button to confirm the changes to the material or on the **Cancel** button to restore the previous values.

Parameter	Value
Density (g/cm <sup>3</sup> )	10.00
Material Type	Oxidising
Sputter Current (mA)	50
Clean Current (mA)	150
Material Tool	1.00

Chamber(mBar) 1×10+3

Turbo Speed  1%

Figure 4-6. Material Parameters

### 4.3.3 Deleting a Material

To delete a material, tap on its name and then tap on the **Delete** button.

## 5 Application Guidelines

This section describes the QT processes and their typical applications.

### 5.1 QT Timed Sputter

Suitable for the following applications:

- SEM coatings for tungsten emission SEM.
- High resolution SEM coatings for field emission SEM.
- General thin film coatings.
- Target materials: Au, Au/Pd or Pt

#### 5.1.1 Tungsten SEM work

For this type of work, the aim is to achieve a typical thickness of 10-20nm from a gold target. Figure 9-1 shows the deposition graph for gold. With a current of 20mA, a deposition rate of 20nm/minute is typically achieved (assuming that the sample height is set to the default height of 60mm and the vacuum is  $1 \times 10^{-2}$  mBar).

To achieve a gold coating of 10nm create a new profile based on *QT Timed Sputter*. The default *Material setting* is *Au*.

- Edit the current to 25 mA.
- Set the time to 30 seconds.

If necessary adjust the time or current slightly to modify the thickness.

#### 5.1.2 High resolution SEM coatings for field emission SEM

Generally, the recommended target materials are Cr or Ir and the objective is to generate a coating thickness of 5-10 nm.

The deposition graph using a Cr target is shown in Figure 9-2. With a current of 100mA, a deposition rate of 20nm/minute is typically achieved (assuming that the sample height is set to the default height of 60mm and the vacuum is  $1 \times 10^{-2}$  mBar)

To achieve a Cr coating of 10nm, create a new profile based on *QT Timed Sputter*.

- Set the material to Cr.
- Edit the current to 100 mA.
- Set the time to 30 seconds.

If necessary adjust the time or current slightly to modify the thickness.

### 5.1.3 Aluminium thin film

Aluminium is often difficult to coat due to its fast oxidizing properties. Also, its oxidized layer is difficult to remove as it reduces the required target voltage to produce a sputter current of 150mA. This increases the time required to clean the target.

However, the Q150T is set up to cycle the plasma which reduces this cleaning time. The cleaning cycle is terminated when the target voltage rises above 300V, thus preventing an already clean target coating the chamber excessively.

As an example, to achieve an Aluminium coating of 100nm:

1. Create a new profile based on *QT FTM Terminated Sputter*.
2. Edit the newly created profile.
3. Set the material to *Aluminium*.
4. When prompted, select *Use material defaults*. This applies a sputter current of 150mA to clean the target.
5. Edit the *Terminate thickness* setting to 100nm.
6. Tap on the **OK** button to close the Editor.

The clean time in the *System* properties should be between 10 and 30 seconds. However, leave at the default value of 30 seconds for this setup. The Q150T applies the optimum parameters for the cleaning cycle appropriate to your selection in the material list (in this case, aluminium).

On running the above process the coater will:

1. Pump down to the clean stage as before.
2. Clean the target for the time specified by *clean time* in the profile.
3. Wait for 20 seconds with the plasma off.
4. Repeat the procedure until the target voltage is above 300V at the end of the clean cycle for two consecutive cycles.
5. Continue with the standard sputter cycle.

If the target voltage fails to reach 300V after 15 cycles (see note below) the process is stopped automatically. This might occur if the target has not been used recently. Vent the system, remove the target and clean it manually using a fine abrasive. Repeat the process.



***The maximum of 15 cycles is determined by the Max pulse clean cycles property in Generic Sputter parameters (see page 45). Note administrator level access is required to change this property.***

## 5.2 QT FTM Terminated Sputter

This process (only available if the FTM is fitted) is suited to the following typical applications:

- SEM coatings for tungsten emission SEM.
- High resolution SEM coatings for field emission FE- SEM.
- General thin film coatings.

### 5.2.1 High resolution SEM coatings for field emission SEM

For High resolution SEM coatings for field emission SEM, assuming the chosen target material for this application is Cr.

Generally, the recommended target materials are Cr or Ir and the objective is to generate a coating thickness of 5-10nm.

To achieve a Cr coating of 5nm, create a new profile based on *QT FTM Terminated Sputter*.

- Set the material to Cr.
- When prompted, select *use material defaults*. This applies a sputter current of 120mA and automatically sets the clean target current to 150mA and the terminate thickness to 5 nm.

If necessary adjust the thickness if the coating is not sufficient.

### 5.2.2 General thin film coatings

As an example, to achieve a silver coating of 100nm:

- Create a new profile based on *QT FTM Terminated Sputter*.
- Edit the newly created profile.
- Set the material to *Silver*.
- When prompted, select *use material defaults*. This applies a sputter current of 50mA and a *terminate thickness* to 5nm.
- Edit the *terminate thickness* setting to 100nm.

## 5.3 Metal Evaporation

This process is designed for the following applications:

- Alternative coatings methods for SEM samples where sputtering is not available.
- Coating metal films on Non EM substrates.

It is only available with Q150T E/ES models equipped with the optional metal evaporation insert. To achieve a specific coating depth, the FTM must be installed.

### 5.3.1 How to achieve a 20nm gold coating

Fit the tungsten filament to the evaporation insert as described on page 59.

Load the filament with a small quantity of the gold to be evaporated. Carefully fit the insert as described on page 58.

1. Create a new profile based on *Metal evaporation*.
2. Edit the new profile:
  - Change the material from *Carbon* to *Gold*.
  - Change *outgas time* to a minimum of 2 seconds
  - Set the *outgas current* to 0 (out gassing is not necessary for this material).
3. Ensure the FTM cover is open
4. Run the new profile.
5. When the *Pump Hold* window is displayed, tap *Continue* when ready to proceed.
6. When the *evaporate* window is displayed use either the right arrows or the slider to increase the requested current gradually until evaporation can be seen on the film thickness monitor display. The measured current may differ from the requested current at this point due to changes in impedance of the source while the metal is melting.

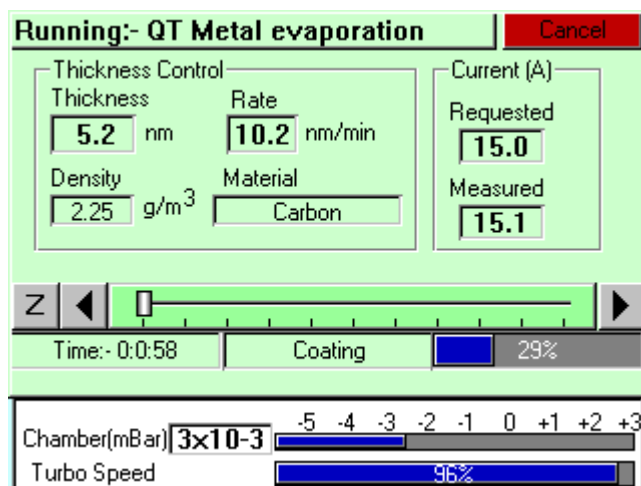


Figure 5-1. QT Metal evaporation process

7. When the required thickness of 20nm is achieved, tap the Z button to the left hand side and the current will immediately reduce to zero.

## 5.4 Pulsed Cord Evaporation

This process is designed for preparing conductive carbon coatings for SEM specimens for X-ray microanalysis EDX and WDX. It is only available with Q150T E/ES models equipped with the carbon cord insert option.

### 5.4.1 How to create a 20nm carbon coating

1. Install the carbon cord insert as described on page 58.
2. Ensure the stage is fitted with the shorter support shaft to give the maximum source-to-stage distance.
3. Create a new profile based on *QT Pulsed cord evaporation*.
4. Edit the newly created profile setting the parameters as shown in Table 5.
5. Run the new profile.

**Table 5 QT Pulsed cord evaporation parameters for 20nm coating.**

Parameter	Value
Pulse Current	50A
Pulses Length	3 seconds
Number of Pulses	1
Out Gas Time	60 seconds
Out Gas Current	30A
Pump Hold	Yes

## 5.5 Controlled Pulse Cord Evaporation

This process is used for preparing conductive carbon coating using carbon cord.

During the process the coating is built up of multiple thin layers using short current pulses (see Figure 5-2). This reduces the heating effect on the sample and allows the FTM to be used to terminate the coating.

### 5.5.1 Using Controlled Pulse to create a 15nm coat or 2-3nm for EBSD

6. Install the carbon cord insert as described on page 58 ensuring that the C5421 carbon cord is used. Note the springs in the insert must be removed to ensure that the cord does not fuse prematurely.
7. For the default tooling factor to be valid the stage should be fitted so the top of the sample is 60mm above the base plate.
8. Create a new profile by pressing the new button in the profile viewer and selecting *Controlled pulse cord*.
9. Edit the newly created profile setting the parameters as shown in Table 6. If an EBSD coating is required, set the terminate thickness to the required thickness i.e. 3nm.

**Table 6 QT Controlled Pulsed cord evaporation parameters for 25nm coating.**

Parameter	Value
Terminate thickness	15 nm <i>User selectable</i>
Pulse Current	54A
Pulses Length	1 seconds
Pulse Interval	10 seconds

The remaining properties have been optimised for coatings between 2 and 15nm with the top of the sample 60mm from the base plate. Thicker coatings at this stage position can be achieved. However this will increase the risk of the cord fusing before reaching the required thickness. If the cord does fuse it tended to deposit about 6nm, thus it can cause the required thickness to be exceeded. In



order to reduce this error the system attempts to detect when the cord is about to fuse. If detected the coater will assume next pulse will produce 6 nm thus will apply the pulse if the predicted outcome would be closer to the terminate value.

For a full list of profile parameters see Table 26.

10. Run the new profile.



*The reliability of this process depends on the operation of the FTM. The stability of the FTM is affected by the quality of the crystal. A crystal will need to be changed before the end of its maximum life. This can even be before the FTM status indicates 10% used (see page 51) as the deposited carbon will increase the thermal errors and can easily flake. These effects will increase if materials other than carbon are deposited on the crystal.*

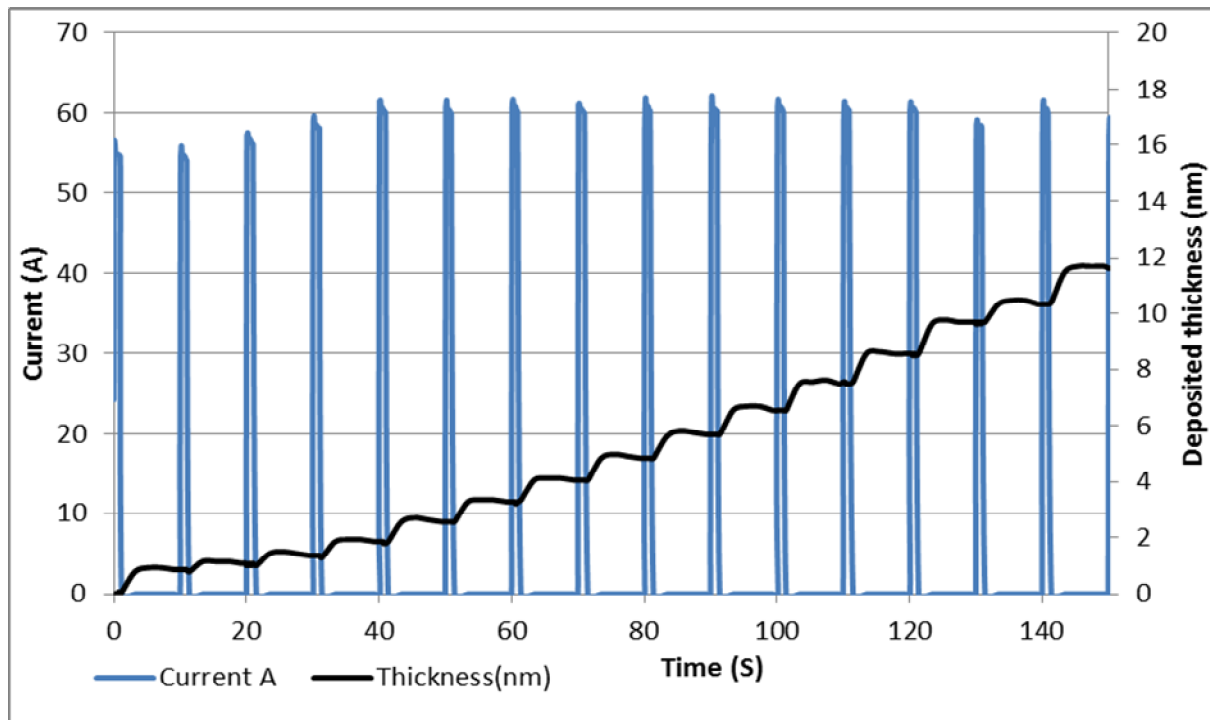


Figure 5-2. Typical 12nm Controlled pulse evaporation

## 5.6 Pulsed Rod Evaporation

Use this process for preparing TEM coatings for applying carbon reinforcement layers onto formvar grids. It is only available with Q150T E/ES models.

### 5.6.1 How to create a conductive layer for SEM

1. Install the carbon insert as described on page 54. Ensure that the carbon rods are prepared with a 1.2mm diameter spigot correctly as described on page 56.
2. Ensure the stage is fitted with a shorter support shaft to give the maximum source-to-stage distance.
3. Create a new profile based on *QT Pulsed rod evaporation*.
4. Edit the newly created profile setting the parameters as shown in Table 7.
5. Run the new profile.
6. The thickness of coating can be varied by adjusting the stage height, raise the stage to increase thickness, lower to reduce.

**Table 7** QT Pulsed rod evaporation parameters for conductive layer for SEM

Parameter	Value
Material	Carbon
Pulse Current*	62A
Pulses Length	3 seconds
Number of Pulses	1
Out Gas Time	10 seconds
Out Gas Current	40A



**CAUTION:** For pulsed rod evaporation, the recommended pulse current range is 60-65A. Currents above this may activate the power supply safety trip causing the unit to shut down.

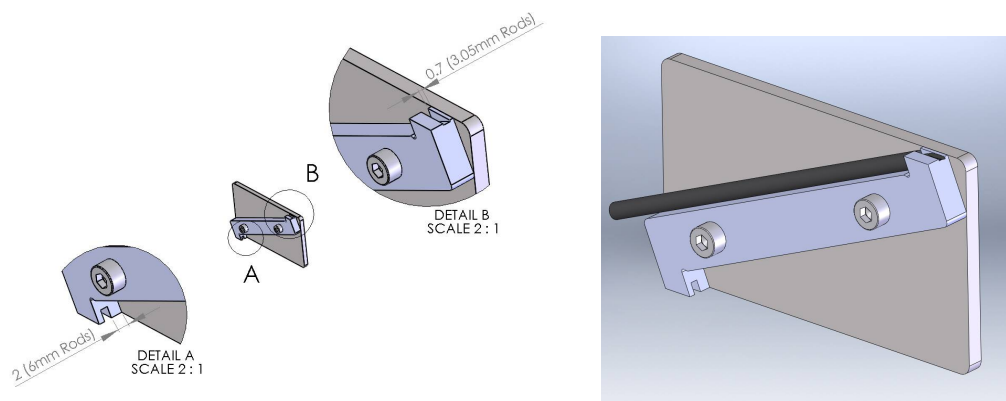
## 5.7 Ramped Profile

The Q150T Ramped Profile produces carbon coatings from a shaped carbon rod. We recommend this profile instead of the pulse carbon rod process if you require a consistently repeatable deposited thickness.

Generally, this process requires the use of the extended height chamber (see page 69). The short chamber may be used for a coating thickness greater than 12nm although the FTM will be inaccurate due to the close proximity of the high temperature rods.

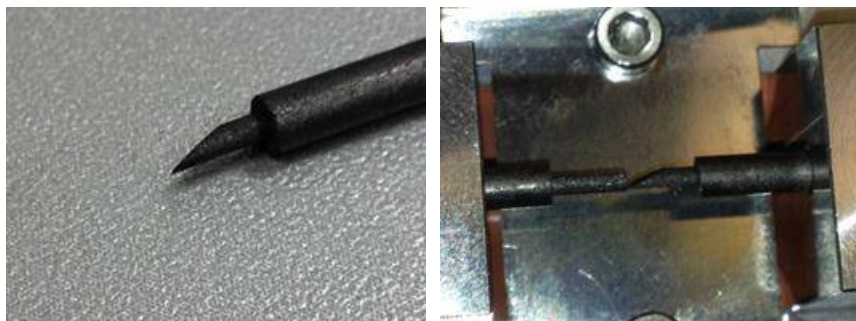
### 5.7.1 Carbon insert setup

1. Use the rod shaper with the red handle (provided in the accessory pack) to prepare two carbon rods each with a spigot 5mm long and with a diameter of 1.4mm diameter (see page 57).
2. You will then need to shape one of these rods to form a wedge using the wedge tool (Part No. 12097). This tool can be used to shape 3mm or 6mm rods. Use the end which has the groove closest to the plate to shape 3mm rods (see Figure 5-3, detail B).
3. Hold the tool with the groove to be used uppermost.



