



Quorum Technologies

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



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Issue 1

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## Disclaimer

The components and packages described in this document are mutually compatible and guaranteed to meet or exceed the published performance specifications. No performance guarantees, however, can be given in circumstances where these component packages are used in conjunction with equipment supplied by companies other than Quorum Technologies 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 67 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/environmental\\_policy.htm](http://www.quorumtech.com/environmental_policy.htm).

### Conformity



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

### 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.

# 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

<b>Gas supplies</b>	Argon - Nominal 4 psi Nitrogen - Nominal 4 psi (Argon may be used as common gas)
<b>Electrical supply</b>	90-240V, 50/60Hz, 1350VA, including pump
<b>Vacuum Pump</b>	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.
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 11).
- Connect the vacuum pump (see page 12).
- Install the sample stage (see page 13).

If you want to install a different insert than that supplied with your instrument, please see page 38. 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.

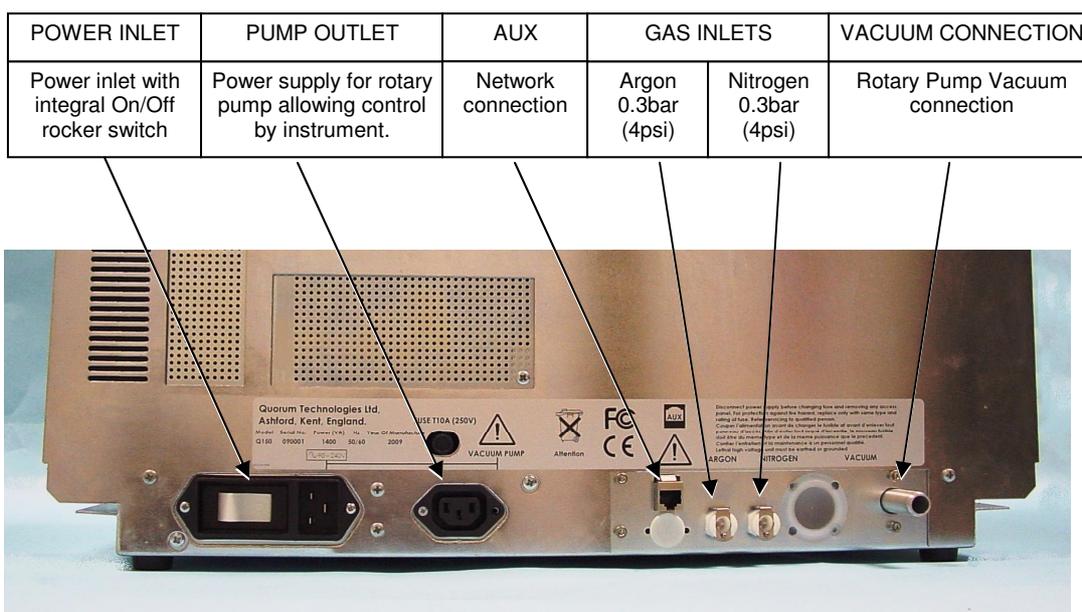


Figure 2-1. Q150T Rear Panel



**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**).
2. Connect a suitable nitrogen supply at a regulated input of 0.3bar (4psi) to the quick connect Nitrogen connector on the rear panel. We do **NOT** recommend using air as the purge gas.

If you prefer, you can use argon for both process and purge supplies. To do so, install a 'T' piece across both gas inlets.

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

### 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.



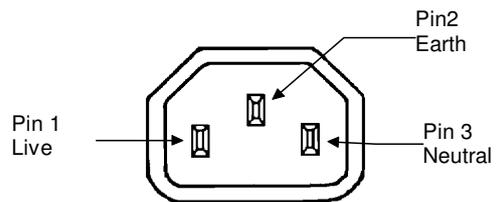
For fuse information, refer to Table 24.

2. Connect the rotary pump power lead to the Pump Output connector on the rear panel (see **Figure 2-2**). 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 2-2. 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 51).*

### 2.3.5 Fitting the Standard Stage

The Q150T is supplied with a standard stage (10067). For installation instructions for other stages, see page 38. 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).

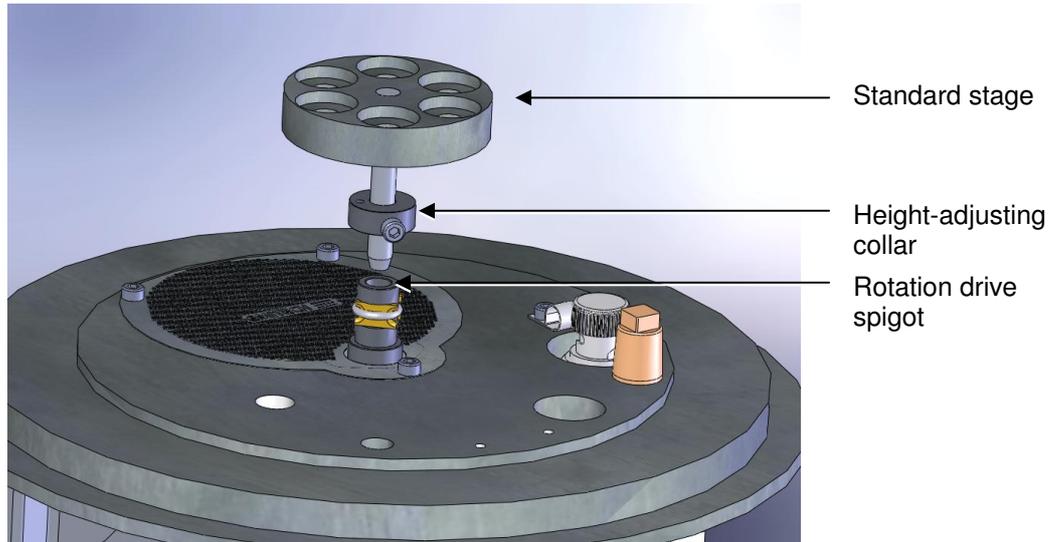


Figure 2-3. Fitting the standard stage



*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

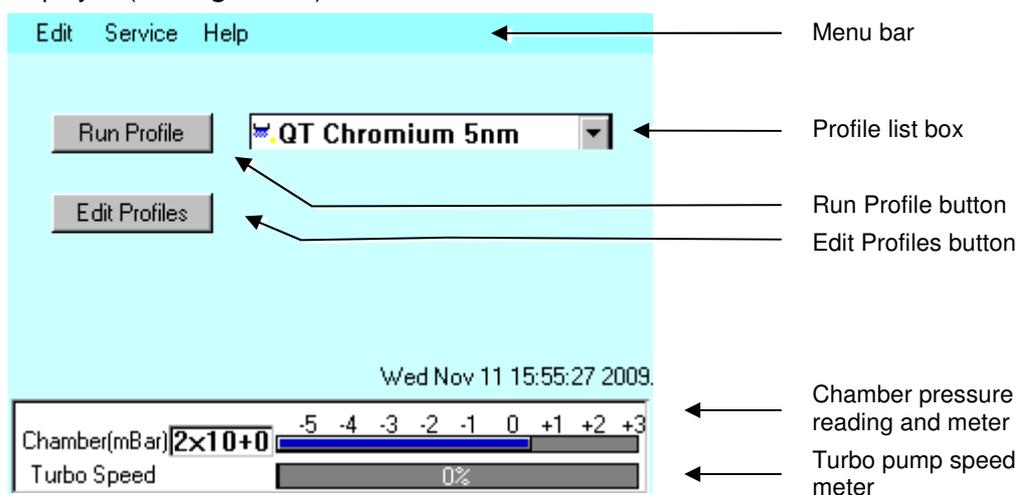
For full connection details of optional units, where provided, please refer to separate instructions. Any other connections on the rear panel not listed are for common manufacturing and are not available for this instrument.

## 3 Operation

This chapter describes the basic operation of the Q150T. For more advanced use, please see *Working with Profiles* on page 18 and *Application Guidelines* on page 24.

### 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 28).
- **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.

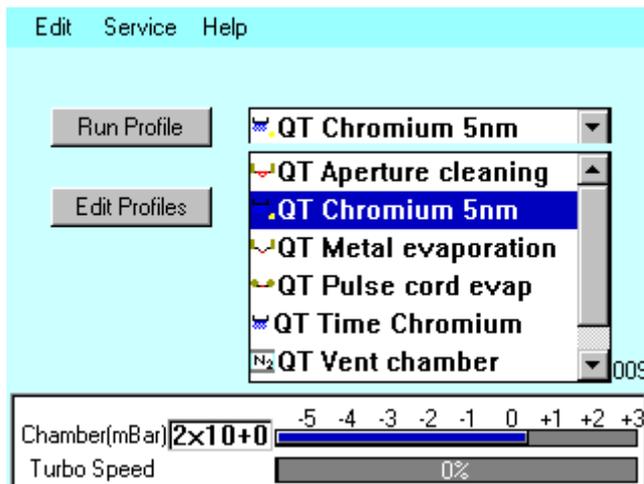
### 3.2 Running a Profile

Before you can run a profile, ensure you have:

- Completed the installation as described on page 9.
- Switched on the instrument (see section 14).
- Loaded a sputter/coating target or loaded an evaporation source (see page 38).

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 24)
QT Chromium 5nm*	Sputter coating run using Chromium target terminated by FTM at a coating thickness of 5nm (see page 24)
QT Metal evaporation	Sputter coating using metal evaporator (see page 26)
QT Aperture cleaning	Default profile for aperture cleaning (see page 25)
QT Pulse rod evap	Evaporation using carbon rods (see page 27)
QT Pulse cord evap	Evaporation using carbon cord (see page 27)
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).

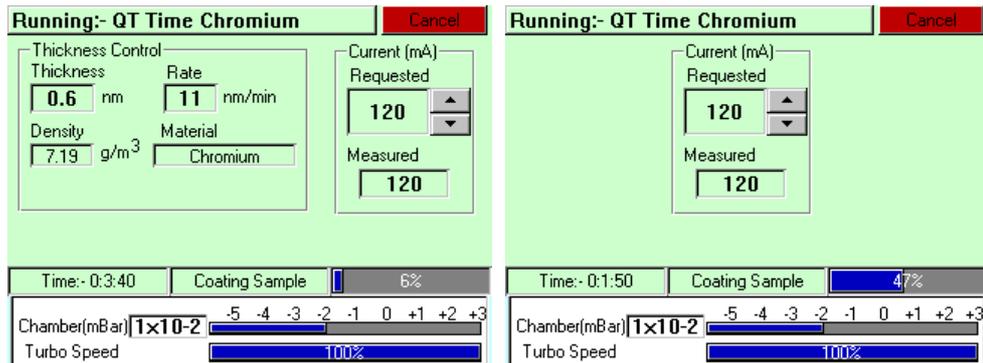


Figure 3-3. A run in progress: with FTM installed (left) and without FTM (right).

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.*

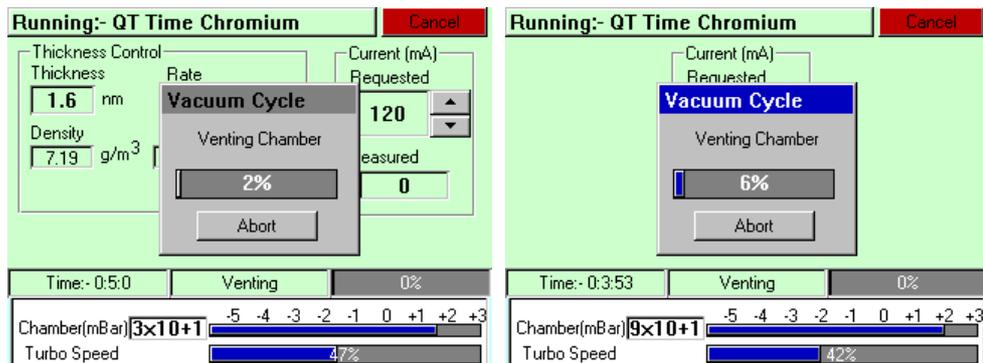


Figure 3-4. Venting the chamber: with FTM installed (left) and without FTM (right).

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).

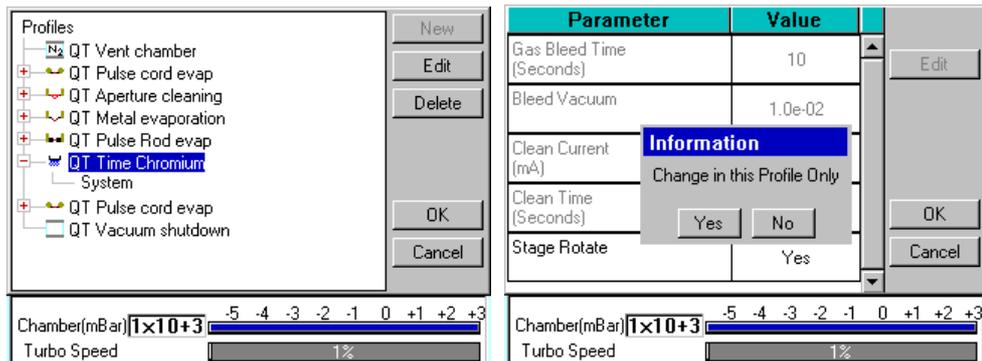


Figure 3-5. Listing system properties for a profile

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.

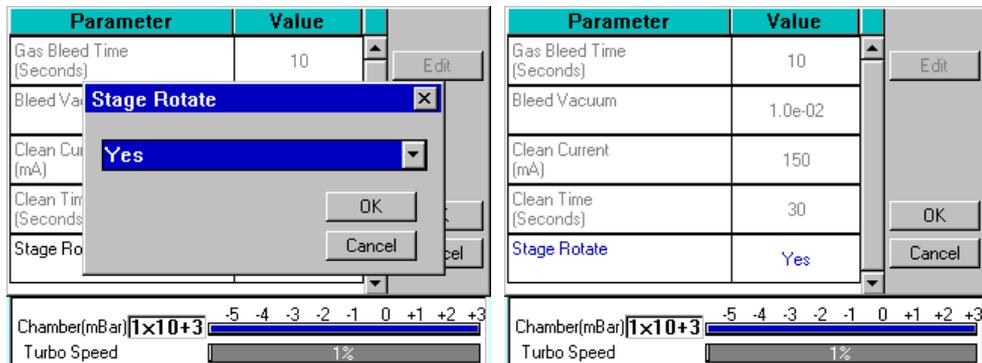


Figure 3-6. Changing the Stage Rotate system property

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 21.