**Figure 5-3. Wedge tool (Part No. 12097)**

4. Place the rod with its shaped end into the groove ensuring the rod is pushed up to the shoulder.
5. File the rod so it is level with the metal tool. For best results, tap the dust out of the groove several times during this shaping process being careful not to move the rod.
6. Fit the flat-ended rod into the carbon gun (see page 56).
7. Fit the wedge-shaped rod with its point closest to the plate of the insert (see Figure 5-4). Ensure that the sliding clamp of the insert is pulled back approximately 5mm and the point of the spigot is resting on the end of the plain spigot. It may be necessary to swap the side of the wedged spigot or to rotate the plain spigot.



**Figure 5-4. (l) A finished wedge-shaped rod; and (r) in position with plain rod**

## 5.7.2 The ramped current profile

To achieve the controlled thickness this process uses a controlled evaporation current profile (see Figure 5-5).

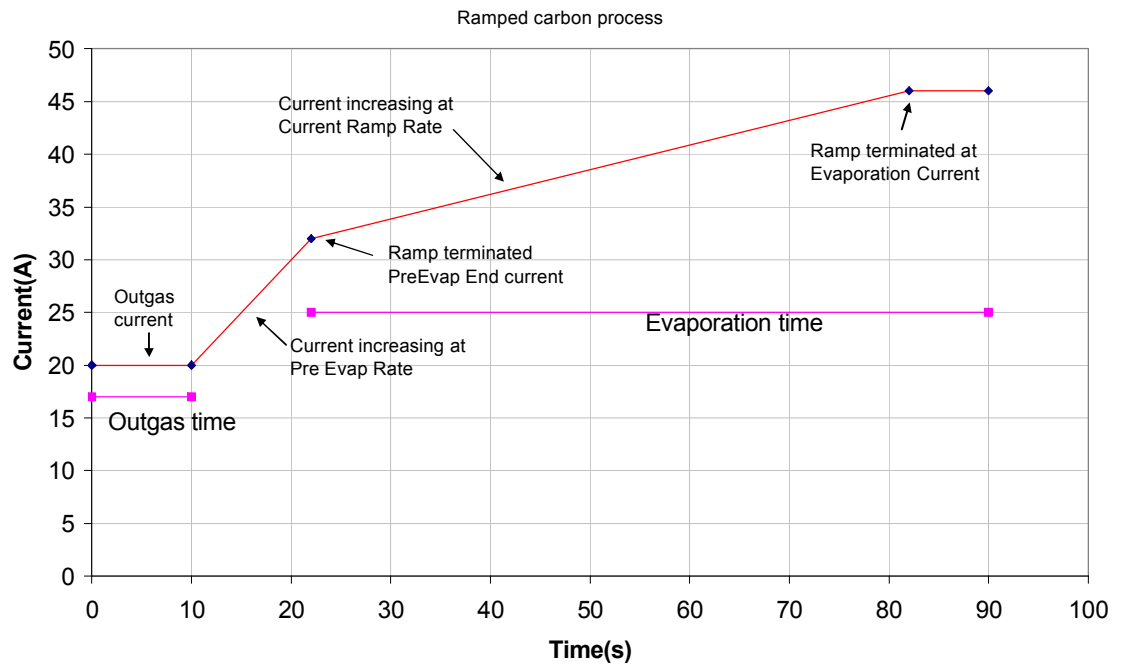


Figure 5-5. Ramped Profile with default parameters

This consists of four phases:

1. The rods are outgassed at the *Outgas Current* for the *Outgas Time*. The shutter opens and the evaporation starts.
2. The evaporation current increases at the *Pre Evap Rate* until the value of *PreEvap End Current* is reached.
3. The evaporation current now increases at the *Current Ramp Rate* until the *Evaporation Current* value is reached or the *Evaporation Time* has expired.
4. The evaporation current is held constant until the *Evaporation Time* has expired.



If you observe excessive sparking during the first 30 seconds of the evaporation stage the *Pre Evap End Current* parameter should be reduced by 1A at a time (but no lower than 27A).

If excessive sparking is seen 30 seconds or more into the evaporation stage, reduce the *Current Ramp Rate*.

If you change Ramped Profile parameters ensure that the evaporation time is sufficient to achieve a constant current for at least 8 seconds (but no more than 30s) at the end of the profile.

The default settings are correct for use with a 1.4mm spigot. However, there is often a slight variation in the tooling of the rod shapers. You can correct the default current setting for the actual rod spigot size using the following formula:

$$\text{New current} = \frac{\text{Spigot diameter}^2}{1.69} \times \text{Default current}$$

For example, if the actual spigot diameter is 1.1mm you should use an evaporation current of 30.8A.

### 5.7.3 Adjusting coating thickness

The default settings in the Ramped Profile will produce a 15 to 20nm coating suitable for SEM use. The actual coating thickness will depend on the stage height and the diameter of the spigot produced by your sharpener.

As an approximate guide, the coating thickness is proportional to the square of the distance between the stage height and the rods (the same amount of material is distributed over an increasing area as it travels away from the rods).

$$\text{New Thickness} = \frac{\text{Distance from source}^2}{\text{Required distance}^2} \times \text{Thickness at original distance}$$

**Example.** Assume that a coating thickness of 18nm has been achieved with a separation between the rods and source of 125mm (equivalent to a stage height of 75mm using the extended height chamber). To achieve a coating thickness of 11nm you would need to increase the separation to 160mm.

The thickness of the deposited carbon can also be controlled by changing the property "Evaporation current". This property is the final current achieved during the ramped profile (see Figure 5-5). The default current is 46A and this is the maximum that should be used for a 1.4mm spigot. However, reducing the Evaporation Current reduces the thickness of the coating. For example, with the Evaporation Current set to 38A the thickness of the coating (at a distance of 125mm) is reduced to approximately 5nm.

### 5.7.4 How to create a carbon support layer For TEM

1. Install the carbon insert as described on page 35. Ensure that the carbon rods are prepared correctly as described on page 57.
2. Ensure the stage is fitted with the longer support shaft adjusted to a height of 75mm above the base plate.
3. Ensure the extended height cylinder 10429 is fitted as described on page 69.
4. Create a new profile based on *QT Ramped Carbon*.
5. Edit the newly created profile setting the parameters as shown in Table 8.
6. Run the new profile.

**Table 8 QT Ramped Carbon TEM parameters for 5nm coating**

Parameter	Value
Material	Carbon
Evaporation Current	41A
Evaporation Time	1 minute
Current ramp rate	0.25A/S
Out Gas Time	10 seconds
Out Gas Current	20A
Pre Evap End Current	32
Pre Evap Rate	1.00 A/S

**How to create a conductive carbon layer for SEM**

1. Install the carbon insert as described on page 56. Ensure that the carbon rods are prepared correctly as described on page 57.
2. Ensure the stage is fitted with the longer support shaft adjusted to a height of 75mm above the base plate.
3. Ensure the extended height cylinder 10429 is fitted as described on page 69.
4. Create a new profile based on *QT Ramped Carbon*.
5. Edit the newly created profile setting the parameters as shown in Table 9.
6. Run the new profile.

**Table 9 QT Ramped Carbon parameters for SEM coatings**

Parameter	Value
Material	Carbon
Evaporation Current	52A
Evaporation Time	1.8 minutes
Current ramp rate	0.25A/S
Out Gas Time	10 seconds
Out Gas Current	20A
Pre Evap End Current	32
Pre Evap Rate	1.00 A/S

## 5.8 Using Outgas Source options

In addition to the evaporation parameters described in the previous section, you can also set up enhanced outgassing with the **Outgas Source** user parameter. This has three settings: *multiple*, *single* or *none* as described in Table 10.



You need to be logged in at Administrator level to access this parameter (see page 49).

**Table 10 Outgas Source options**

Setting	Action
Single outgas	Applies the outgas current for the outgas time once. If the <i>vacuum max recovery time</i> is zero the coat cycle will automatically start. Otherwise, the current is turned off and outgas recovery starts. In this period, the Q150T waits for the vacuum to return to the level it was before the current was applied. This time is limited by the <i>max outgas recovery time</i> parameter (default 10s). After this, the coating continues automatically.
Multiple outgas	The Multiple outgas option allows you to verify that out gassing is occurring and to decide to continue or repeat the outgas cycle. It applies the outgas current and outgas recovery as above. After a cycle is completed, you are prompted to (a) carry out further out gas cycles, (b) start the coating or (c) vent the chamber.  If the vacuum is less than 0.05 mbar below the vacuum after the outgassing, the <b>Coat</b> button changes to green to advise that further outgassing is not necessary.
None	Skips the outgas step and waits 5 seconds for the stage to speed up before commencing coating.

### 5.8.1 Setting Outgas Source options

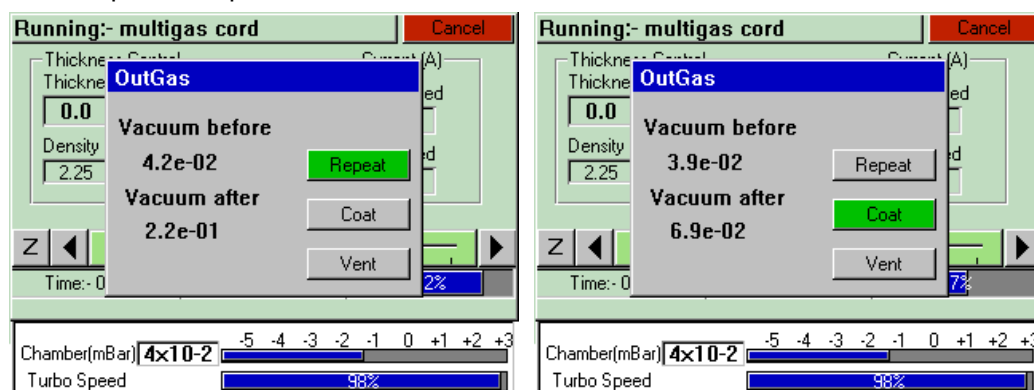
To set up outgassing options:

- Change the user group mode to *Admin* level (see page 49).
- Select **Edit | Profiles** (see page 21).
- Choose the profile you want to edit.
- Tap on **Outgas source**.
- Select *Multiple*, *Single* or *None*.
- Tap on **OK** to confirm the change.

### 5.8.2 Running Multiple Outgassing

When you run a profile modified for multiple outgassing, you are prompted to repeat outgassing or proceed with coating (see below).

- Tap on the **Repeat** button to run another outgas cycle.
- Tap on the **Coat** button to continue with the coating following the parameters set for the particular profile.



**Figure 5-6.** Prompts to repeat the outgas procedure (left) and proceed with coating (right)

## 5.9 Glow Discharge

This process can be used to clean hydrocarbon contamination from components. It is only available with Q150T S and ES models which are equipped with the Sputter power supply

1. Carefully fit the insert as described on page 62.
2. Select *QT Glow discharge* from the process menu and run the process.  
The default settings should be sufficient to create a hydrophilic surface on a carbon film. The process can be varied by creating a new profile.
3. Create a new profile from the default *Glow discharge -ve* process.
4. Edit the glow discharge current from 20mA to a higher value, for example, 25mA.

The current may also be increased manually during the process but this setting would not be retained for future runs.

### 5.9.1 Hydrophilisation

Freshly made carbon support films tend to have a hydrophobic surface which inhibits the spreading of suspensions of particles in negative staining solutions. However, after Glow Discharge treatment with air, the carbon film is made hydrophilic and negatively charged, thus allowing easy spreading of aqueous suspensions. With subsequent Magnesium Acetate treatment the surface is made hydrophilic and positively charged.

In addition to Glow Discharge treatment using air, other process gases may be used to modify surface properties. For example, if alkylamine is used as a process gas, the carbon film surface will become hydrophobic and positively charged. On the other hand, using methanol as a process gas results in the surface becoming hydrophobic and negatively charged.

Such treatments can facilitate the optional absorption of selected biomolecules.

### 5.9.2 Surface Cleaning

In many instances, surfaces need to be completely cleared of contamination films or deposits. This applies particularly to EM components where such deposits impair the maintenance of a clean vacuum system. A Glow Discharge treatment can be used to clean such components of undesirable residues.

Table 11 Glow discharge treatments

GLOW DISCHARGE		
Atmosphere	Surface	Charge
Air	Hydrophilic	Negative
Air	Hydrophilic	Positive (With subsequent magnesium acetate treatment)
Alkylamine	Hydrophobic	Positive
Methanol	Hydrophobic	Negative



## 5.10 Aperture Cleaning

This process is designed to clean hydrocarbon contamination from SEM & TEM apertures. It is only available with Q150T E/ES models equipped with the optional metal evaporation insert.

1. Fit the molybdenum boat source to the evaporation insert as described on page 59.
2. Choose the *QT aperture cleaning* profile from the list. Edit the profile and change the current to 10A and the time to 5 minutes.
3. Run the profile.
4. When the coating unit has reached 'HiVac' and the current reads 10 A use the stylus to slide the slider to the right or tap the Right Arrow button (▶) to increase the current gradually.
5. Watch the metal boat and keep increasing the current until the boat glows cherry red (see below). Make a note of the current.

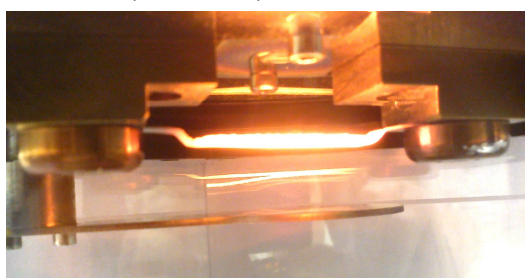


Figure 5-7. Aperture cleaning in progress

6. Slide the Z slider back to the right until the current reads zero again, and terminate the process.
7. Create a new profile based on the QT aperture cleaning profile and save with a new file name.
8. Change the current to a value approximately 5-10 A below the point where the boat was glowing cherry red. Change the time to 5 minutes and save the profile.
9. Remove the head.



**CAUTION: Take care when removing the head and aperture as it will be very hot!**

10. Replace the head into the coater carefully.
11. Load and run the profile that has just been created.
12. When the current has reached the value set in the profile use the slider or tap the Right Arrow button ▶ to slowly increase the current until the boat is glowing cherry red.
13. Heat the aperture in the boat for approximately 30 seconds.



**CAUTION: Do not take the current beyond the point where the boat is no longer cherry red (i.e. bright yellow/white) as this will damage the aperture.**

14. After 30 seconds either slide the slider to the left or tap the Z button to zero the current. The boat will stop glowing.
15. Reduce the current to 0 and terminate the process or wait until the process self terminates after 5 minutes.



**CAUTION: Take care when removing the head and aperture as it will be very hot!**

## 6 Instrument Management

The software controls the general operation of the instrument through a system of default settings. This section describes how you can:

- Change general instrument settings
- Define the Network address and set up a connection
- Create user and group accounts
- Monitor the Film Thickness Monitor (FTM)
- Adjust the instrument clock

### 6.1 The Q150T Menus

From the standby screen (see page 17), you can control the Q150T using commands from the menu bar. Use the Edit menu to modify profiles and change the instrument setup; use the Service menu to set the system clock, monitor FTM usage, and connect the Q150T to a network. The Help menu displays version information about the Q150T software.

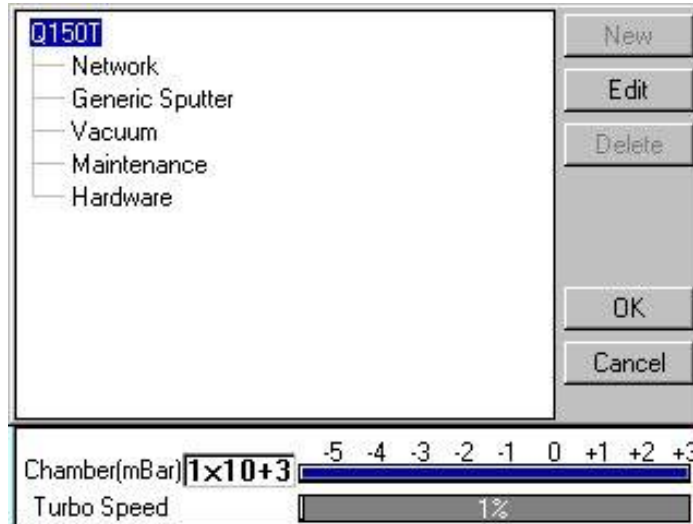
**Table 12 Q150T Menus**

Menu	Sub-menu	Command	Purpose
Edit		Profiles	Create, edit or delete profiles (see page 21)
Edit		Materials	Create, edit or delete coating parameters for specific metals or alloys (see page 25)
Edit		System	Change hardware settings in System Editor (see below)
Edit	User	Level	Change user group/login privilege level (see page 49)
Edit	User	Groups	Create, edit or delete user groups and passwords (see page 50)
Service		FTM	Monitor FTM usage (see page 51)
Service		Set Time	Set instrument clock (see page 51)
Service		System	Engineer use only
Service		Connect Network	Connect Q150T to local network (see page 44)
Help		About	Software version information
Help		Information	

## 6.2 Instrument Settings

The specific operation of the Q150T is determined by the settings of the active profile. Default sputter settings and general hardware settings are configured through *System Editor*.

To view the *System Editor*, select **Edit | System** from the menu bar (see **Figure 6-1**).



**Figure 6-1.** System Editor

*System Editor* arranges settings in five categories:

- Network
- Generic Sputter
- Vacuum
- Maintenance
- Hardware

### 6.2.1 Network

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 (see **Figure 6-2**).

Parameter	Value
Automatic IP (DHCP)	Yes
IP Address	192.168.5.250
IP Mask	255.255.255.0

Edit  
 OK  
 Cancel

Chamber(mBar)  $1 \times 10^3$

Turbo Speed 1%

**Figure 6-2. Network properties**

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.

#### 6.2.1.1 Connecting to a Network

To connect to a network:

Ensure that you have connected the instrument correctly to your network (see **Figure 6-3**).

Choose **Service | Connect Network** on the menu bar. A dialog box confirms that the connection is active and shows its IP address.



**Figure 6-3. Active ftp address**

## 6.2.2 Generic Sputter

This option allows you to change the default settings used during sputter coating sequences. The Q150T uses these settings in all profiles of type: *Timed Sputter* and *FTM Terminated Sputter* unless overridden in the profile (see page 83).

To change the settings, tap on **Generic Sputter** and then tap on the **Edit** button. The *Generic Sputter* properties are displayed (see **Figure 6-4** and **Table 13**).

Parameter	Value
Gas Bleed Time (Seconds)	10
Bleed Vacuum	1.0e-02
Clean Current (mA)	150
Clean Time (Seconds)	30

Chamber(mBar)  $1 \times 10^3$  -5 -4 -3 -2 -1 0 +1 +2 +3

Turbo Speed 1%

**Figure 6-4.** Generic sputter parameters

**Table 13** Generic Sputter parameters

Name	Default Value	Minimum Value	Maximum Value	Comment
Gas Bleed Time (Seconds)*	15	0	20	Time Ar allowed to flow into chamber before plasma started
Bleed Vacuum*	$1 \times 10^{-2}$	$5 \times 10^{-3}$	$5 \times 10^{-1}$	Pressure at which the chamber is maintained at while the plasma is present
Clean Current (mA)*	150	100	150	Current at which the target is cleaned at.
Clean Time (Seconds)*	30	0	60	Time for which the target is cleaned for
Clean Discharge time (Seconds)*	20	15	90	Only used during pulse cleaning of target. Time allowed for the target to discharge after the clean time
Max pulse clean cycles*	2	25	15	Only used during pulse cleaning of target. Specifies maximum number of repeated pulse cleaning cycles that can be carried out before the process is aborted

\* Admin group level required to edit this property

1. To edit a parameter, tap on its value.
2. Change the value as required. The instrument displays a dialog box for editing purposes, with either a numeric keypad or keyboard as required. The dialog box also shows the allowed values for the parameter.
3. When you edit a value, click on the **OK** button to confirm the change or on the **Cancel** button to restore the previous value.
4. Edit other parameters as required.
5. Back on the *Generic Sputter* page, click on the **OK** button to confirm the changes or on the **Cancel** button to restore the previous values.

### 6.2.3 Vacuum

This option allows you to change the default settings for pumping/venting cycles used in both sputter coating and evaporation sequences. The Q150T uses these settings in all profiles.

To change the settings, tap on **Vacuum** and then tap on the **Edit** button. The Vacuum properties are displayed (see **Figure 6-5** and **Table 14**).

Parameter	Value
Operational Vacuum (mBar)	5.0e-03
Vent Time (Seconds)	70
Flush Time (Seconds)	30
Flush Vac Threshold (mBar)	5.0e+01
Extra Pump time	60

Chamber(mBar)  $1 \times 10^3$  -5 -4 -3 -2 -1 0 +1 +2 +3

Turbo Speed 1%

**Figure 6-5.** Vacuum parameters

**Table 14** Vacuum parameters

Name	Default Value	Minimum Value	Maximum Value	Comment
Operational Vacuum (mBar)*	$1 \times 10^{-3}$	$5 \times 10^{-3}$	$1 \times 10^{-1}$	The vacuum the system achieves before proceeding to extra pump time.
Vent Time (Seconds)*	70	10	240	Time to vent the chamber after the turbo has reached 50%. When using the extended height cylinder extend the vent time to 120 seconds.
Flush Time (Seconds)*	70	10	240	
Flush Vac Threshold (mBar)*	8	0.1	100	Vacuum the system will pump down to before venting with nitrogen during a flush
Extra Pump time*	120	1	600	Time waited after the operational vacuum is achieved
Pump Hold Time (Hours)*	2	0.1	24	The time the system will wait for user input before venting if pump hold enabled
Max Pumpdown Time**	600	60	600	Maximum time the system will wait for the chamber to reach the <i>Safe outgas threshold</i> and 60% turbo speed.
Safe outgas threshold	1	$5 \times 10^{-2}$	2	Sets the vacuum that needs to be achieved during <i>Max Pumpdown Time</i> .

\* Admin group level required to edit this property

\*\* Engineer group level required to edit this property

1. To edit a parameter, tap on its value.
2. Change the value as required. The instrument displays a dialog box for editing purposes, with either a numeric keypad or keyboard as required. The dialog box also shows the allowed values for the parameter.

- When you edit a value, click on the **OK** button to confirm the change or on the **Cancel** button to restore the previous value.
- Edit other parameters as required.
- Back on the *Vacuum* page, click on the **OK** button to confirm the changes or on the **Cancel** button to restore the previous values.

#### 6.2.4 Maintenance

This option allows you to change the default settings for cleaning and service reminders.

To change the settings, tap on **Maintenance** and then tap on the **Edit** button. The *Maintenance* properties are displayed (see Figure 6-6 and Table 15).

Parameter	Value
Service reminders enabled	Yes
Service interval (Days)	365
Cleaning reminders enabled	Yes
Cleaning interval (Hours)	30.0

Chamber(mBar)  $1 \times 10 + 0$  -5 -4 -3 -2 -1 0 +1 +2 +3

Turbo Speed 0%

Figure 6-6. Maintenance settings

Table 15 Maintenance settings

Name	Default Value	Minimum Value	Maximum Value	Comment
Service reminders enabled*	Yes	No	Yes	Enable the display of service reminders
Service interval (Days)*	365	1	730	Set the number of days between services
Service reminder sleep time*	7	1	180	Set the number of days before a service reminder message is repeated
Cleaning reminders enabled*	Yes	No	Yes	Enable the display of cleaning reminders
Cleaning interval (Hours)*	30.0	0.1	60	Set the number of hours of sputtering before cleaning is required. One pulse evaporation is treated as 4 minutes of sputtering.
Cleaning reminder sleep time	15.0	1	120	Set the number of minutes before a cleaning reminder message is repeated

\* Admin group level required to edit this property

- To edit a parameter, tap on its value.
- Change the value as required. The instrument displays a dialog box for editing purposes, with either a numeric keypad or keyboard as required. The dialog box also shows the allowed values for the parameter.
- When you edit a value, click on the **OK** button to confirm the change or on the **Cancel** button to restore the previous value.

4. Edit other parameters as required.
5. Back on the *Maintenance* page, click on the **OK** button to confirm the changes or on the **Cancel** button to restore the previous values.

### 6.2.5 Hardware

This option allows you to change the settings defining the configuration of your instrument. The Q150T uses these settings in all profiles of type: *Timed Sputter* and *FTM Terminated Sputter*.

To change the settings, tap on **Hardware** and then tap on the **Edit** button. The *Hardware* properties are displayed (see **Figure 6-7** and **Table 16**).

Parameter	Value
Target A	Chromium
Vacuum Gauge Type	Pfeiffer TPR28x
Use Turbo Pumping	Yes
Stage Rotate	Yes

Buttons: Edit, OK, Cancel

Chamber(mBar):  $1 \times 10^{-3}$  (Slider from -5 to +3)

Turbo Speed: 1% (Slider)

**Figure 6-7.** Hardware settings (single target)

**Table 16** Hardware settings

Name	Default Value	Minimum Value	Maximum Value	Comment
Target A				Target material, if installed.
Target B				Target material, if installed.
Target C				Target material, if installed.
Vacuum Gauge Type				Read only: displays gauge type
Use Turbo Pumping*	Yes	No	Yes	If No the turbo pump will not be turned on during the pumping of the chamber
FTM Present	No	No	Yes	
Turbo Present	Yes	No	Yes	
Stage Rotate	Yes	No	Yes	Set the state of the stage unless overridden in the process profile
Stage Rotate Speed				Sets the speed of the stage unless overridden in the process profile
Available Targets*	1	1	3	Sets the number of auxiliary sputter inserts allowing the whole insert to be changed making the use of multiple materials easier

\* Admin group level required to edit this property

1. To edit a parameter, tap on its value.
2. Change the value as required. The instrument displays a dialog box for editing purposes, with either a numeric keypad or keyboard as required. The dialog box also shows the allowed values for the parameter.



3. When you edit a value, click on the **OK** button to confirm the change or on the **Cancel** button to restore the previous value.
4. Edit other parameters as required.
5. Back on the *Hardware* page, click on the **OK** button to confirm the changes or on the **Cancel** button to restore the previous values.

## 6.3 User Management

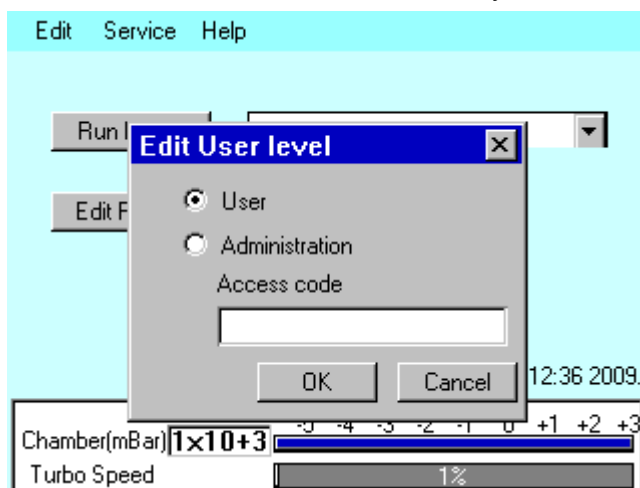
The Q150T software does not employ a user account system with individual login names and passwords. Instead, users are granted access privileges at a *group* level. The lowest security group: **User**, is not password protected. In this mode, a user can run the instrument for sputtering or evaporation and create or edit profiles. The second security group **Administration** is password protected with the password **admin**. In this level, it is possible to edit a number of hardware settings. It is also possible to create further user groups with customised privileges for instrument use.

### 6.3.1 Changing User Group

When first switched on, the Q150T starts in *User* group mode.

If you want to change to *Administration* level:

1. Select **Edit | User | Level** from the menu bar. The *Edit User Level* dialog box is displayed (see **Figure 6-8**).
2. Select the **Administration** option button.
3. Tap on the *Access Code* text box. Use the on-screen keyboard (see **Figure 4-3**) to enter the password: **admin**.
4. Tap on the **OK** button. Alternatively, tap on the **Cancel** button to close the on-screen keyboard without entering the password.
5. Back in the *Edit User Level* dialog box, tap on the **OK** button. Alternatively, tap on the **Cancel** button to return to the standby screen without changing the user level.



**Figure 6-8.** Changing the user level

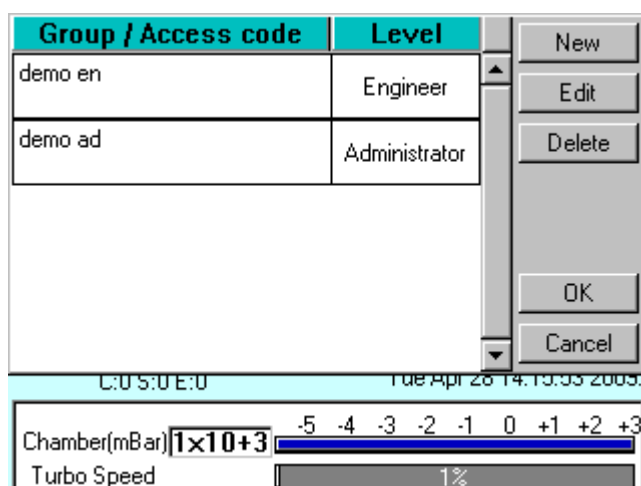
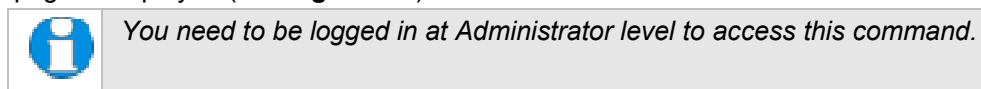
If you want to change back to *User* level:

1. Select **Edit | User | Level** from the menu bar. The *Edit User Level* dialog box is displayed (see **Figure 6-8**).
2. Select the **User** option button.
3. Tap on the **OK** button. Alternatively, tap on the **Cancel** button to return to the standby screen without changing the user level.

### 6.3.2 Managing User Groups

The Q150T software is set up with User and Administration access levels. There is also the facility for creating new user groups with customised access privileges or for editing or deleting existing groups.

To manage user groups, select **Edit | User | Groups** from the menu bar. The *Edit User Group* page is displayed (see **Figure 6-9**).



**Figure 6-9. Managing user groups**

#### 6.3.2.1 Creating a New Group

To create a new user group:

1. Tap on the **New** button. The *Edit User Group* dialog box is displayed.
2. Tap on the Group Name box. Enter a name using the displayed keyboard dialog box.
3. Select the required privilege level from the *Level* dropdown box.
4. Tap on the **OK** button to confirm the change or on the **Cancel** button to exit without creating the new group.

#### 6.3.2.2 Editing a Group

To edit an existing user group, tap on its name and then tap on the **Edit** button.

1. Tap on the **Edit** button. The *Edit User Group* dialog box is displayed.
2. To edit the name, tap on the Group Name box. Edit the name using the displayed keyboard dialog box.
3. To change the privilege level, tap on the *Level* dropdown box and select the required level.
4. Tap on the **OK** button to confirm the change or on the **Cancel** button to exit without creating the new group.

#### 6.3.2.3 Deleting a Group

To delete a user group:

1. Tap on its name to select it and then tap on the **Delete** button.
2. Tap on the **OK** button. Alternatively, tap on the **Cancel** button to return to the standby screen without changing the user level.

## 6.4 Film Thickness Monitor

To view the status of the Film Thickness Monitor (FTM), select **Service | FTM** from the menu bar. The FTM Status window is displayed (see **Figure 6-10**).

This shows the percentage of the crystal used and will help you decide when to replace it (see page 68).

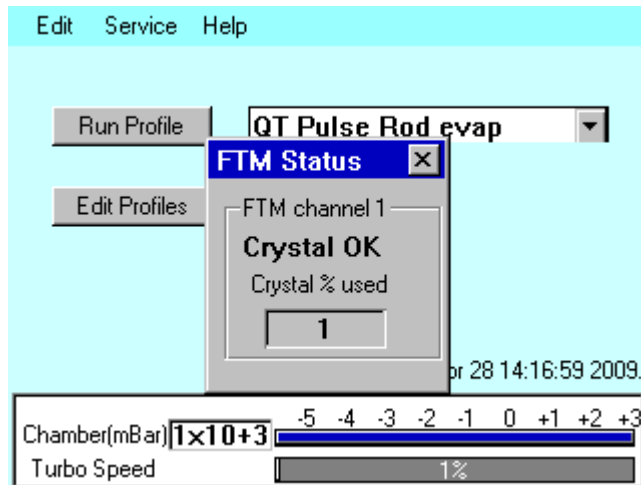


Figure 6-10. FTM Status

## 6.5 Setting the Date and Time

To adjust the Q150T's clock, select **Service | Set Time** from the menu bar. The Set Date Time dialog box is displayed (see **Figure 6-11**).

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.

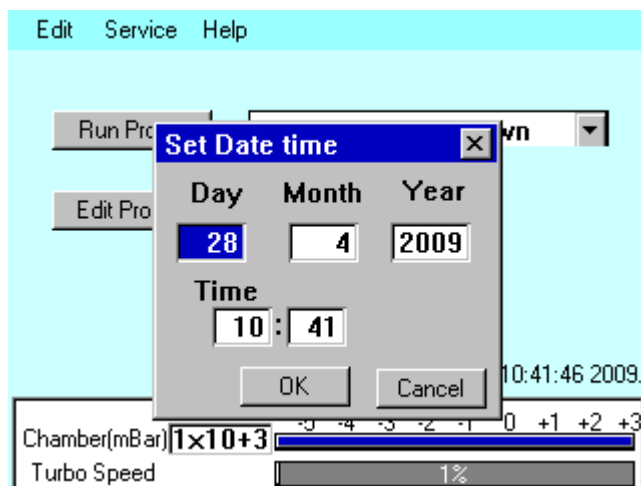


Figure 6-11. Setting the date and time

## 6.6 Setting up a Network connection

Connect the Q150T to your network as described on page 14.