### 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**).

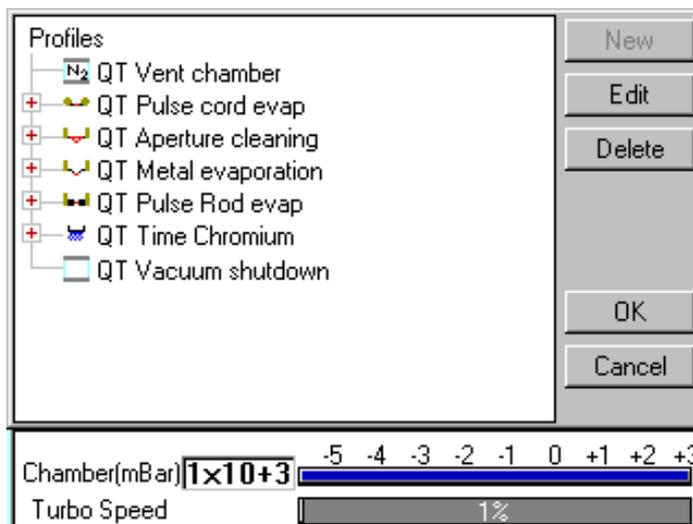
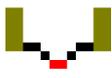
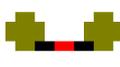
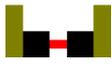


Figure 4-1. Profile Editor

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**

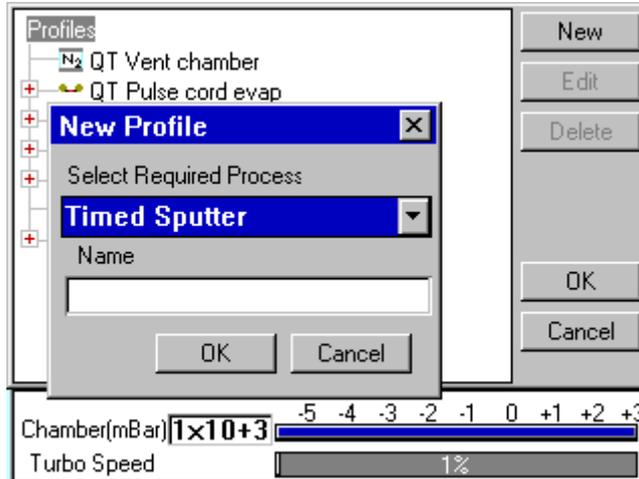
Icon	Profile/Process Type
	Timed sputter (see Table 18)
	FTM terminated sputter (see Table 18)
	Aperture cleaning (see Table 21)
	Metal evaporation (see Table 20)
	Pulse cord evaporation (see Table 19)
	Pulse rod evaporation (see Table 19)
	Vacuum shutdown (see Table 22)
	Vent chamber

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 the **New** button or tap on *Profiles* at the root of the profile 'tree'.
2. The *New Profile* dialog box is displayed (see **Figure 4-2**).



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

3. 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.

4. 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

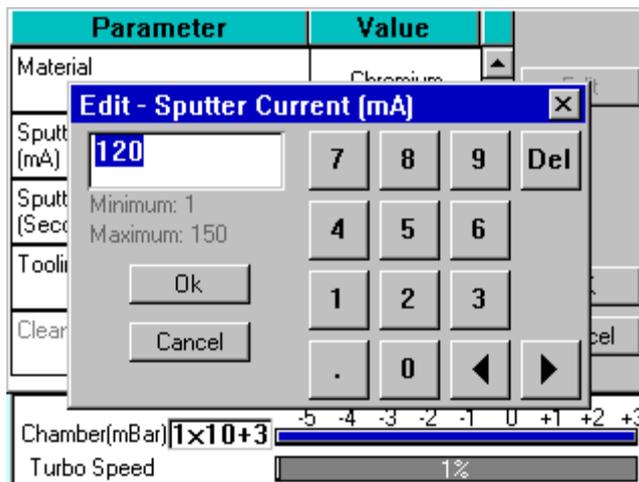
5. Tap on the **OK** button to confirm the changes to the profile. Alternatively, tap on the **Cancel** button to close the dialog box without creating a new profile.
6. The new profile is created using the default settings for the chosen process type.
7. Now refer to the *Editing Profile Parameters* 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 34 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 58.

## 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.

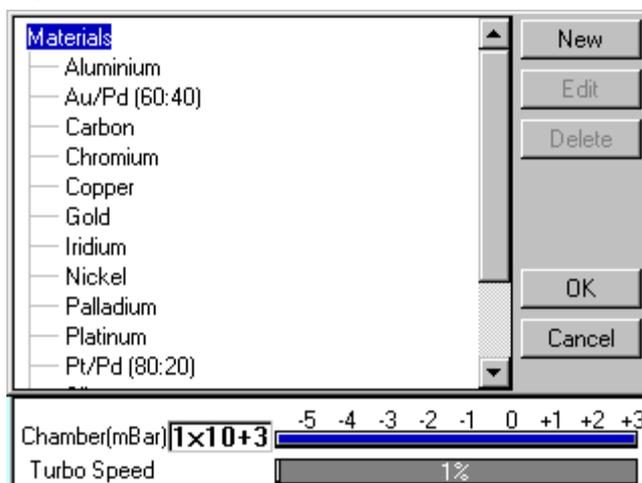
**Table 3 Materials and their density**

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) (60:40 mix)	16.40
Tungsten	19.30
Gold	19.32
Platinum / Palladium (Pt/Pd) (60:40 mix)	19.56
Platinum	21.45
Iridium	22.40
User Defined allowable range	1.00 - 23.00

### 4.3 Creating a New Material

To create a new entry in the material database:

1. 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.

2. Tap on one of the buttons on the right side of the editor:
  - a. To create a new material, tap on the **New** button or tap on **Materials** at the root of the materials 'tree' (see **Creating a new material**).
  - b. To edit a material, tap on its name and then tap on the **Edit** button (see **Editing material parameters**).
  - c. To delete a material, tap on its name and then tap on the **Delete** button.

### 4.3.1 Creating a New Material

To create a new profile:

1. Select **Edit | Materials** from the menu bar. *Material Editor* is displayed (see **Figure 4-5**).
2. Tap on the **New** button or tap on *Materials* at the root of the materials 'tree'. The *New Material* dialog box is displayed.
3. 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.
4. 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.
5. The new material is created using the default settings for the chosen process type.
6. Now refer to the **Editing Material Parameters** section.

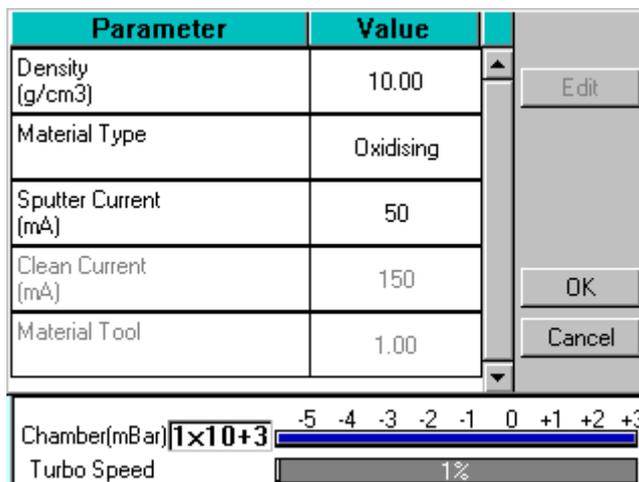
### 4.3.2 Editing Material Parameters

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	200	
Material Tool		0.1	10	

1. To edit a material, tap on its 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, click 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, click on the **OK** button to confirm the changes to the material or on the **Cancel** button to restore the previous values.



**Figure 4-6. Material Parameters**

## 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.

## 5.2 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 Aperture Cleaning

This process is designed to clean hydrocarbon contamination from SEM 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 43.
2. Load the aperture into the boat.
3. Carefully fit the insert as described on page 43.

Select *Aperture cleaning* from the process menu and run the process.

The default settings should be sufficient to heat the boat for 1 minute and drive off any contaminants from the aperture. If the cleaning is not sufficient, the current may be increased slightly:

1. Create a new profile from the default aperture cleaning process.
2. Edit the *evaporate current* to a higher value, for example, 35 Amps.

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

## 5.4 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.

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

Fit the tungsten filament to the evaporation insert as described on page 43.

Load the filament with a small quantity of the gold to be evaporated. Carefully fit the insert as described on page 43.

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.