You can view data files stored on the Q150 using Internet Explorer but to be able to have read/write access you will need to use third party FTP software or Windows Explorer. To use Windows Explorer, you will need to set up an exception for it on the firewall (see below).

### 6.6.1 Configuring a Firewall Exception for Windows Explorer

To set up Windows Explorer:

1. Right click on the network connection in the system tray.
2. Select *Change Windows Firewall settings* from the popup menu.
3. Select the **Exceptions** tab and click the **Add Programs** button.
4. From the list select *Windows Explorer*. If this is not in the list, click on the **Browse** button and navigate to the file *explorer.exe* (this can be found in the *Windows* folder).
5. Click on the **Change Scope** button.
6. In the dialog select the *My network (subnet) only* option.
7. Confirm your selections by clicking on the **OK** buttons in the open dialog boxes.

### 6.6.2 Connecting the Q150

To connect the Q150 to the network:

1. From the Q150's standby page (see Figure 3-1), select **Service | Connect Network** on the menu bar.
2. A dialog box confirms that the connection to the network is active and shows its IP address (see Figure 6-12).



**Figure 6-12. Connecting the Q150 to a network**

3. Note the complete address line, for example: **ftp://10.1.1.92**. Type it into the address bar of Windows Explorer on the networked PC. Click on the **Go** button or press the Return key.
4. The window status bar shows the message *connecting to xx.xx.xx.xx* followed by *getting contents of folder*. Windows Explorer displays a list of files stored on the Q150.

You can copy files to or from the instrument. Only files supplied by Quorum or previously copied or moved from the instrument should be transferred. A file cannot be opened directly from the instrument; copy it to the networked PC before attempting to open it.

### 6.6.3 Network Troubleshooting

If the connection fails, check that the first three numbers in the IP addresses of the instrument and the computer are the same. Check the firewall settings.

The Q150 will only support one connection. For example, it will not allow simultaneous connections to Internet Explorer and Windows Explorer.

## 6.7 Process Logging

To view the process log, listing the profiles run on the Q150T:

1. With the system at the Standby screen (see Figure 3-1), tap on **Service**.
2. From the displayed **Service** menu, tap on **Process Log**.
3. The process log is displayed (see Figure 6-13). Process events are listed in order with the most recent at the top of the list.
4. The log displays five events on each page. To browse through the list, use the buttons in the lower left corner to step through the list viewing other pages.

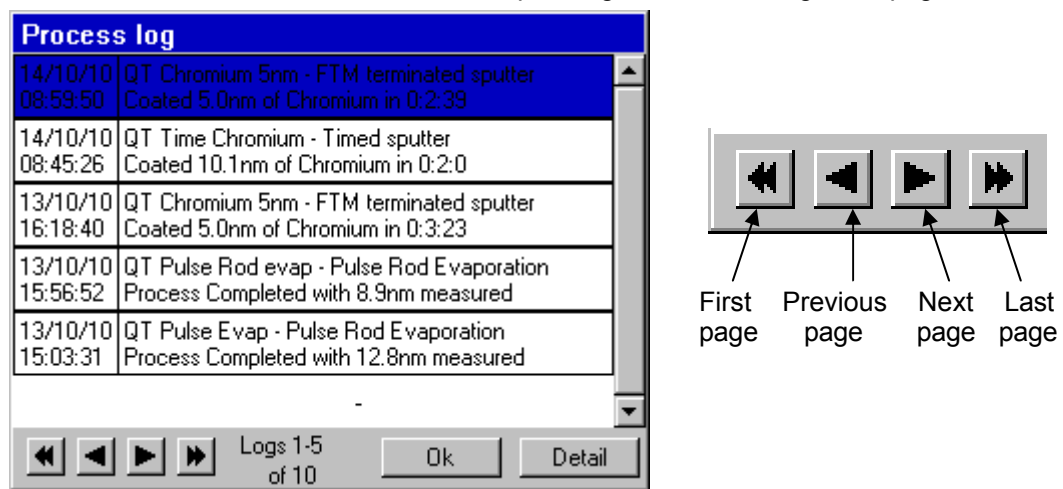


Figure 6-13. Process log and browse buttons

To view the details of a particular logged event:

1. Use the buttons to browse through the list.
2. Select the event.
3. Tap on the **Details** button.

Details for the logged event are displayed (see Figure 6-14). The actual data displayed will depend on the process type. If any problems were encountered during the process, the report will include error and warning messages.

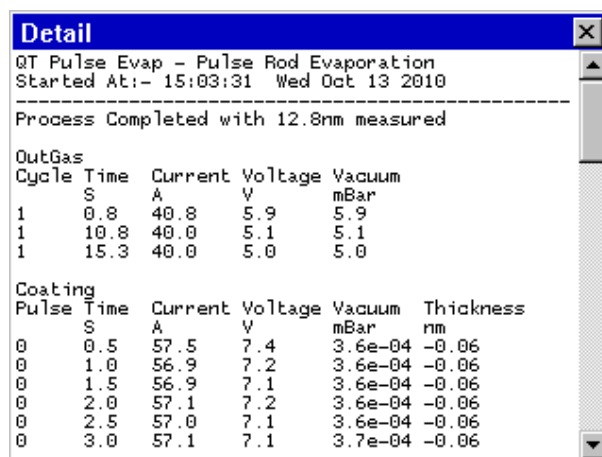


Figure 6-14. Process log detail

## 7 Accessories

The QT150T can be configured for various sputtering and evaporation applications. This section describes the installation of:

- Sputter insert pre-installed as standard on Q150T S and Q150T ES models. Includes instructions for changing the target. Additional sputter insert available (10453).
- Carbon rod insert for 3mm rods (10033) pre-installed as standard on Q150T E models. Carbon rod insert for 6mm rods (10456).
- Carbon fibre insert (10455)
- Metal evaporation insert (10457) including its configuration for both downwards and upwards evaporation, and the installation of a wire basket or molybdenum boat).
- Glow discharge insert (10262).
- Rotacota stage (10360)
- Slide stage (10358)
- Four wafer stage and gear box (10458)
- Specimen stage with adjustable tilt (10357)
- Film thickness monitor (10454)
- Extended height cylinder (10429)
- Full range vacuum gauge assembly (10428)
- Rotating vacuum spigot (10422)
- Emergency stop module (11223)

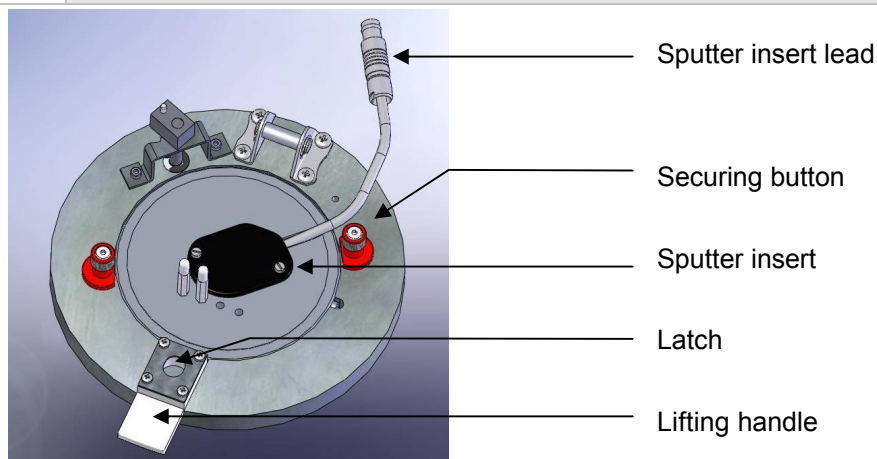
### 7.1 Sputter Insert

This section describes the installation of the standard sputter head supplied with Q150TS and Q150T ES instruments.



#### **WARNING – HIGH VOLTAGES AND HIGH VACUUM**

**This equipment produces high voltages and high vacuum in its operation.**



**Figure 7-1. Top view of the sputter insert**

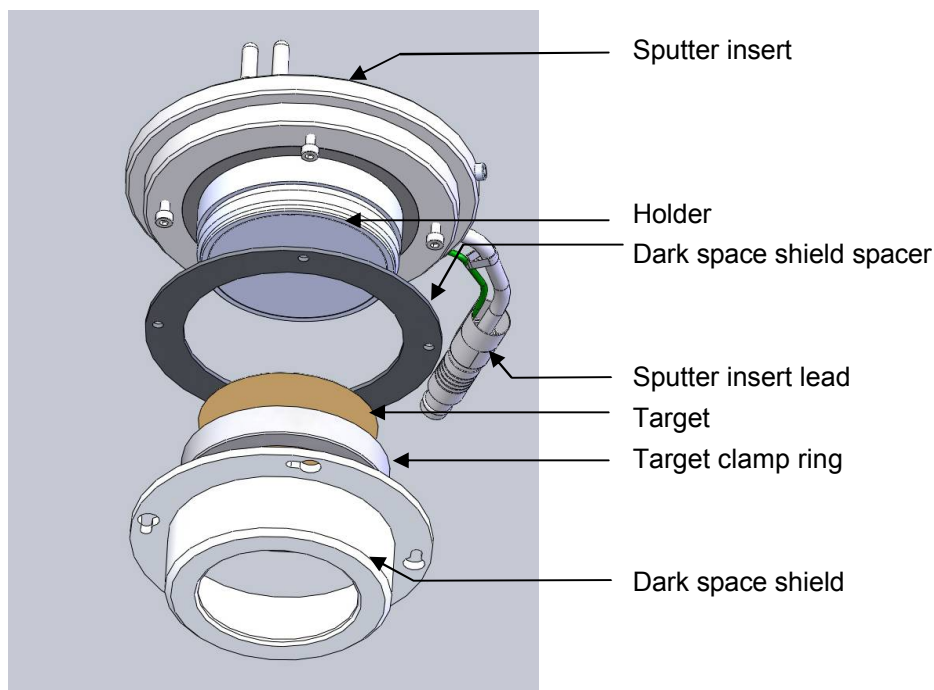
1. Check the machine is not operating.
2. Press down firmly on the top cover to release the latch.
3. Lift the top cover and rest it against its stop.

4. Turn the two securing buttons to release the installed insert and remove the insert (see **Figure 7-1**).



**Q150T ES users only:** If the insert is a carbon rod type you may have to remove the rods first (see page 56). To do this, check that the securing buttons are restraining the insert and open the lid assembly and rest it against the top cover assembly. Then, using a 2.5mm hex key, release the rod clamping screws and withdraw the rods. Close the lid assembly and release the insert by turning the securing buttons. Now remove the insert.

5. Prepare the sputter insert for installation by removing from any packaging, plastic bags etc. Check the 'O' ring in the outer ring of the lid assembly for damage or debris and clean or replace as required.
6. To fit a target (we recommend you wear latex gloves to do so):
  - a. Unscrew the target clamp ring (see **Figure 7-2**)
  - b. Place a new target centrally on the holder. Hold it in place with one finger through the clamp ring.
  - c. Screw the clamp ring firmly back in place. If the target thickness is greater than 0.3mm then one or more spacers (Part No. A4117193) should be fitted between the dark space shield and the sputter insert to maintain a 1.5mm gap between the inside face of the dark space shield and the target clamp ring.
7. Place the insert in position in the outer ring of the lid assembly carefully locating the M3 screw head in the rim of the insert in the slot to the right of the outer ring.
8. Lock the insert in position by turning the securing buttons until their flanges overlap the insert.
9. Plug the sputter insert lead into the socket on the hinge assembly.



**Figure 7-2. Sputter insert and target assembly**



## 7.2 Carbon Rod Insert

This section describes the installation of the carbon rod insert supplied with Q150T E and Q150T ES instruments. There are two inserts designed to accommodate 3mm carbon rods (10033) or 6mm rods (10456).

To install the carbon rod insert:

1. Check the machine is not operating.
2. Press down firmly on the top cover to release the latch.
3. Lift the top cover and lay back against its stop.
4. Turn the two securing buttons to release the installed insert and remove the insert.
5. Prepare the carbon rod insert for installation by removing from any packaging, plastic bags etc. Check the 'O' ring in the outer ring of the lid assembly for damage or debris and clean or replace as required.
6. Place the insert in position in the outer ring of the lid assembly carefully locating the M3 screw head in the rim of the insert in the slot to the right of the outer ring. Lock the insert in position by turning the securing buttons until their flanges overlap the insert.
7. Prepare two carbon rods (see page 57).
8. Install the carbon rods (see **Figure 7-3**):
  - a. Install the flat-ended carbon rod into the fixed terminal.
  - b. Install the sharpened carbon rod into the moveable terminal so that the shaped end touches the other rod.
  - c. Tension the sliding clamp assembly by sliding it to the right to the full extent of the dowels. Tighten the clamp screw to fix the carbon rod in position.
9. Close the lid assembly onto the glass chamber.
10. Check that the copper terminal contacts on the top of the insert and in the underside of the top cover are clean and free from damage and that the top faces are flat for good electrical contact.
11. Close the top cover assembly and press firmly down to secure the latch.

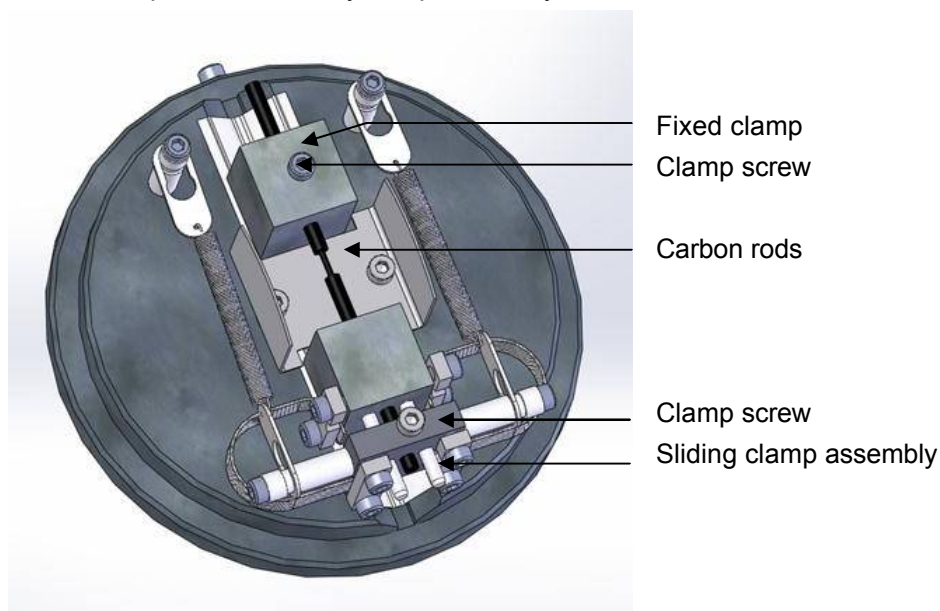


Figure 7-3. Carbon Rod Insert



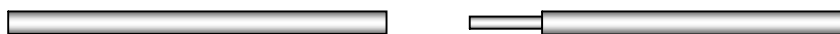
### 7.2.1 Shaping Carbon Rods for Pulsed Evaporation



#### WARNING

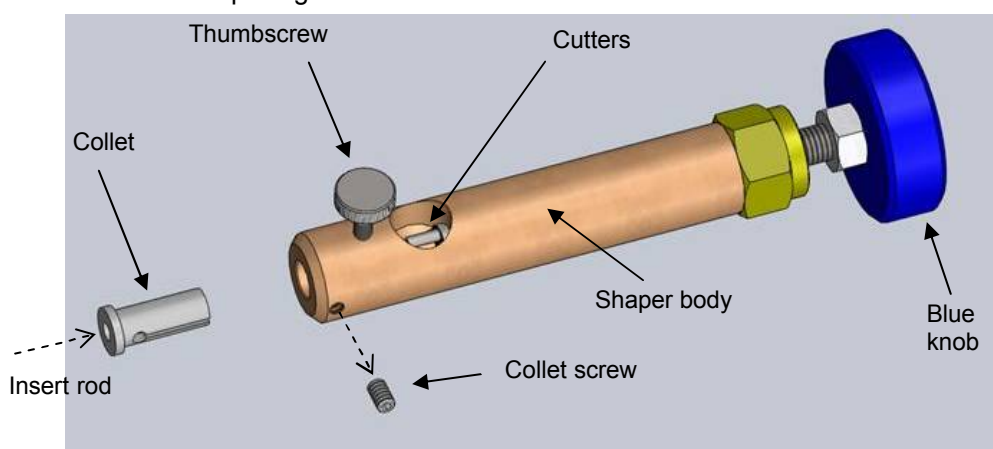
It is essential that you shape the tips of the carbon rods to the correct profile to minimise the possibility of damage to the instrument due to excessive currents.

For pulsed evaporation, one rod should be shaped to 1.2mm diameter x 5 mm long using the shaper with the blue handle. The other should be flattened as shown in **Figure 7-4**.



**Figure 7-4. Recommended Carbon Rod shapes**

The accessory pack contains a rod shaper (see **Figure 7-5**) that will accept 3mm and 6mm rods. To enable the shaper to accept 6mm rods, remove the collet by unscrewing the collet screw and pulling the collet out.



**Figure 7-5. Carbon Rod Shaper (S8650/S8651)**

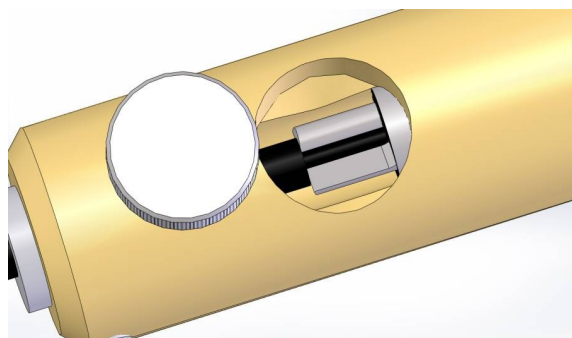
To shape a carbon rod:

12. Cut a 50mm length of rod.



*Use only Quorum rods due to the varying diameter and quality of other manufacturer's rods. Quorum supply rods in two sizes: 3mm (C5422) and 6mm (C5423).*

13. Hold the shaper stationary and insert the carbon rod until it touches the cutters. Pull the cutter shaft out to its full extent.
14. Gently tighten the thumb screw to hold the carbon rod in place.
15. Holding the shaper body and, with very little force, gently turn the black knob on the end of the shaper clockwise (when viewed face on).
16. Keep turning the knob until the tip of the rod touches the end of the cutter shaft (5mm) as shown opposite. Clear the carbon rod dust as necessary.
17. Undo the thumb screw and withdraw the rod carefully to avoid damaging the newly formed tip.



18. If the rod tip should break in the cutter, it can be removed by unscrewing the brass coupling, removing the cutter and pushing out the broken rod tip, while avoid damaging the teeth of the cutter.



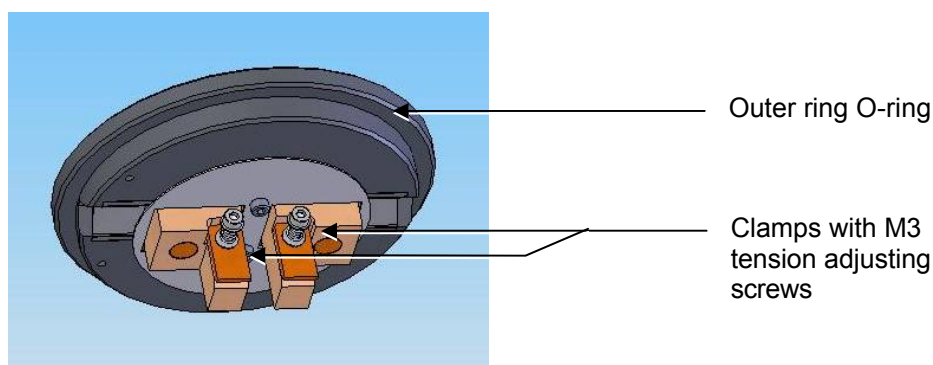
**WARNING**

**TAKE CARE WHEN HANDLING THE CUTTER: IT IS VERY SHARP.**

### 7.2.2 Shaping Carbon Rods for Ramped Evaporation

When shaping rods for ramped evaporation, it is necessary to produce a 1.4mm diameter x 5mm long tip to the rod using the shaper with the red handle. Remove the yellow protective cap by pulling the tab. To prevent accidents, replace the cap on the unused cutter.

### 7.3 Fitting the Carbon Fibre Insert



**Figure 7-6. Carbon string insert**

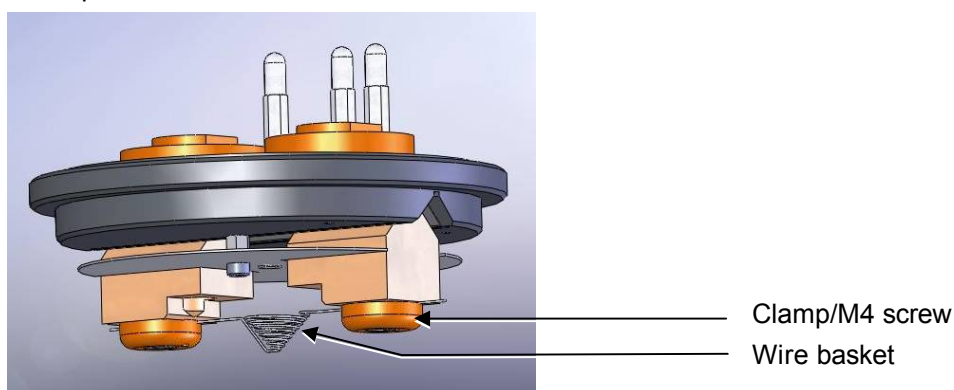
The carbon fibre insert (10455) is designed for carbon evaporation from carbon cords, carbon fibre woven cord and carbon fibre fine strands (see **Figure 7-6**).

1. Check the machine is not operating.
2. Press down firmly on the top cover to release the latch.
3. Lift the top cover and lay back against its stop.
4. Turn the two securing buttons to release the installed insert and remove the insert.
5. Prepare the carbon fibre insert for installation by removing from any packaging, plastic bags etc. Check the 'O' ring in the outer ring of the lid assembly for damage or debris and clean or replace as required.
6. Place the insert in position in the outer ring of the lid assembly carefully locating the M3 screw head in the rim of the insert in the slot to the right of the outer ring.
7. Lock the insert in position by turning the securing buttons until their flanges overlap the insert.
8. Fit the carbon cord (C5421) between the two clamps. Do not pull the cord tight or induce it to loop. For most applications, the spring-loaded clamps adequately secure the cord and provide the correct tension. However, for controlled pulse evaporation, you will achieve more repeatable results if you remove the springs and tighten the clamps using the screws.
9. If you are using fine strands of fibre (C5461 - not suitable for controlled pulse evaporation), fold in half and gently twist together before fitting between the clamps.
10. To prevent excessive fraying of the cord, cut it to length (35mm) after clamping.
11. Close the lid assembly on to the glass chamber assembly.
12. Check the copper terminal contacts on the top of the insert are clean and free from damage, (They must have a flat top face.) and that the contacts in the underside of the top cover assembly are also clean and flat.

## 7.4 Metal Evaporation Insert

This section describes the installation of the metal evaporation insert (10457) designed for downwards evaporation (see **Figure 7-7**). To install the stage:

1. Check the machine is not operating.
2. Press down firmly on the top cover to release the latch. (See note below.).
3. Lift the top cover and rest it against its stop.
4. Turn the two securing buttons to release the installed insert and remove the insert.
5. Prepare the metal evaporation insert for installation by removing from any packaging, plastic bags etc. Check the 'O' ring in the outer ring of the lid assembly for damage or debris and clean or replace as required.
6. Place the insert in position in the outer ring of the lid assembly. Carefully align the M3 screw head in the rim of the insert with the slot on the right of the outer ring. Lock the insert in position by turning the securing buttons until their flanges overlap the insert.



**Figure 7-7. Fitting the metal evaporation insert for downwards evaporation**

### 7.4.1 Installing a Wire Basket

To install a wire basket or molybdenum boat:

1. Open the lid assembly and lay back against its stop.
2. Slacken the two M4 socket screws in the terminal clamps.
3. Fit the wire basket so that it lies diagonally across the screws and between the clamps and the terminals (see **Figure 7-7**).
4. Tighten the two M4 screws.
5. Close the lid assembly on to the glass chamber assembly.
6. Check the copper terminal contacts on the top of the insert are clean and free from damage (they must have a flat top face) and that the contacts in the underside of the top cover assembly are also clean and flat.
7. Close the top cover assembly and press firmly down to secure the latch.

### 7.4.2 Installing a Molybdenum Boat for Aperture Cleaning

To install a molybdenum boat:

1. Open the lid assembly and lay back against its stop.
2. Slacken the two M4 socket screws in the terminal clamps.
3. Fit the molybdenum boat between the screws and between the clamps and the terminals.
4. Tighten the two M4 screws.
5. Close the lid assembly on to the glass chamber assembly.

6. Check the copper terminal contacts on the top of the insert are clean and free from damage (they must have a flat top face.) and that the contacts in the underside of the top cover assembly are also clean and flat.
7. Close the top cover assembly and press firmly down to secure the latch.

### **7.4.3 Adapting the Insert for Upwards Evaporation**

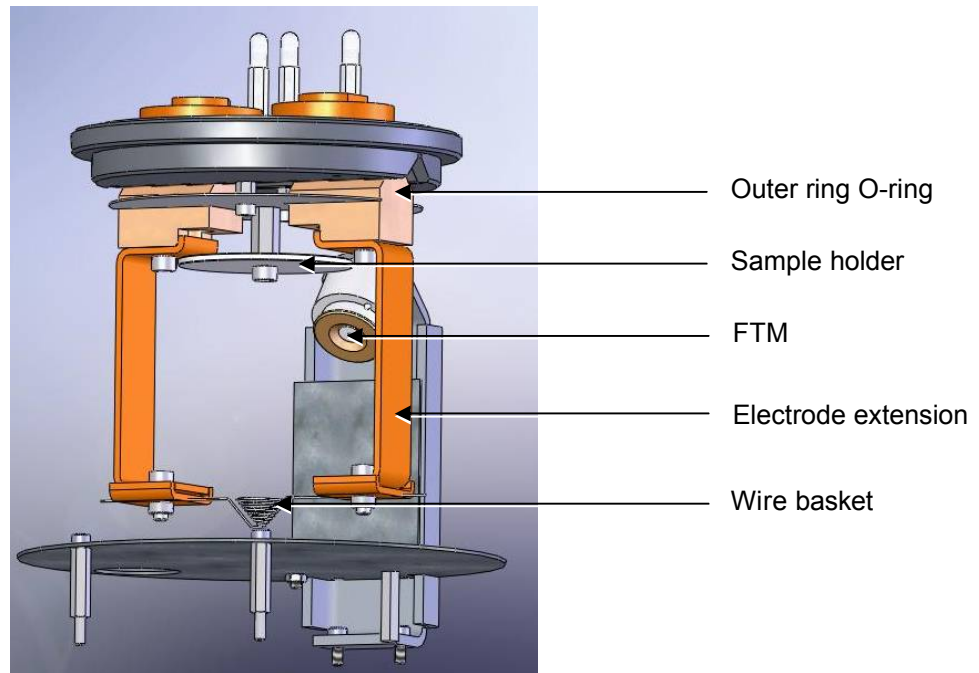
Install the evaporation insert as described previously. To adapt the insert for upwards evaporation:

1. Remove the two terminal clamps and replace with the electrode extensions (see **Figure 7-8**).
2. Fit the stage assembly to the hole in the centre of the insert shield.
3. Fit the wire basket or molybdenum boat to the electrode extensions as described above.
4. If an FTM is fitted, you will need to reposition it as described below.
5. Close the lid assembly on to the glass chamber assembly.
6. Check the copper terminal contacts on the top of the insert are clean and free from damage, (They must have a flat top face.) and that the contacts in the underside of the top cover assembly are also clean and flat.
7. Close the top cover assembly and press firmly down to secure the latch.

#### **7.4.3.1 Relocating the FTM**

If you want to use an FTM with the metal evaporation insert adapted for upwards evaporation you will need to reposition it as shown in **Figure 7-8**.

1. Remove the glass chamber assembly.
2. Unplug the FTM's lead from the BNC socket and remove the existing crystal holder from its bracket.
3. Remove the two screws near the inside diameter of the glass chamber holding the turbo shield in place and replace with two M3 x 20 hex spacers.
4. Remove the existing crystal holder bracket.
5. Fit the new crystal holder bracket using two M3x8 socket cap screws.
6. Attach the FTM lead to the BNC connector.
7. Attach the circular heat shield to the two hex spacers fitted previously with two M3x6 socket cap screws having first fed the FTM lead through the hole provided.
8. Pass the FTM lead through the hole in the crystal holder bracket and fix to the crystal holder.
9. Fit the crystal holder to the bracket with two M2.5 x 12 socket cap screws.
10. Refit the glass chamber assembly.



**Figure 7-8. Metal evaporation insert adapted for upwards evaporation**

## 7.5 Glow Discharge Insert

This section describes the installation of the glow discharge insert (Part No. 10837).



### WARNING – HIGH VOLTAGES AND HIGH VACUUM

This equipment produces high voltages and high vacuum in its operation.

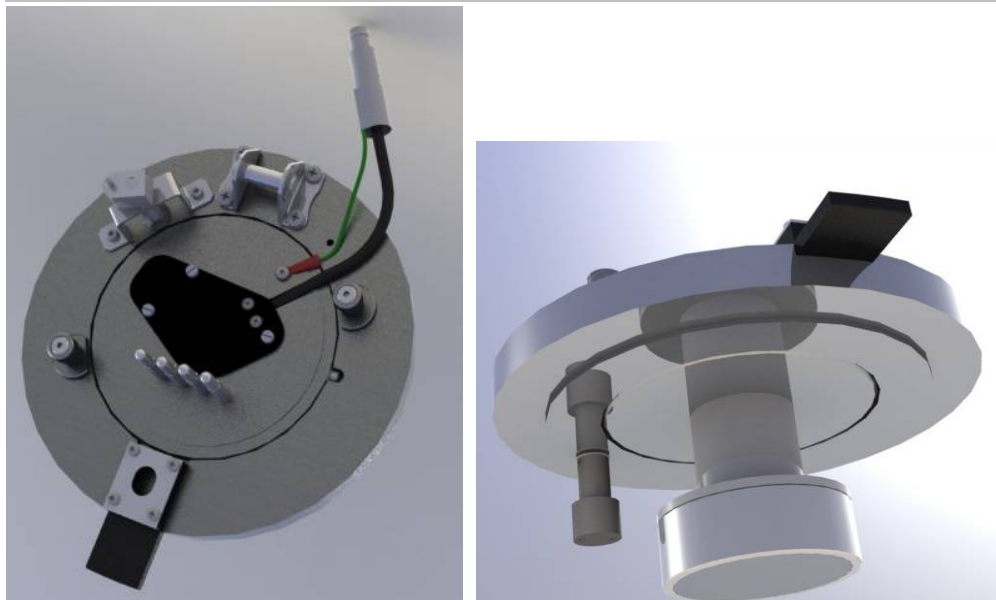


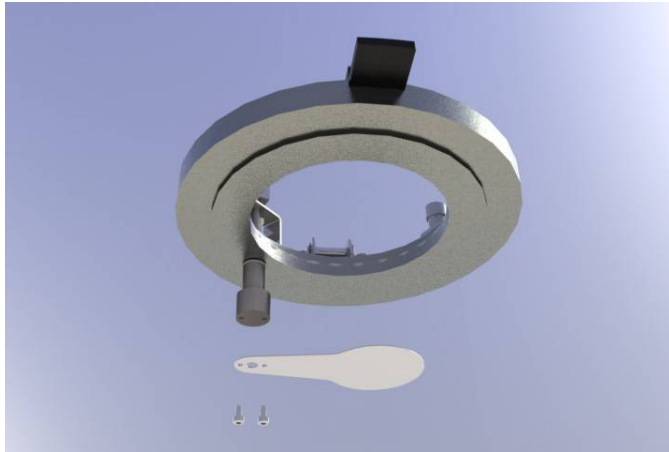
Figure 7-9. Glow discharge insert

1. Check the machine is not operating.
2. Press down firmly on the top cover to release the latch.
3. Lift the top cover and rest it against its stop.
4. Turn the two securing buttons to release and remove the installed insert (see **Figure 7-1**).



**Q150T ES users only:** If the insert is a carbon rod type you may have to remove the rods first (see page 56). To do this, check that the securing buttons are restraining the insert and open the lid assembly and rest it against the top cover assembly. Then, using a 2.5mm hex key, release the rod clamping screws and withdraw the rods. Close the lid assembly and release the insert by turning the securing buttons. Now remove the insert.

5. Prepare the glow discharge insert for installation by removing from any packaging, plastic bags etc. Check the 'O' ring in the outer ring of the lid assembly for damage or debris and clean or replace as required.
6. Remove the shutter by unscrewing the two retaining M3 screws (see **Figure 7-10**). Place the insert in position in the outer ring of the lid assembly carefully locating the M3 screw head in the rim of the insert in the slot to the right of the outer ring.
7. Lock the insert in position by turning the securing buttons until their flanges overlap the insert.
8. Plug the insert lead into the socket on the hinge assembly.