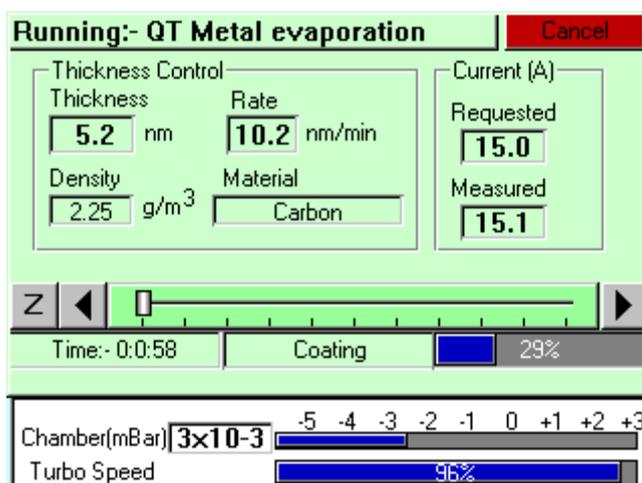


Figure 5-1. QT Metal evaporation process

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.

## 5.5 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.

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

1. Install the carbon cord insert as described on page 42.
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

## 5.6 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 5nm carbon support layer

1. Install the carbon insert as described on page 40. Ensure that the carbon rods are prepared correctly as described on page 41.
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 rod evaporation*.
4. Edit the newly created profile setting the parameters as shown in Table 6.
5. Run the new profile.

**Table 6 QT Pulsed rod evaporation parameters for 5nm coating.**

Parameter	Value
Material	Carbon
Pulse Current	75A
Pulses Length	1.5 seconds
Number of Pulses	2
Out Gas Time	30 seconds
Out Gas Current	50A

## 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 14), 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.

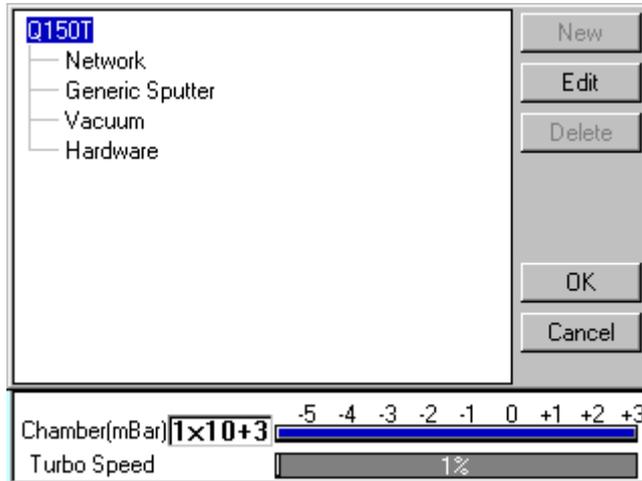
**Table 7 Q150T Menus**

Menu	Sub-menu	Command	Purpose
Edit		Profiles	Create, edit or delete profiles (see page 18)
Edit		Materials	Create, edit or delete coating parameters for specific metals or alloys (see page 22)
Edit		System	Change hardware settings in System Editor (see below)
Edit	User	Level	Change user group/login privilege level (see page 34)
Edit	User	Groups	Create, edit or delete user groups and passwords (see page 35)
Service		FTM	Monitor FTM usage (see page 36)
Service		Set Time	Set instrument clock (see page 36)
Service		System	Engineer use only
Service		Connect Network	Connect Q150T to local network (see page 30)
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**).



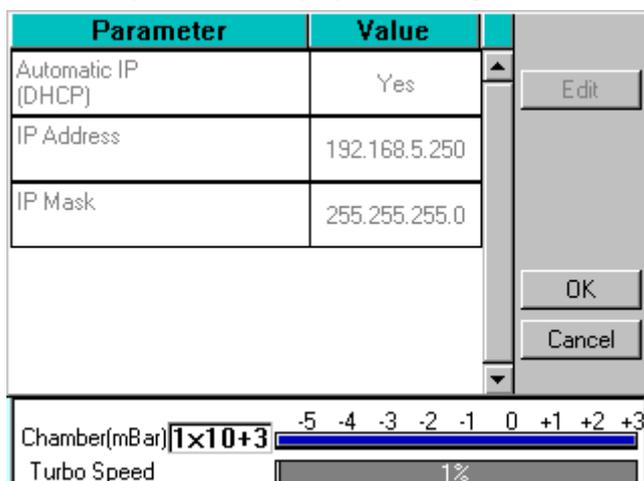
**Figure 6-1.** System Editor

*System Editor* arranges settings in four categories:

- Network
- Generic Sputter
- Vacuum
- 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**).



**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.

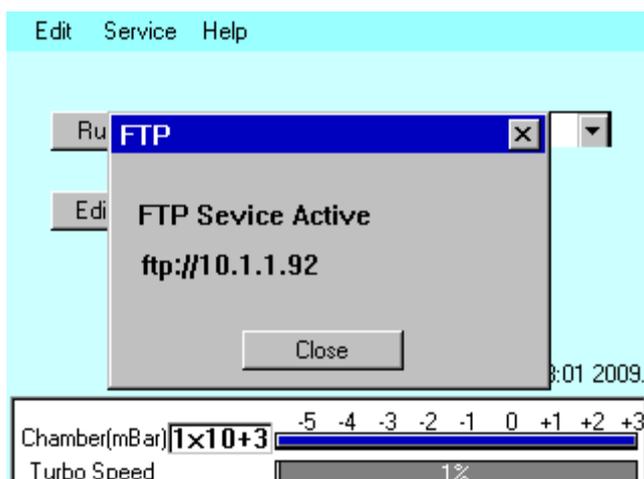
To set the IP address manually, set *Automatic IP (DHCP)* to *No*, then enter the primary IP address and subnet mask address manually.

### 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 61).

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 8**).

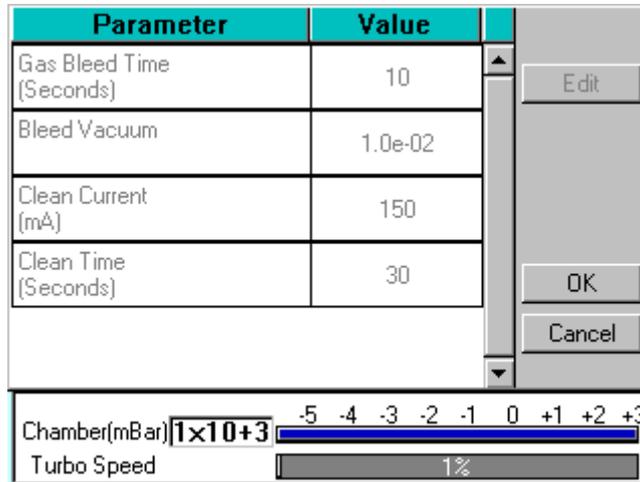


Figure 6-4. Generic sputter parameters

Table 8 Generic Sputter parameters

Name	Default Value	Minimum Value	Maximum Value	Comment
Gas Bleed Time (Seconds)*	10	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	200	Current at which the target is cleaned at.
Clean Time (Seconds)*	30	0	60	Time for which the target is cleaned for

\* 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 9**).

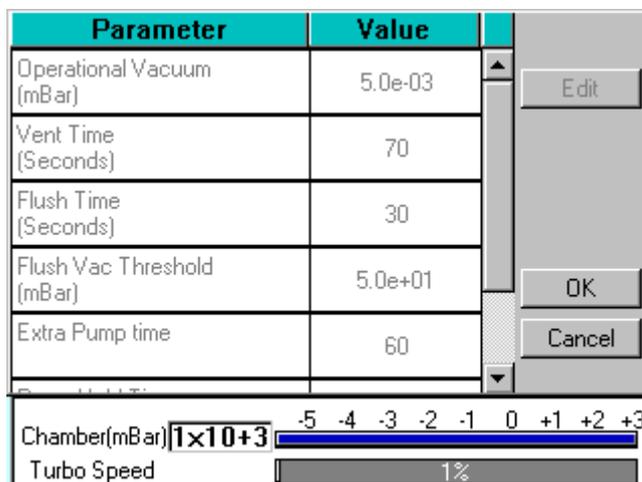


Figure 6-5. Vacuum parameters

Table 9 Vacuum parameters

Name	Default Value	Minimum Value	Maximum Value	Comment
Operational Vacuum (mBar)*	$1 \times 10^{-3}$	$5 \times 10^{-3}$	$1 \times 10^{-1}$	Time Ar allowed to flow into chamber before plasma started
Vent Time (Seconds)*	70	10	240	Time to vent the chamber after the turbo has reached 50%
Flush Time (Seconds)*	70	10	240	
Flush Vac Threshold (mBar)*	50	0.1	100	Vacuum the system will pump down to before venting with nitrogen during a flush
Extra Pump time*	60	1	240	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 operational vacuum

\* Admin group level required to edit this property

\*\* Engineer 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.
- 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 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 6-6** and **Table 10**).