**Figure 7-10. Removing the shutter**

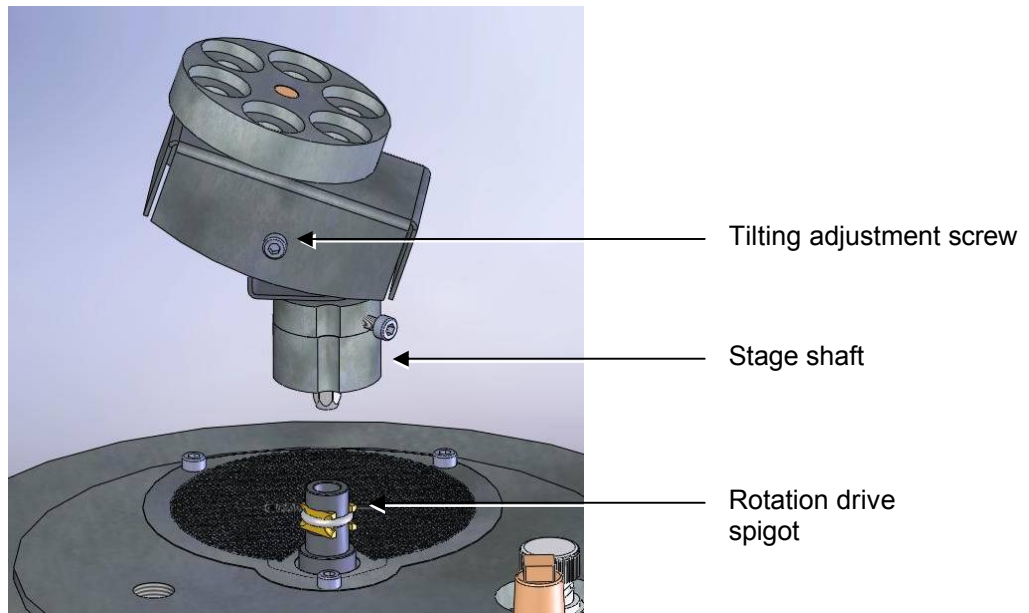


*To ensure the correct operation of the glow discharge accessory install the restrictor plate (see below).*

## 7.6 Rotacota Stage

The Rotacota stage (10360) is an offset rotating stage, with tilting sample holder, designed to improve the even distribution of sputtering or evaporation (see **Figure 7-11**).

1. Check the machine is not operating.
2. Open the top cover fully so it rests against its backstop.
3. Remove any installed sample stage by lifting carefully upwards.
4. Fit the RotaCota stage:
  - a. Locate its shaft in the top of the stage rotation drive spigot protruding from the baseplate.
  - b. With a twisting motion, push it gently down until the base collar rests on the baseplate. Locate one of the four cut-outs by the shield fixing screw.
5. Adjust the angle of the stage (up to 30° from horizontal):
  - a. Slacken the screws in the side of the shield.
  - b. Angle the stage as required.
  - c. Re tighten the screws before use.



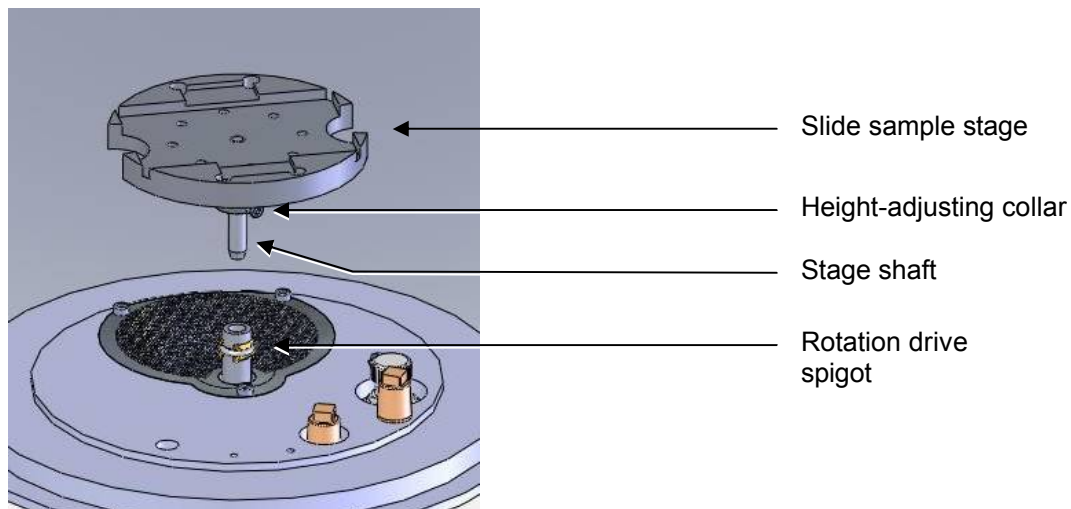
**Figure 7-11. Rotacota stage**



## 7.7 Slide Stage

To install the slide sample stage (10358):

1. Check the machine is not operating.
2. Open the top cover fully so it rests against its backstop.
3. Remove any installed stage by lifting carefully upwards.



**Figure 7-12. Slide stage**

4. If necessary, adjust the stage height above the base plate:
  - a. Slacken the M3 screw in the collar with a hexagonal key.
  - b. Slide the collar to the desired position and retighten the M3 screw.

The recommended position for the collar is to achieve a 31.5mm distance between the underside of the collar and the underside of the stage. If you require a greater distance between the stage and the target, the collar can be removed altogether with the underside of the stage therefore resting on the top of the drive spigot.

An alternative shaft is supplied with the stage (10214) to further increase the range of stage height adjustment available. To fit, hold the stage firmly and release the M5 nut. Unscrew the shaft, transfer the nut to the new shaft and fit to the stage so that the top is flush with the lower surface of the stage when the nut is tightened.

5. Fit the slide stage:
  - a. Locate its shaft in to the top of the stage rotation drive spigot protruding from the base plate.
  - b. With a twisting motion, push gently down until the collar around the shaft rests on top of the drive spigot (see **Figure 7-12**).

Remove the collar if you need more distance between the stage and the target: the underside of the stage then rests on the top of the drive spigot.

To maximise the area or achieve more uniform coating on the slide stage, install the stage gearbox assembly (10359) – see page 66.

## 7.8 102mm Stage and Gearbox

The 102mm stage (10458) is designed to hold 102mm (4") silicon wafers (see Figure 7-13). If you want to use a FTM with this stage, install the stage gearbox assembly (10359).

The sample stage gearbox allows you to install the sample stage in an offset rotating position. To install the 102mm stage and its gearbox:

1. Check the machine is not operating.
2. Open the top cover fully so it rests against its backstop.
3. Remove any installed stage by lifting carefully upwards.
4. Remove the M3 socket cap screw securing the turbo mesh (this is the screw nearest to the stage rotation drive spigot).
5. Fit the gearbox:
  - a. Locate its shaft into the top of the stage rotation drive spigot
  - b. With a twisting motion, push it gently down until it sits down on the turbo mesh.
  - c. Secure in place with the M3 x 16 socket cap screw provided.
6. Fit the large stage by locating its shaft in to the top of the stage rotation drive spigot protruding from the base plate and with a twisting motion pushing it gently down until the collar around the shaft rests on top of the drive spigot.
7. Adjust the stage height above the base plate:
  - a. Slacken the M3 screw in the collar with a hexagonal key
  - b. Slide the collar to the desired position and retighten the M3 screw.

Remove the collar if you need more distance between the stage and the target: the underside of the stage then rests on the top of the drive spigot.

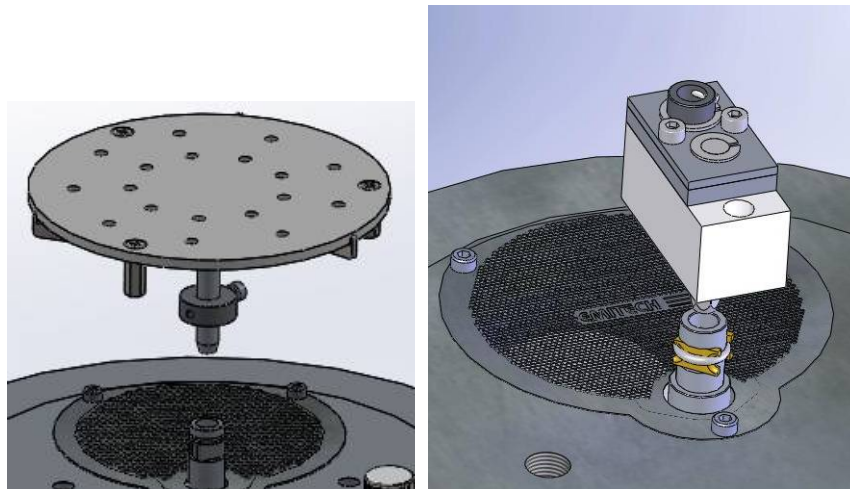


Figure 7-13. Large (102mm) Sample Stage and gearbox

## 7.9 Tilt Stage

The tilt stage (10357) allows you to vary the sample angle or height (see Figure 7-14). To fit the tilt stage:

1. Check the machine is not operating.
2. Open the top cover fully so that it rests against its back stop.
3. Remove any installed stage by lifting carefully upwards.
4. Fit the tilt stage by locating its shaft in to the top of the stage rotation drive spigot protruding from the baseplate and with a twisting motion. Push gently down until the collar around the shaft rests on top of the drive spigot.
5. Adjust the tilt angle:
  - a. Slacken the M3 screw below the stage with a hexagonal key
  - b. Tilt the stage to the desired angle and retighten the M3 screw.
6. Adjust the stage height above the base plate:
  - a. Slacken the M3 screw in the collar with a hexagonal key
  - b. Slide the collar to the desired position and retighten the M3 screw.

Remove the collar if you need more distance between the stage and the target: the underside of the stage then rests on the top of the drive spigot. The recommended position is so that the collar is a distance of 31.5mm below the stage.

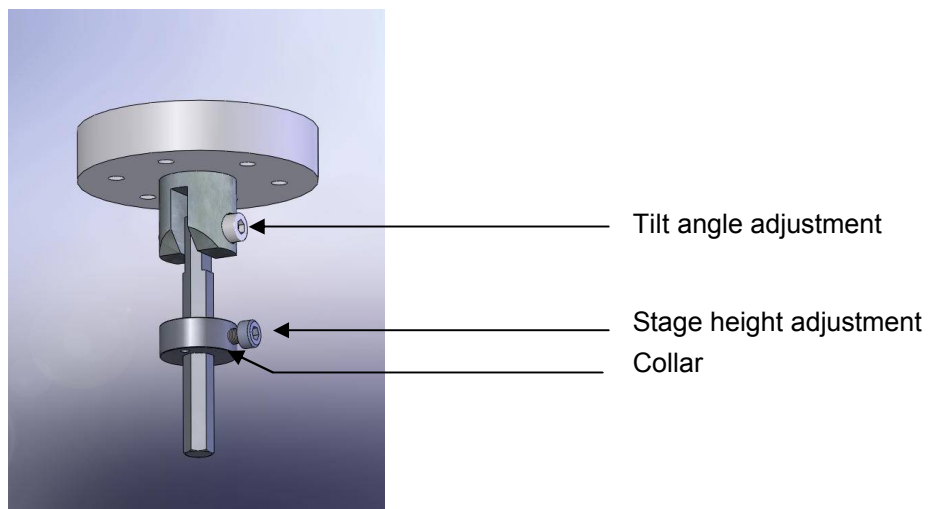


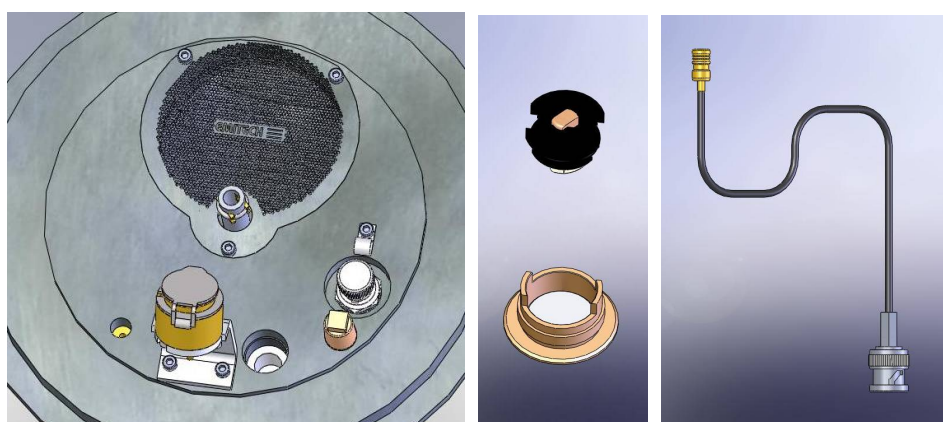
Figure 7-14. Adjustable tilting stage

## 7.10 Film Thickness Monitor (FTM)

If you have specified an FTM on the configuration of your Q150T it will be preinstalled. To install the film thickness monitor (10362):

1. Check the machine is not operating.
2. Open the top cover fully so it rests against its backstop.
3. Remove the glass chamber assembly.
4. Fit the FTM assembly to the baseplate with two M3 x 8 socket cap screws (see **Figure 7-15**).
5. Plug the FTM lead in to the BNC connector on the baseplate after removing the dust cap.
6. Refit the glass chamber assembly.
7. Close the top cover assembly and press down firmly to secure the latch.

The crystal cover (see **Figure 7-15**) may be removed completely for cleaning or if the FTM is in continual use.



**Figure 7-15.** FTM (left); replacing the FTM crystal (centre); FTM lead (right)

### 7.10.1 Replacing the FTM crystal

1. Check the machine is not operating.
2. Press down firmly on the top cover to release the latch.
3. Lift the top cover and rest it against its stop.
4. Remove the glass chamber assembly.
5. Unscrew the top cap of the crystal holder and withdraw (see **Figure 7-15**).
6. Turn the cap upside down and remove the spring insulator assembly.
7. Tip the old crystal (if fitted) out of the cap and fit the new crystal with the cap inverted.
8. Refit the spring insulator assembly to the cap.
9. Screw the cap assembly back on to the crystal holder body.
10. Refit the glass chamber assembly.
11. Close the top cover assembly and press down firmly to secure the latch.

## 7.11 Extended Height Cylinder

1. Check the machine is not operating.
2. Press down firmly on the top cover to release the latch.
3. Lift the top cover and rest it against its stop.
4. Remove the standard glass cylinder assembly (10068).
5. Remove the M6 Cap head screw from the front of the pillar, slide the whole top cover and inner pillar assembly upwards until you see the fourth hole line up and replace the M6 cap head screw.
6. Place the extended glass cylinder assembly 10429 in place and close the top cover.



*The vent times will need to be extended to approx 200 seconds in profiles using the extended height cylinder.*



Figure 7-16. The extended height cylinder in position

## 7.12 Full Range Vacuum Gauge Assembly



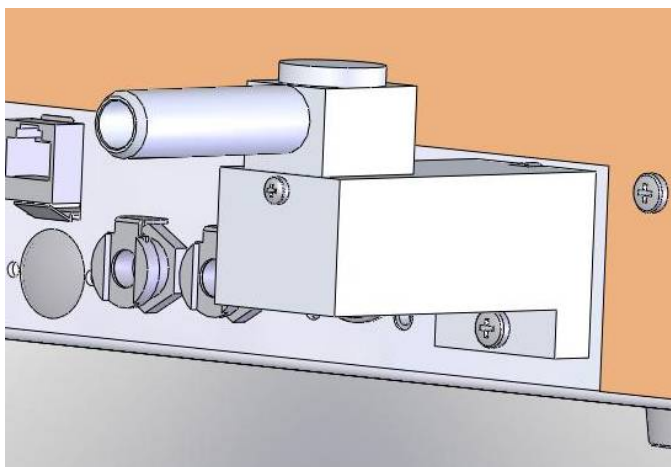
*The instrument must be returned to the factory for fitting this option as the covers need to be removed.*

As standard, the Q150T is fitted with a Pirani gauge with a measurement range of 1000 –  $5 \times 10^{-4}$  mbar. The typical ultimate vacuum of the pumping system in a clean instrument after pre-pumping with dry nitrogen gas is  $5 \times 10^{-5}$  mbar. When the vacuum is better than  $5 \times 10^{-4}$  mbar the instrument simply displays “HiVac”. For users who need an accurate value for the vacuum achieved before and during the coating process (for example, when evaporating carbon it is desirable to achieve as good a vacuum as possible), the Full Range Vacuum Gauge Assembly option (10428) extends the accurate measurement range to 1000 –  $5 \times 10^{-9}$  mbar.

Contact Quorum for further information.

### 7.13 Rotating Vacuum Spigot

The vacuum spigot (10422) allows more convenient connection of a vacuum hose to the rear of the Q150T when the instrument is located close to a wall, bench upstand or other obstruction (see Figure 7-17).



**Figure 7-17. Rotating vacuum spigot**

To install the spigot:

1. Shutdown the instrument.
2. Remove the lower screw below the protruding vacuum spigot.
3. Apply a little vacuum grease to the spigot protruding from the rear of the instrument.
4. Take the Rotating Vacuum Spigot assembly and check there is an 'O' ring in the bore.
5. Push the Rotating Vacuum Spigot assembly over the protruding spigot until it is completely home against the chassis (a slight twisting motion helps).
6. Screw the assembly home using an M4 x 20 pan headed screw underneath the assembly.
7. Rotate the spigot to a suitable orientation and attach the hose from the backing pump.



## 7.14 Emergency Stop Module

The emergency stop module (Part No. 11223) sits on top of the right hand side of the instrument. In the assembly there is the main stop box, the power plug and cable and the safety bracket to stop removal of the power plug.



Figure 7-18. The emergency stop module



Figure 7-19. Connecting the emergency stop module

1. Before starting work on the instrument ensure it is not operating, turn off the main power switch on the rear of the instrument and unplug the power lead.
2. Remove the two screws on the top left or the rear panel.
3. Position the main stop box as shown in Figure 7-18, making sure the plug and cable do not scratch the instrument case.
4. Secure the main stop box to the rear panel using the two M4 x 10 recessed pan headed screws provided.
5. Connect the power plug from the stop box in to the main power switch (see Figure 7-19).
6. Remove the screws in the two holes to the immediate right of the main power switch and fit the safety cable bracket using the M4 x 6 recessed pan headed screws provided.
7. Plug the main power lead into the socket in the stop box.
8. Check the red knobbed emergency stop switch is in the working position by removing the key and striking the red knob then turning the key to the right to release.

The instrument should now power up in the normal way when the main switch is operated.

## 7.15 Spares

The following are available from Quorum, or your local distributor, and are featured in more detail on the Quorum website: [www.quorumtech.com](http://www.quorumtech.com).

**Table 17 Spare Parts for the Q150T**

SPARES FOR Q150T	CATALOGUE NUMBER	QUANTITY
Carbon rods 3.05mm	C5422	Pack of 10
Carbon rods 6mm		Pack of 10
Carbon Fibre	C5461	1 Metre
Carbon Cord	C5421	1 Metre
Molybdenum Boats	B5228	1 x packet 10
Glass Cylinder 6"	G6260	Each
'L' Gaskets to suit		Pair
Oil Mist Filter	O7803	Each
10A ceramic fuse	16030015	Each
Supergrade 'A' Rotary Pump Oil	O7802	1 Litre

**Table 18 Replacement targets for Q150T S and Q150T ES**

REPLACEMENT TARGETS	CATALOGUE NUMBER
54mm x 0.2mm Chromium Target	TK8845
57mm x 0.5mm Tungsten Target*	TK8846
57mm Dia x 0.1mm Gold Target	SC502-314A
57mm Dia x 0.1mm Au/Pd Target	SC502-314B
57mm Dia x 0.1mm Platinum Target	SC502-314C
54mm x 1.5mm Chromium Target*	TK8862
57mm x 0.2mm Tungsten Target	TK8867
54mm x 1.5mm Carbon Target*	TK8869
57mm Dia x 0.1mm Copper Target	SC502-314H
57mm Dia x 0.1mm Silver Target	SC502-314E
57mm Dia x 0.1mm Nickel Target	SC502-314D
57mm Dia x 1.0mm Aluminium Target	TK8875
57mm Dia x 0.1mm Palladium Target	SC502-314G
57mm Dia x 0.1mm Pt/Pd (80/20%) Target	TK8878
57mm Dia x 1.5mm Titanium Target	TK8879
57mm Dia x 0.3mm Pt/Pd (80/20%) Target	TK8887
57mm Dia x 0.3mm Gold Target	TK8889
57mm Dia x 0.3mm Au/Pd (60/40%) Target	TK8891
57mm Dia x 0.3mm Platinum Target	TK8893
57mm Dia x 0.5mm Titanium Target*	TK8895
57mm Dia x 0.1mm Iron Target	TK8897
57mm Dia x 0.2mm Iridium Target	TK8899
57mm Dia x 0.1mm Cobalt Target	TK8900



REPLACEMENT TARGETS	CATALOGUE NUMBER
57mm Dia x 0.1mm Tin Target	TK8902
57mm Dia x 0.1mm Molybdenum Target	TK8903
57mm Dia x 0.3mm Magnesium Target	TK8905
57mm Dia x 0.1mm Tantalum Target	TK8906
57mm Dia x 0.3mm ITO Target	TK8907

\* Requires spacer A4117193 under shield (see page 54 and Figure 7-2).



*Quorum can supply a wider range of target materials and thickness'. Please enquire for details.*

## 7.16 Other Accessories

The following are available from Quorum or your local distributor.

**Table 19 Accessories for the Q150T**

USEFUL ACCESSORIES FOR Q150T	CATALOGUE NUMBER	QUANTITY
Wenol Polish	C5424	100ml. Tube
Amberclens Foam Cleaner	C5427	Each
Mini Tork Rolls	C5435	Each
Carbon Rod Shaper For 3mm Rods	S8651	Each
Carbon Rod Shaper For 6mm Rods	S8650	Each

## 8 Service and Maintenance

For technical and applications advice plus our on-line shop for spares and consumable parts visit [www.quorumtech.com](http://www.quorumtech.com)



### CAUTION

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

### 8.1 Maintenance

Table 20 Maintenance Tasks

PROCEDURE	FREQUENCY
Inspect electrical power cords and plugs for general condition.	Regularly
<b>FTM users:</b> Check the status of the FTM (see page 42) and replace when necessary (see page 68).	Regularly
Check and clean the glass chamber and the 'L' gaskets as required, using a lint-free tissue and foam cleanser, or similar. <b>Do not use vacuum grease on 'L' gaskets.</b>	Monthly
<b>QT150T S and QT150T ES only:</b> 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.	Monthly
Check vacuum pump oil level	Monthly
Change oil using 1 litre of supergrade 'A'.	6 Monthly
Check oil mist filter for saturation. This is a disposable plastic filter and cannot be reactivated.	6 Monthly or more regularly as required.



*Obtain consumable items from Quorum or an approved distributor only. Use only Quorum recommended items. For technical assistance and advice - contact Quorum.*

## 8.2 Troubleshooting

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



### CAUTION

**Disconnect the power cord BEFORE carrying out any servicing activities.**

- Check power to Instrument.
- Check fuse.
- Check vacuum pump local switch should be in 'on' position.
- Check chamber seating for vacuum leaks.
- Check operating conditions of Instrument controls.
- Check target and connections.
- Check correct conditions for sputtering have been set.
- Check all connections.

## 8.3 Error Messages

Table 21 Error Messages

Error messages	Description of fault
<i>Invalid group name</i>	The name entered is either too long or the same as an existing group
<i>Maximum groups Reached</i>	Up to 20 groups allowed
<i>Selected material not found in material list cannot continue with coating?</i>	The specified material in the profile has been removed from the material list
<i>Name already exists</i>	The name entered is the same as an existing profile/Material
<i>Name is too long</i>	The name entered is longer than 19 characters
<i>Cannot run process</i>	An unrecoverable undefined error has occurred in starting a process.
<i>This instrument does not support this process</i>	The process run is not able to be run on this instrument
<i>Evaporation PSU not found</i>	A Evaporation process has been run but the PSU is not present or not communicating
<i>Sputter PSU not found</i>	A sputtering process has been run but the PSU is not present or not communicating
<i>FTM crystal not oscillating. Please check or replace</i>	FTM crystal failed and needs to be replaced
<i>FTM Tooling Factor less than 0.1</i>	The Product of the material tooling factor and the profile tooling factor to less than 0.1
<i>FTM Tooling Factor greater than 20</i>	The Product of the material tooling factor and the profile tooling factor to greater than 20
<i>Vacuum interlock not operated. Can not proceed</i>	The operational vacuum as indicated by the gauge has been achieved but vacuum interlock switch has not operated.
<i>Current less than expected. Check cord Process terminated</i>	The measured current is less than 20% of the requested value. Check that the cord is fitted correctly.
<i>Cord voltage less expected. Check insert for shorts</i>	The voltage is less than 20% of the expected voltage. (expected voltage= measured current/0.16). Check that the correct type of cord is being used and there are no

Error messages	Description of fault
	shorts between the source terminals and the insert base.
<i>Process stopped due to FTM crystal failure</i>	The FTM has stopped oscillating during the coating.
<i>Interlock has been activated process stopped</i>	This is most likely caused by the top cover being opened during a cycle
<i>Unable to strike plasma</i>	The required sputter voltage has been applied for 10 second and the plasma has not struck. Check target is connected and that the Argon to turned on
<i>Short on Sputter output. Please check target</i>	The target shield needs cleaning. As required output current is seen but the target voltage is less than 80V.
<i>System failed to achieve operational Vacuum</i>	The system has been pumping for the Max pump down time and has not achieved the operation vacuum
<i>Carbon Rod insert not found</i>	A profile has been run that using the Carbon Rod insert and it is not fitted in the chamber lid.
<i>Carbon String insert not found</i>	A profile has been run that using the Carbon String insert and it is not fitted in the chamber lid.
<i>Evaporation insert not found</i>	A profile has been run that using the Evaporation insert and it is not fitted in the chamber lid.
<i>Please contact your supplier a problem has been found with the safety interlock. Continue with coating?</i>	For safety the interlock operates in two ways and it has been detected that one has failed. Turn the system off and back on after 10 seconds to clear. If message is repeated, please contact your supplier.
<i>System PSU overtemperature Pleaes turn off system and alow to cool down</i>	The power supply is over heating: coating will be disabled until the system has cooled sufficiently.
<i>Current less than expected. Process terminated</i>	Seen in evaporation processes when the current through the source is lower than expected or zero. Indicates that the source is open circuit/broken.
<i>Rod voltage less than 4V. Process terminated</i>	Seen in rod evaporation processes when the voltage between the evaporation source terminals is less than 4V. Indicates that the rods have been incorrectly set up or there is a conduction path between the terminals of the insert. Check rods and clean the insert.

**Table 22 Warning Messages**

<b>Warning messages</b>	<b>Description</b>
<i>Please close top cover. Press OK when done</i>	The top cover above the chamber has not been closed on to the chamber lid
<i>Please fit sputter head and close the Top cover. Press Ok when done</i>	The sputter head needs to be fitted
<i>Maximum output power exceeded. Please check cord type.</i>	The output power has exceeded 700W on the last pulse.
<i>Possible cord fuse detected on pulse</i>	It has been detected that the next pulse is likely to fuse the cord. Also, fusing the cord is likely take the deposition excessively above the required thickness.

**Table 23 Information Messages**

<b>Information messages</b>	<b>Description</b>
<i>Change in this Profile Only</i>	This can occur when editing a system level property with in a process profile. Yes: will set the value in this profile. No: will change the value of the system parameter thus changing all process.
<i>Use Materials Defaults</i>	This occurs when the material is changed in a profile. Yes: will copy the relevant properties i.e. oxidizing from the material list to the profile No: will just change the material. This may prevent the clean property being set unless at admin user level.

## 9 Appendices

### 9.1 Profile Parameters

Operation of the Q150T is controlled by a process profile. There are several types of profile as listed in Table 24. Each profile contains a number of adjustable parameters. The following tables list the parameters available in each type of profile, showing their default values and allowed ranges.

**Table 24 FTM/Timed Sputter Coating parameters**

Name	Default Value	Minimum Value	Maximum Value	Comment
Material	Gold			Target Material required for this process
Sputter Current (mA)	20	1	50	Coating current Updated from material list
Sputter Time (seconds)	120	1	3600	<i>Timed Sputter only</i> Stops sputtering at set time.
Terminate Thickness (nm)		1	2000	<i>FTM Terminated Sputter only</i> Stops sputtering when the FTM reads this thickness
Maximum Sputter Time (minutes)	4.0	0	60.0	<i>FTM Terminated Sputter only</i> Sets upper limit to sputtering if FTM thickness has not been achieved
Tooling Factor	2.3	0.1	10	Tooling factor for this process This is multiplied by that in the material list.
Clean target*	No	No	Yes	Clean target before coating
Flush chamber*	No	No	Yes	Flush chamber with nitrogen before pumping down.

\* Admin group level required to edit this property

**Table 25 Carbon Pulse/Rod Evaporation profile parameters**

Name	Default Value	Minimum Value	Maximum Value	Comment
Material	Carbon			Fixed; read only parameter
Pulse current (A)	60 (cord) 75 (rod)	0	120	Current applied to cord during the evaporation pulse
Max Pulse Voltage (V)*	20 (cord) 10 (rod)	0	20	The voltage across the cord is limited to this value during the evaporation pulse
Pulses Length (s)	1	0.02	10	Time is second that the pulse is applied for
Number of pulses	1	1	5	Number of consecutive pulse cycles
Pulse interval (s)	10	1	30	The time between the start of consecutive pulse cycles. Must exceed pulse length.
Outgas time (s)	10	2	60	Time cord or rod is outgassed before pulse cycle(s).
Outgas current (A)	30 (cord) 20 (rod)	0	40	Current applied at the start of outgas step.
Max Outgas current (A)	40	0	50	Maximum current permitted during outgas.
Max Outgas voltage (V)	10	0	20	Maximum voltage permitted during outgas
Outgas source*	Yes	No	Yes	Include or exclude outgassing step
Tooling factor	5	0.1	10	Tooling factor for this process
Pump hold*	No	No	Yes	If Yes, Q150T pumps down to outgas-ready state and waits for user input.  <b>Note:</b> If hold time (set in <b>System   Vacuum   Pump hold time</b> – see page 46 is exceeded, Q150T vents chamber.
Flush chamber*	No	No	Yes	Set to Yes to flush chamber with nitrogen before pumping down.

\* Admin group level required to edit this property

**Table 26 Controlled Pulse cord**

Name	Default Value	Minimum Value	Maximum Value	Comment
Terminate thickness	5	0.5	30	Terminate the coating when the FTM measured thickness reaches this value
Pulse Resolution	0.4	0.2	2	Requested deposition on FTM for each pulse. Note this should be multiplied by the tooling factor to find the expected stage thickness for each pulse.
Current Step Rate	0.4	4	2	Set the amount the pulse current is changed by if the deposited thickness on the last pulse is not within 0.2nm of the pulse Resolution
Pulse Current	54	0	70	Sets the starting pulse current
Max Pulse Voltage	11	9	16	Maximum voltage during the pulse
Pulse Length (Second)	1	0.02	10	Set the Pulse length in seconds
Maximum Pulses	25	1	50	Set the maximum number of pulses to apply if the terminate thickness is not being achieved
Pulse Interval	10	5	30	Set the length of time between the pulses in seconds. Note reducing this time will reduce the time the FTM has to settle and reduce accuracy
Out Gas Time	30	2	60	Time the cord is outgassed
Out Gas current	30	0	50	The current applied to the cord during the outgas time
Max outgas recovery time*	60	0	300	The maximum time the system will wait for the vacuum to return to the vacuum level it was at prior to outgassing
Flush chamber*	No			Set to yes to flush the chamber with the vent (N <sub>2</sub> ) gas before pumping down for the process
Pump hold	Yes			If yes, Q150T pumps down to an outgas – ready state and waits for user input.  Note: If the system waits longer than the Pump hold time the chamber will be vented. Pump hold time can be found in System   Vacuum
Tooling factor	2.25	0.1	10	The deposition on the FTM crystal is multiplied by this value before it is displayed. Thus allowing it to be used to compensated the FTM for a different rate of deposition between the FTM and the stage

\*Admin group level required to edit this property



**Table 27 Ramped profile parameters**

Name	Default Value	Minimum Value	Maximum Value	Comment
Evaporation Current	46	5	60	Maximum evaporation current.
Evaporation time (min)	1.5	0.1	4	The time the current is applied. Starts when the evaporation Current exceeds Pre Evap end current.
Out Gas Time (s)	10	2	120	Time cord or rod is outgassed.
Outgas Current	20	2	50	Time cord or rod is outgassed before pulse cycle(s).
Pre Evap Rate* (A/S)	1	0.5	20	Rate at which the current is increase after the outgas time.
PreEvap End current (A)	32	0	60	The output current at which the above ramp rate is stopped. The evaporation time is started at this point.
Current Ramp Rate (A/S)	0.20	0.01	20	Rate at which the current is increase until the value of Evaporation current property is reached.
Tooling Factor	1.0	0.1	10	Tooling factor for this process.
Pump hold*	No	No	Yes	If Yes the process will pump down to an outgas ready state and wait for user input. After the System>Vacuum>Pump hold time has expired the system will vent the chamber.
Flush chamber*	No	No	Yes	Set to Yes to flush chamber with nitrogen before pumping down.

\* Admin group level required to edit this property

**Table 28 Metal Evaporation profile parameters**

<b>Name</b>	<b>Default Value</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Comment</b>
Material	Carbon			Material to be evaporated in this process
Evaporation Current (A)	0	0	50	Current applied during the evaporation pulse
Evaporation time (Minutes)	1	0.1	4	Duration of evaporation pulse
Out Gas Time (Seconds)	10	2	60	Time source is outgassed before evaporation pulse.
Out Gas Current (A)	20	0	40	Current applied to source at the start of outgas step. Thus allowing automated outgassing. Note the current during the out gas may be adjusted.
Max Out Gas Current (A)	40	0	50	Maximum current that can be set during outgas
Max Out Gas Voltage (V)	10	0	20	The voltage across the rod is limited to this value during Outgas
Outgas source	Yes	No	Yes	Include or exclude outgassing step
Tooling Factor	5	0.1	10	Tooling factor for this process
Pump hold	No	No	Yes	If Yes, Q150T pumps down to outgas-ready state and waits for user input.  <b>Note:</b> If hold time (set in <b>System   Vacuum   Pump hold time</b> – see page 46) is exceeded, Q150T vents chamber.
Flush chamber	No	No	Yes	Set to Yes to flush chamber with nitrogen before pumping down.