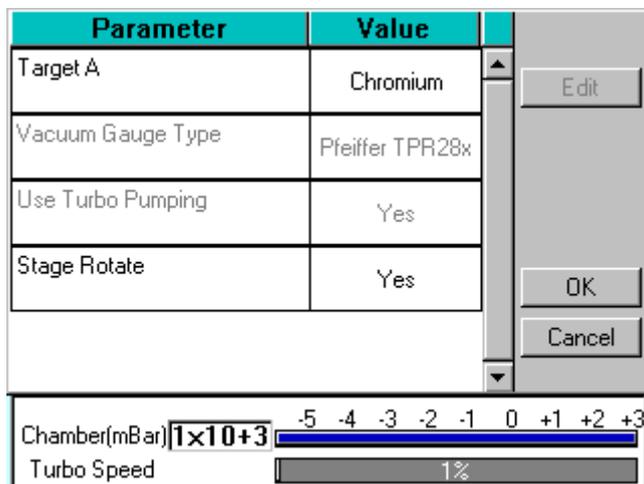


Figure 6-6. Hardware settings (single target)

Table 10 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 <i>No</i> 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

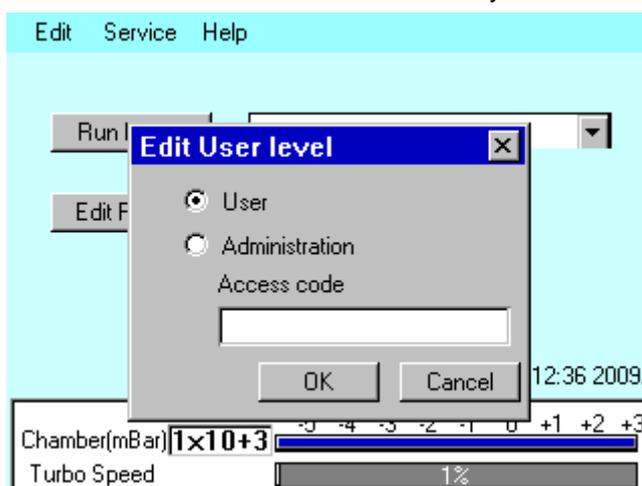
The Q150T software does not employ a user account system with individual login names and passwords. Instead, users are granted access privileges at a *group* level. The lowest security group: **User**, is not password protected. In this mode, a user can run the instrument for sputtering or evaporation and create or edit profiles. The second security group: **Admin**, is password protected. 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 6-7**).
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.
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 6-7.** Changing the user level

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

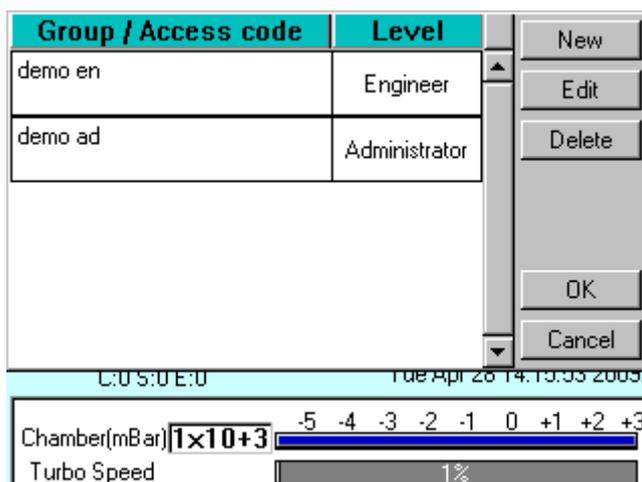
1. Select **Edit | User | Level** from the menu bar. The *Edit User Level* dialog box is displayed (see **Figure 6-7**).
2. Select the **User** option button.

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 6-8**).



**Figure 6-8.** 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 6-9**).

This shows the percentage of the crystal used and will help you decide when to replace it (see page 50).

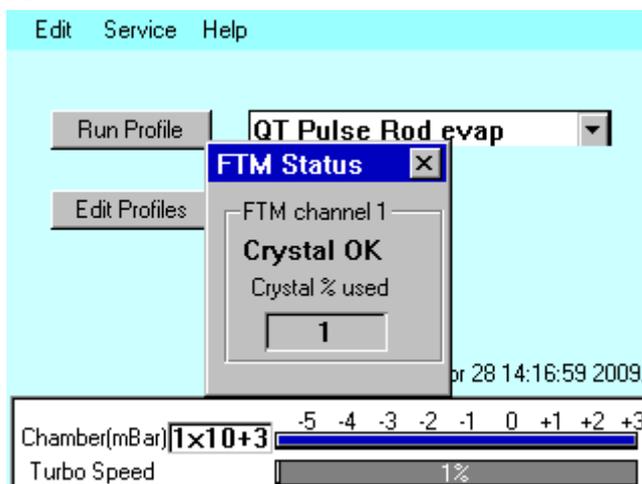


Figure 6-9. FTM Status

## 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 6-10**).

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.

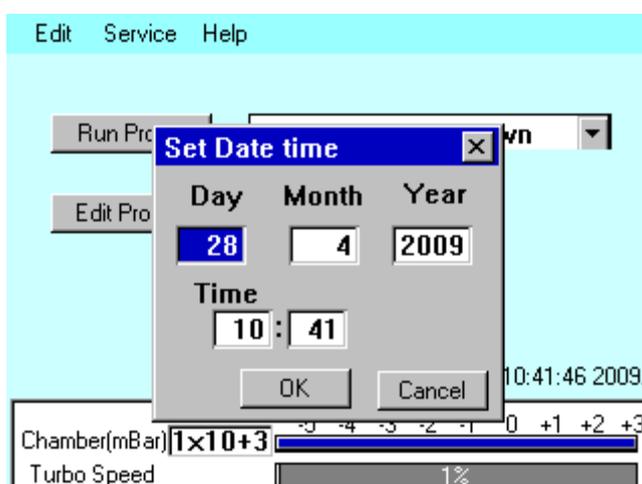


Figure 6-10. Setting the date and time

## 6.6 Setting up a Network connection

Connect the Q150T to your network as described on page 11.

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 6-11).



Figure 6-11. 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.