Table 29 Aperture Cleaning profile parameters

Name	Default Value	Minimum Value	Maximum Value	Comment
Evaporation Current (A)	0	0	50**	Current applied to evaporation source during the evaporation. <b>**If Max Evaporation Voltage</b> parameter set below 2V the maximum value will increase to 100A.
Evaporation time (Minutes)	1	0.1	4	Duration of evaporation pulse.
Max Evaporation Voltage(V)	20	1	20	Set the maximum voltage that can be driven on to the source.
Tooling Factor	5	0.1	10	Tooling factor for this process
Pump hold	No	No	Yes	If Yes, Q150T pumps down to outgas-ready state and waits for user input. <b>Note:</b> If hold time (set in <b>System   Vacuum   Pump hold time</b> – see page 46) is exceeded, Q150T vents chamber.
Flush chamber	No	No	Yes	Set to Yes to flush chamber with nitrogen before pumping down.

Table 30 Vacuum shutdown properties

Name	Default Value	Minimum Value	Maximum Value	Comment
Shut down Vacuum (mBar)	1	1x10 <sup>-2</sup>	1x10 <sup>+2</sup>	Set the Vacuum that the system will pump down to. Note the final vacuum may be different.

## 9.2 System Overrideable Parameters

If you have Admin group privileges, you can override some of the parameters normally determined by the selected profile.

Table 31 System override properties

Name	Overridden System property	Description
Gas bleed time	System>Generic Sputter> Gas bleed time	Time Ar allowed to flow into chamber before plasma started
Bleed Vacuum	System>Generic Sputter> Bleed Vacuum	Pressure at which the chamber is maintained at while the plasma is present
Clean current	System>Generic Sputter> Clean current	Current at which the target is cleaned at.
Clean time	System>Generic Sputter> Clean time	Time for which the target is cleaned for
Stage rotate	System>Hardware>Stage Rotate	Allow the stage to be turned off for just this cycle
Stage Speed	System>Hardware>Stage Speed	Set the speed of the stage for this process

### 9.3 Technical Specification

Table 1 lists the technical specification of the Q150T.

**Table 32 Technical Specification**

<b>All instruments</b>	
<b>Instrument Case</b>	585mm Wide x 4700mm Deep x 410mm High
<b>Work Chamber</b>	Borosilicate Glass 165mm Dia x 127mm High
<b>Safety Shield</b>	PET
<b>Ultimate vacuum</b>	$5 \times 10^{-5}$ mbar
<b>Turbomolecular Pump</b>	60 litres/sec
<b>Vacuum Gauge Range</b>	1000 - $5 \times 10^{-4}$ mbar
<b>Fuse</b>	T 10A ceramic (5x20mm); fuse standard IEC60127-2
<b>Weight</b>	33.4 kg
<b>Sputter Coater (Q150T S and Q150T ES)</b>	
<b>Target</b>	54mm Dia x 0.2mm Thick (Chromium fitted as Standard)
<b>Specimen Stage</b>	60mm Dia. Rotating Stage
<b>Deposition Current</b>	0-150mA
<b>Deposition Rate</b>	0-20nm/Minute
<b>Sputter Timer</b>	0-10 minutes
<b>Evaporation (Q150T E and Q150T ES)</b>	
<b>Evaporation current (rod)</b>	0-90A
<b>Outgas current</b>	0-50A
<b>Carbon source</b>	3.2mm rods or carbon cord

## 9.4 Sputtering Deposition Rate



*These graphs are provided for guidance only and are not to be taken for absolute reference*

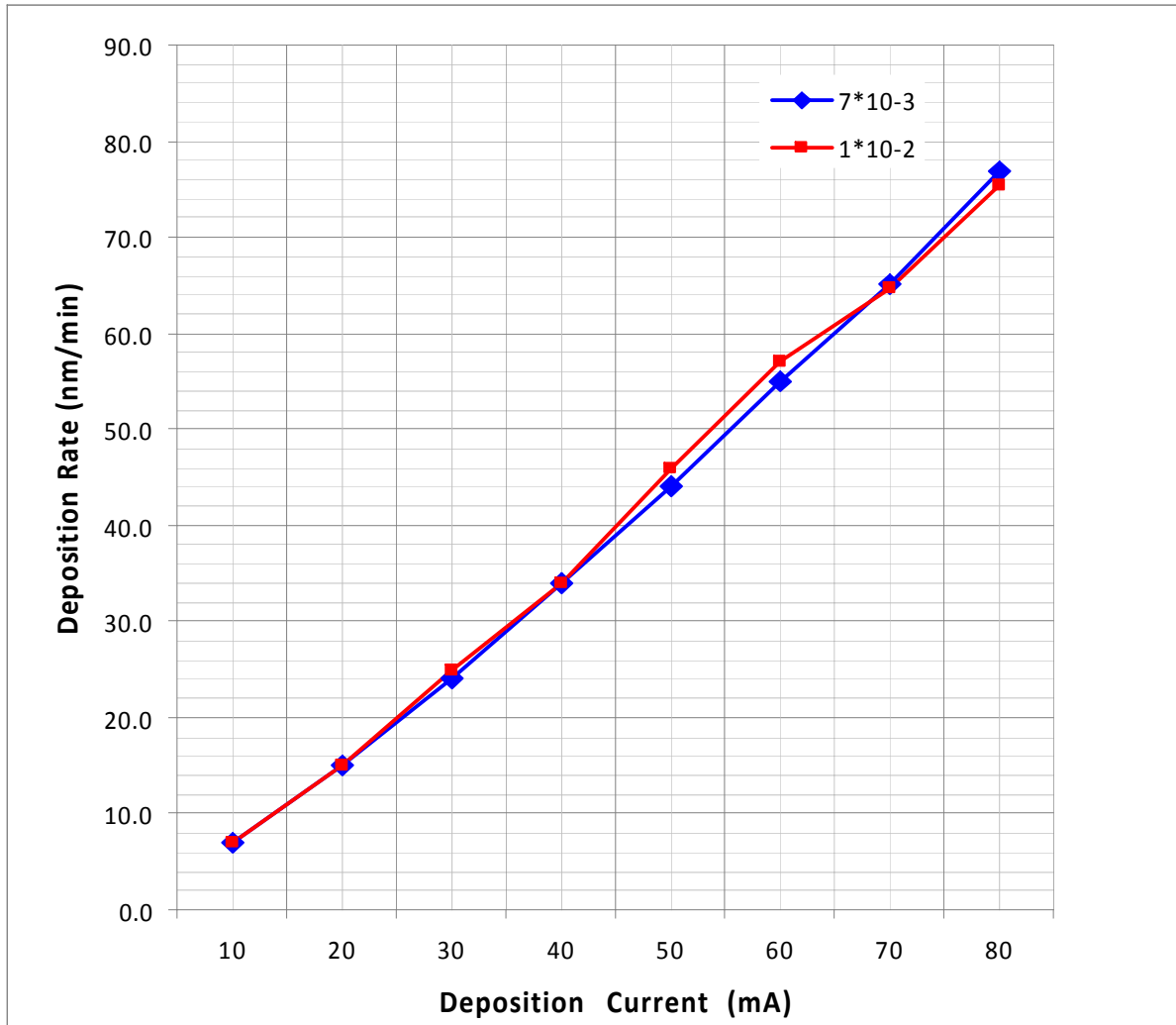


Figure 9-1. Sputtering Deposition Rate using Gold

Gold tooling factor = 2.7

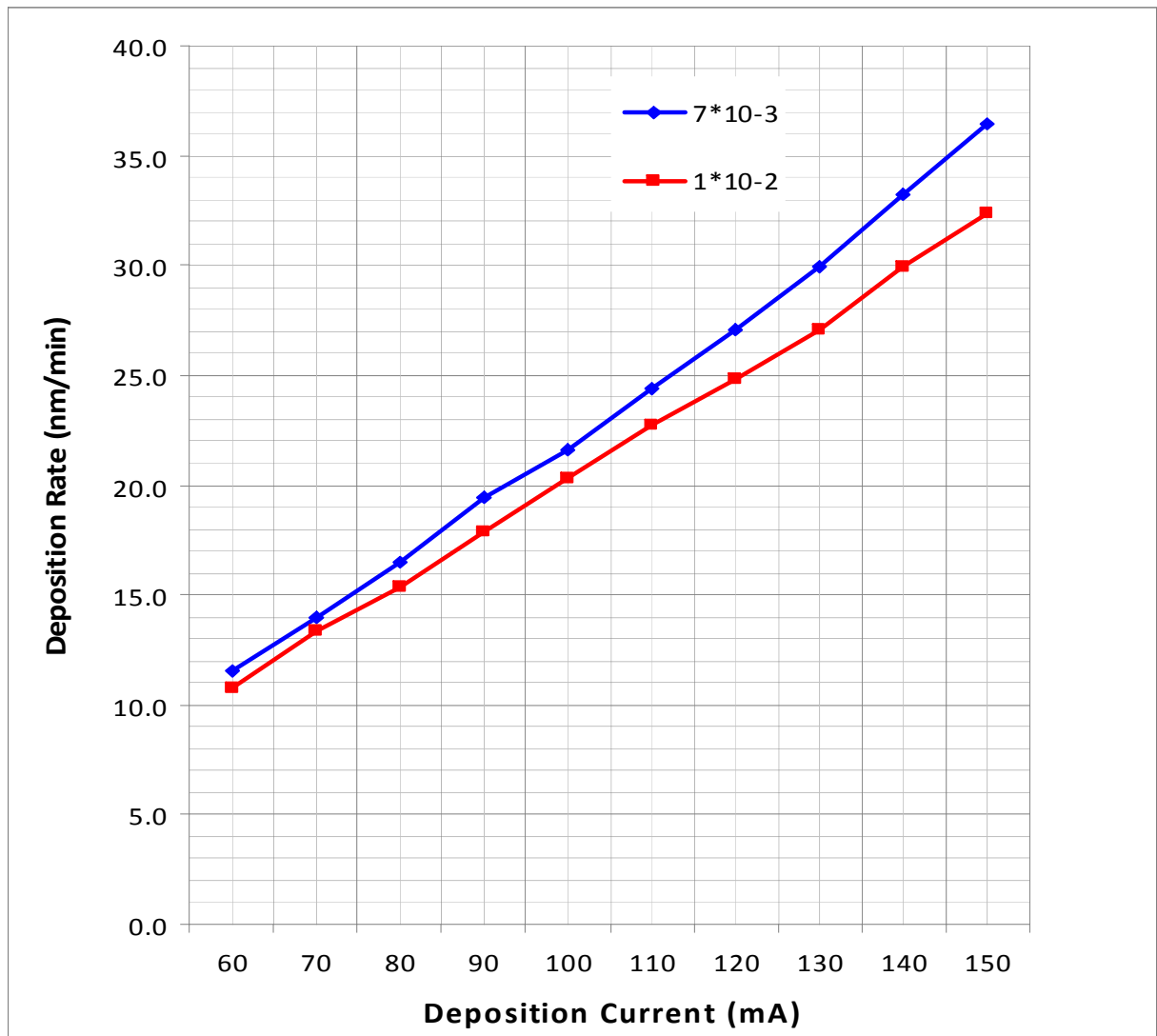
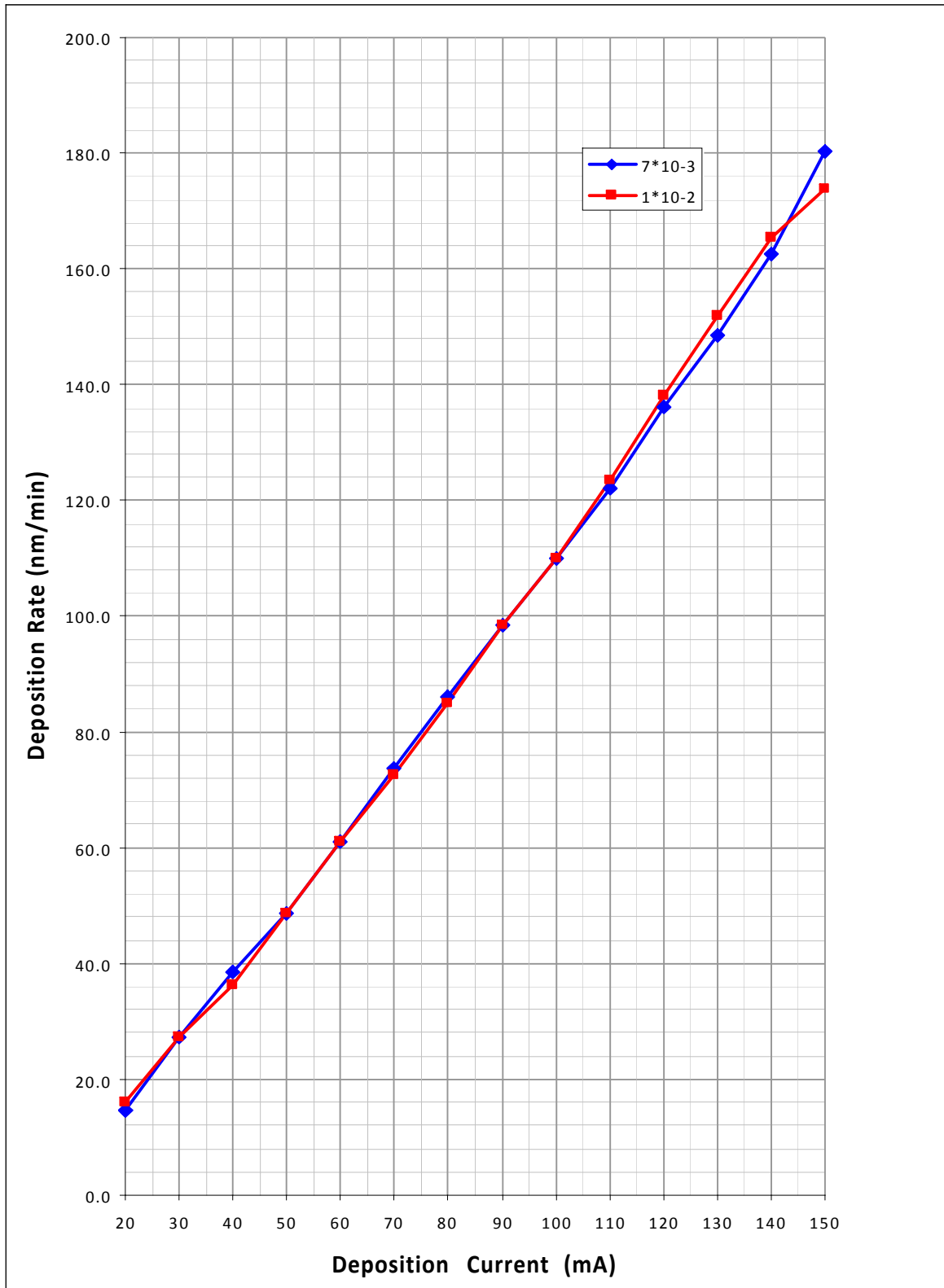


Figure 9-2. Sputtering Deposition Rate using Chromium

Chromium tooling factor = 2.28



**Figure 9-3. Sputtering Deposition Rate using Silver**

Silver tooling factor = 2.5

## **9.5 Return of Goods**

This section contains important safety information regarding the return of Preparation Equipment and Accessories.

### **9.5.1 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 -9.5.5 for the form)

### **9.5.2 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'.

### **9.5.3 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.

### **9.5.4 Return Address:**

F.A.O.: The Service Manager,  
Quorum Technologies,  
Units 1 & 2 Eden Business Centre  
South Stour Avenue,  
ASHFORD,  
Kent. TN23 7RS



### 9.5.5 Declaration of Contamination Form

Table 33 Declaration of Contamination Form

<b>Declaration of Contamination of Preparation Equipment and Accessories.</b>				
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.				
<b>This declaration may only be completed and signed by authorised and qualified staff.</b>				
<b>1. Description of component</b>		<b>2. Reason for return:</b>		
- Equipment type/model: _____		_____		
- Code No.: _____		_____		
- Serial No.: _____		_____		
- Invoice No. (if known) _____		_____		
- Delivery Date.: (if known) _____		_____		
<b>3. Equipment condition</b>		<b>4. Process related contamination of Equipment/ Accessories.</b>		
- Has the equipment been used? Yes/No		- Toxic Yes/No		
- What type of operating medium was used? _____		- Corrosive Yes/No		
- Is the equipment free from potentially harmful substances? Yes/No		- Explosive* Yes/No		
(If Yes go to Section 5)		- Microbiological* Yes/No		
(If No go to Section 4)		- 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 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	Chemical name and symbol	Danger class	Precautions associated with substance.	First aid measures in the event of an accident.
Product name				
Manufacturer				
1.				
2.				
3.				
4.				
5.				
<b>5. Legally Binding Declaration.</b>				
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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