## 7 Accessories

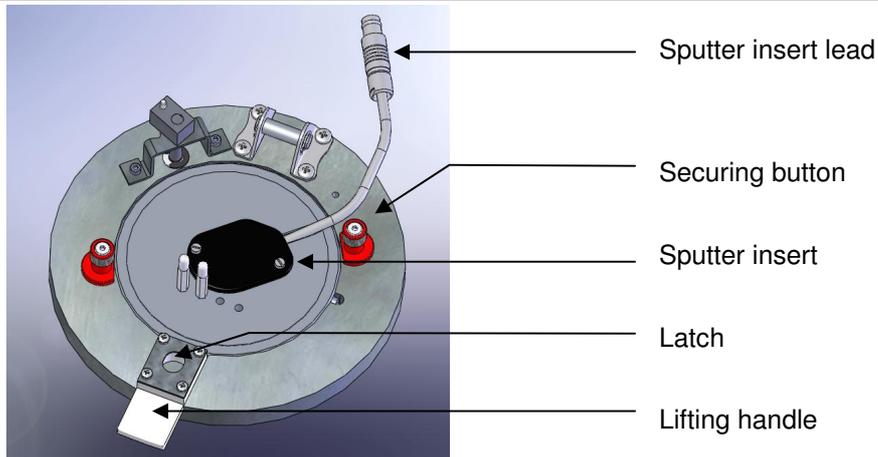
The QT150T can be configured for various sputtering and evaporation applications. This section describes the installation of:

- 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).
- Metal evaporation insert (10457) including its configuration for both downwards and upwards evaporation, and the installation of a wire basket or molybdenum boat).
- Carbon fibre insert (10455)
- 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)
- Vacuum spigot (10422)

### 7.1 Installing the Sputter Insert

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

	<p><b>WARNING – HIGH VOLTAGES AND HIGH VACUUM</b> This equipment produces high voltages and high vacuum in its operation.</p>
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**Figure 7-1. Top view of the sputter insert**

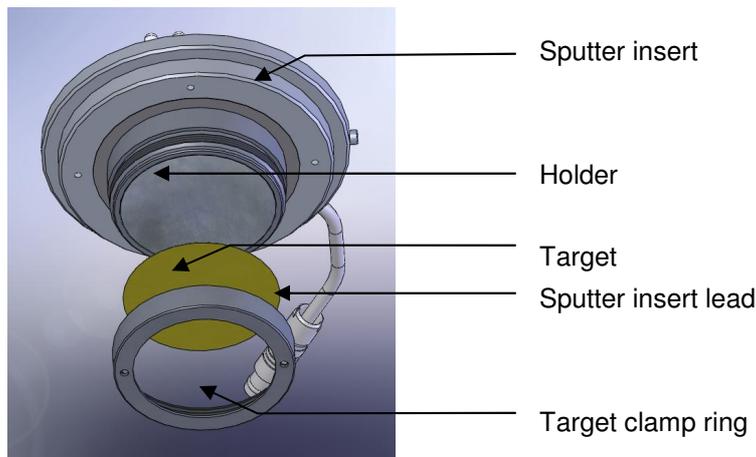
1. Check the machine is not operating.
2. Press down firmly on the top cover to release the latch.
3. Lift the top cover and rest it against its stop.

- 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 40). 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.

- 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.
- To fit a target (we recommend you wear latex gloves to do so):
  - Unscrew the target clamp ring (see **Figure 7-2**)
  - Place a new target centrally on the holder. Hold it in place with one finger through the clamp ring.
  - Screw the clamp ring firmly back in place.
- 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.
- Plug the sputter insert lead into the socket on the hinge assembly.



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

## 7.2 Installing the 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 41).
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.

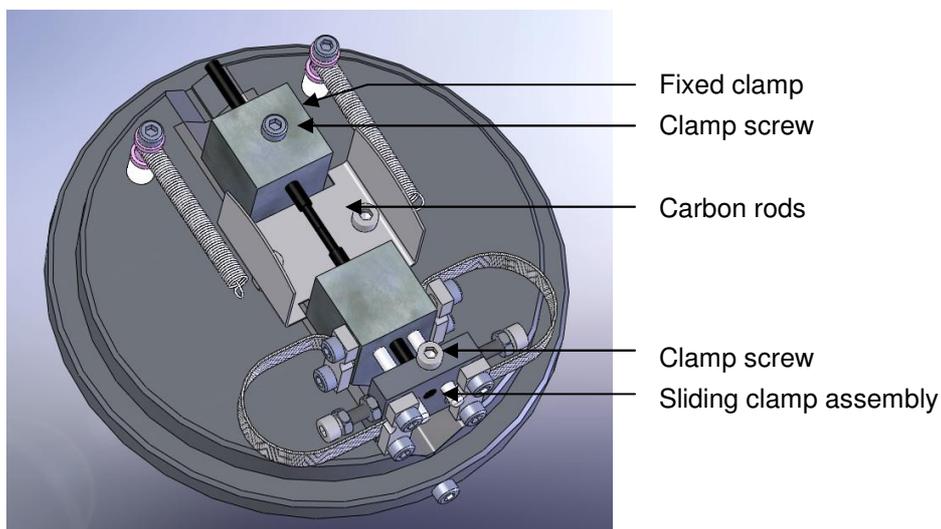


Figure 7-3. Carbon Rod Insert

## 7.2.1 Shaping Carbon Rods



### WARNING

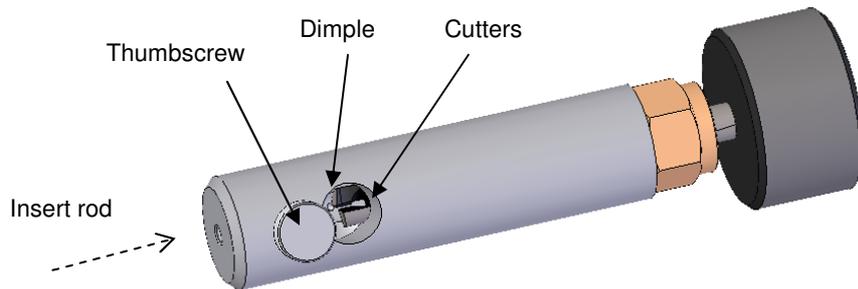
It is essential that you shape the tips of the carbon rods to the correct profile to minimise the possibility of damage to the instrument due to excessive currents.

We recommend that you shape the rods so that one is sharpened to 1.4mm diameter x 4mm long and the other is 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 rods (part no S8651). A rod shaper is also available for 6mm rods (part no. S8650).



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

To shape a carbon rod:

1. 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).*

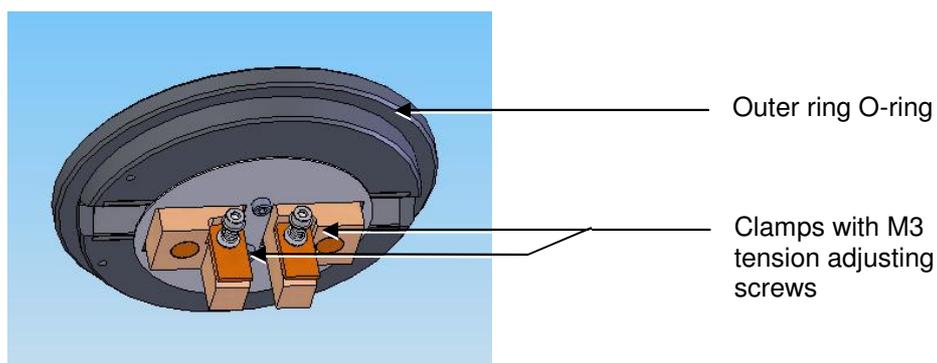
2. Hold the shaper stationary and insert the carbon rod from the bottom to half way through the window, as indicated by the dimple at the bottom of the hole.
3. Gently tighten the thumb screw to hold the carbon rod in place.
4. Holding the shaper body and, with very little force, gently turn the black knob on the end of the shaper clockwise (when viewed face on).
5. Keep turning the knob until the desired length is achieved, clearing the carbon rod dust as necessary.
6. Undo the thumb screw and withdraw the rod carefully to avoid damaging the newly formed tip.
7. 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.**

### 7.3 Fitting the Carbon Fibre Insert



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

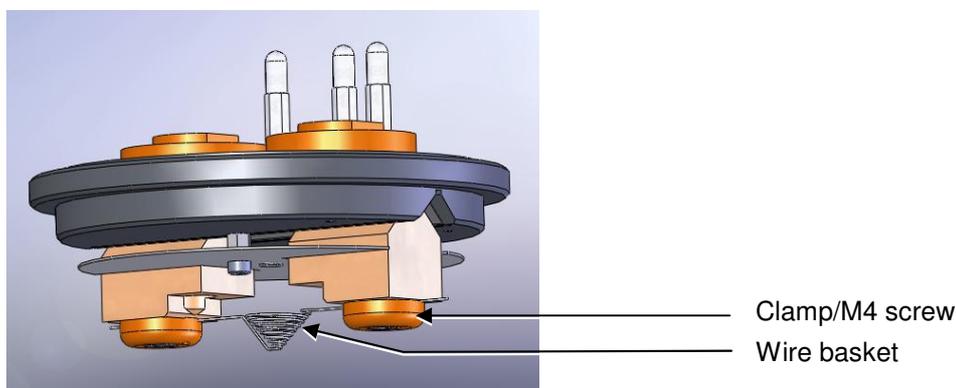
The carbon fibre insert (10455) is designed for carbon evaporation from carbon cords, carbon fibre woven cord and carbon fibre fine strands (see **Figure 7-6**).

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. Cut a length of carbon fibre: 35mm if you are using woven cord (C5421) or 70mm if you are using fine strands (C5461).
9. Fit the fibre between the two clamps on the insert. If you are using fine strands (C5461), fold in half and gently twist together before fitting between the clamps.
10. Adjust the clamp tension by turning the M3 screws on the terminals.
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 Fitting the 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.

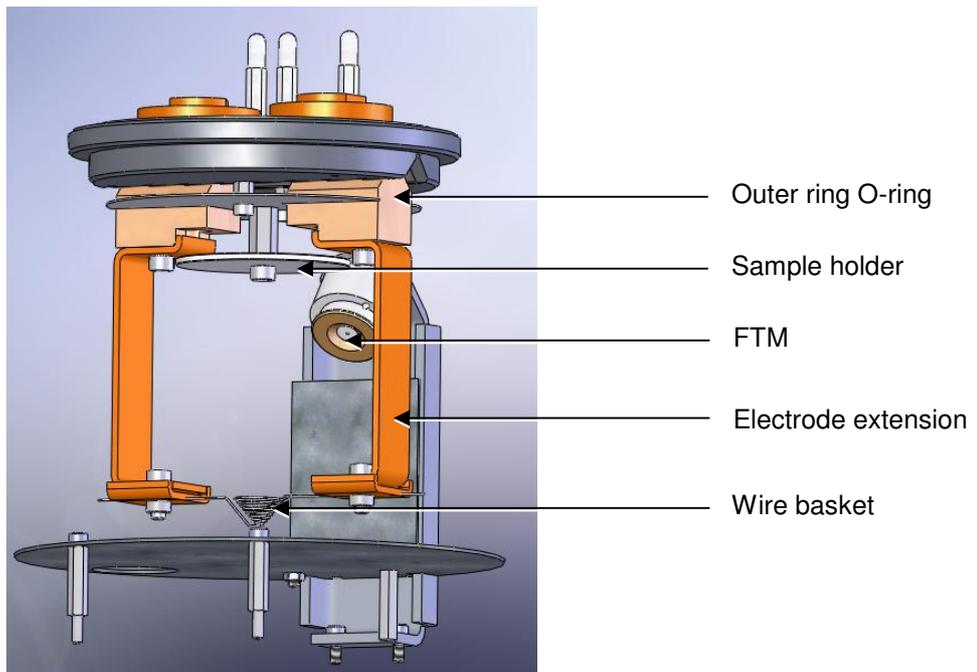
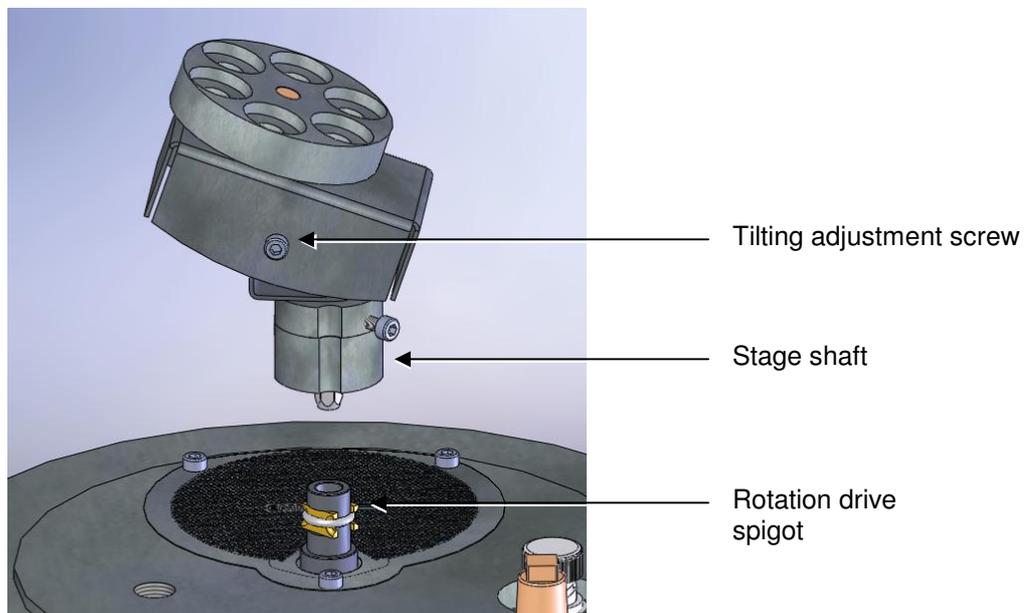


Figure 7-8. Metal evaporation insert adapted for upwards evaporation

## 7.5 Fitting the 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 7-9**).

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.

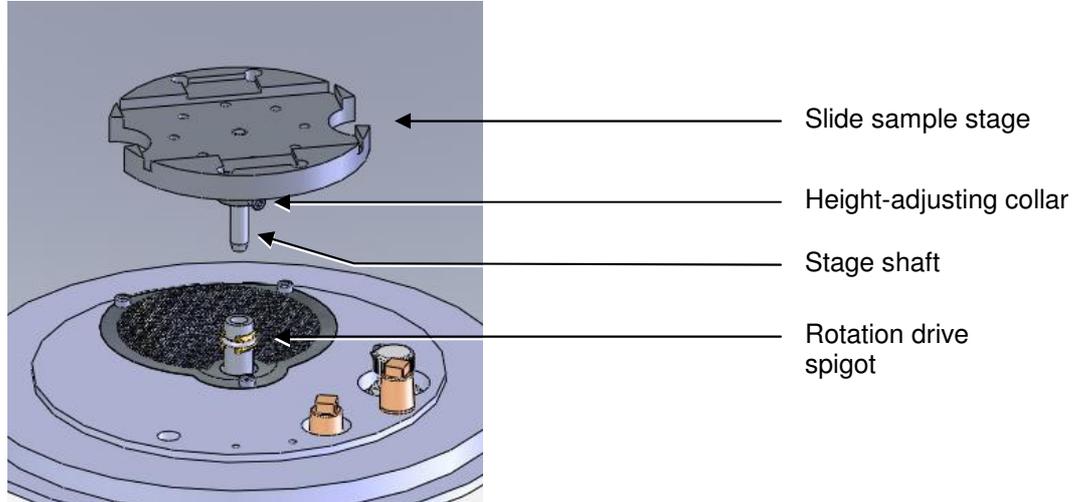


**Figure 7-9. Rotacota stage**

## 7.6 Fitting the 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 7-10. 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 7-10**).

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 48.

## 7.7 Fitting the 102mm Stage and Gearbox

The 102mm stage (10458) is designed to hold 102mm (4") silicon wafers (see Figure 7-11). 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.

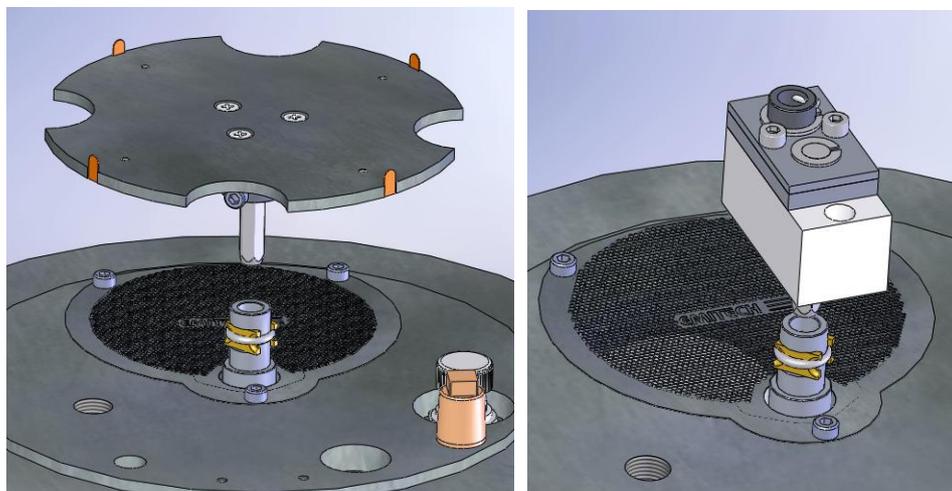


Figure 7-11. Large (102mm) Sample Stage and gearbox

## 7.8 Installing the Tilt Stage

The tilt stage (10357) allows you to vary the sample angle or height (see Figure 7-12). 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.

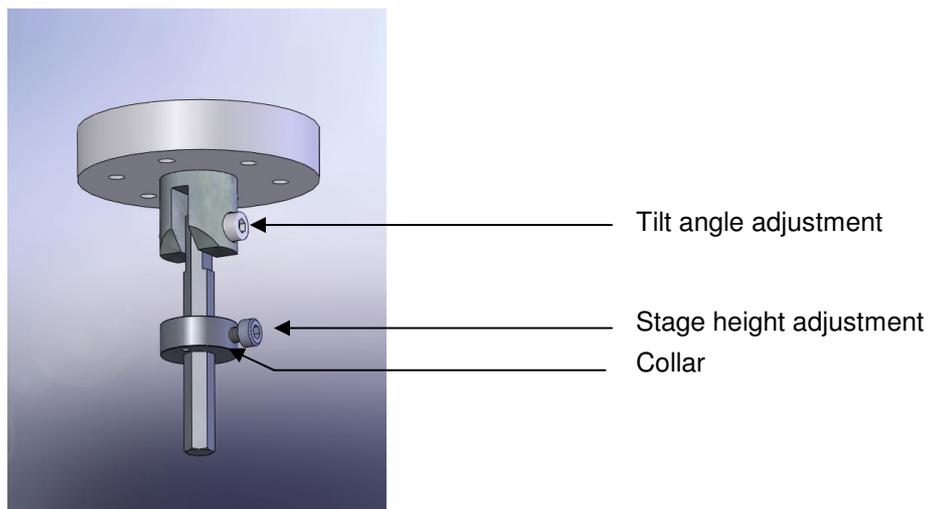


Figure 7-12. Adjustable tilting stage

## 7.9 Installing the 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 7-13**).
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 7-13**) may be removed completely for cleaning or if the FTM is in continual use.

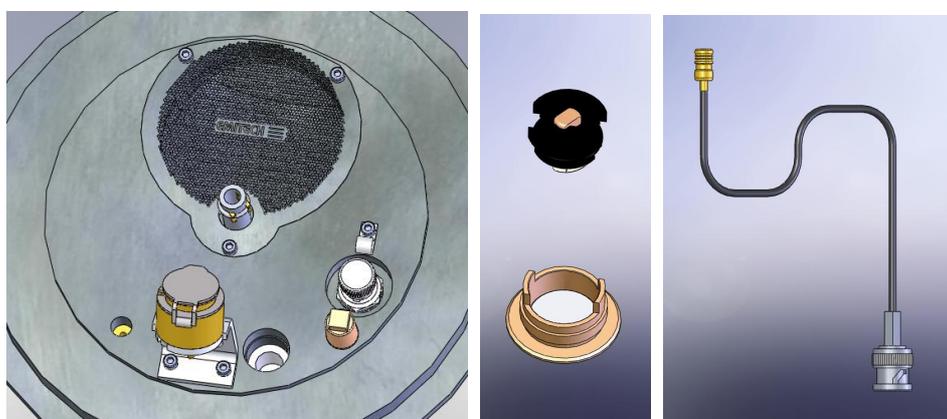


Figure 7-13. FTM (left); replacing the FTM crystal (centre); FTM lead (right)

### 7.9.1 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 7-13**).
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.

## 7.10 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.



Figure 7-14. The extended height cylinder in position

## 7.11 Full range vacuum gauge assembly



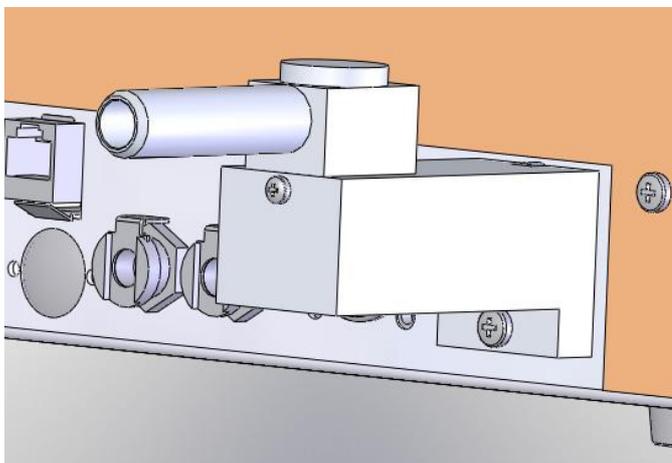
*The instrument must be returned to the factory for fitting this option as the covers need to be removed.*

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.

## 7.12 Installing the 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 7-15).



**Figure 7-15. 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.

**7.13 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 11 Spare Parts for the Q150T**

<b>SPARES FOR Q150T</b>	<b>CATALOGUE NUMBER</b>	<b>QUANTITY</b>
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 12 Replacement targets for Q150T S and Q150T ES**

<b>REPLACEMENT TARGETS</b>	<b>CATALOGUE NUMBER</b>
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

<b>REPLACEMENT TARGETS</b>	<b>CATALOGUE NUMBER</b>
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



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

## **7.14 Other Accessories**

The following are available from Quorum or your local distributor.

**Table 13 Accessories for the Q150T**

<b>USEFUL ACCESSORIES FOR Q150T</b>	<b>CATALOGUE NUMBER</b>	<b>QUANTITY</b>
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 14 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 28) and replace when necessary (see page 50).	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 15 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>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 is turned on
<i>Short on Sputter output. Please</i>	The target shield needs cleaning. As required output

## Q150T Sample Preparation System

<i>check target</i>	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. Please contact your supplier to get it fixed

**Table 16 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

**Table 17 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 18. 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 18 Pulse/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	240	<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	10.0	<i>FTM Terminated Sputter only</i> Sets upper limit to sputtering if FTM thickness has not been achieved
Tooling Factor	5.0	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 19 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) 95 (rod)	0	120	Current applied to cord during the evaporation pulse
Max Pulse Voltage (V)*	20	0	20	The voltage across the cord is limited to this value during the evaporation pulse
Pulses Length (s)	1	0.02	3	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 32 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 20 Metal Evaporation profile parameters**

Name	Default Value	Minimum Value	Maximum Value	Comment
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 32) is exceeded, Q150T vents chamber.
Flush chamber	No	No	Yes	Set to Yes to flush chamber with nitrogen before pumping down.

**Table 21 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
Evaporation time (Minutes)	1	0.1	4	Duration of evaporation pulse
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 32) is exceeded, Q150T vents chamber.
Flush chamber	No	No	Yes	Set to Yes to flush chamber with nitrogen before pumping down.

**Table 22 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 23 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.

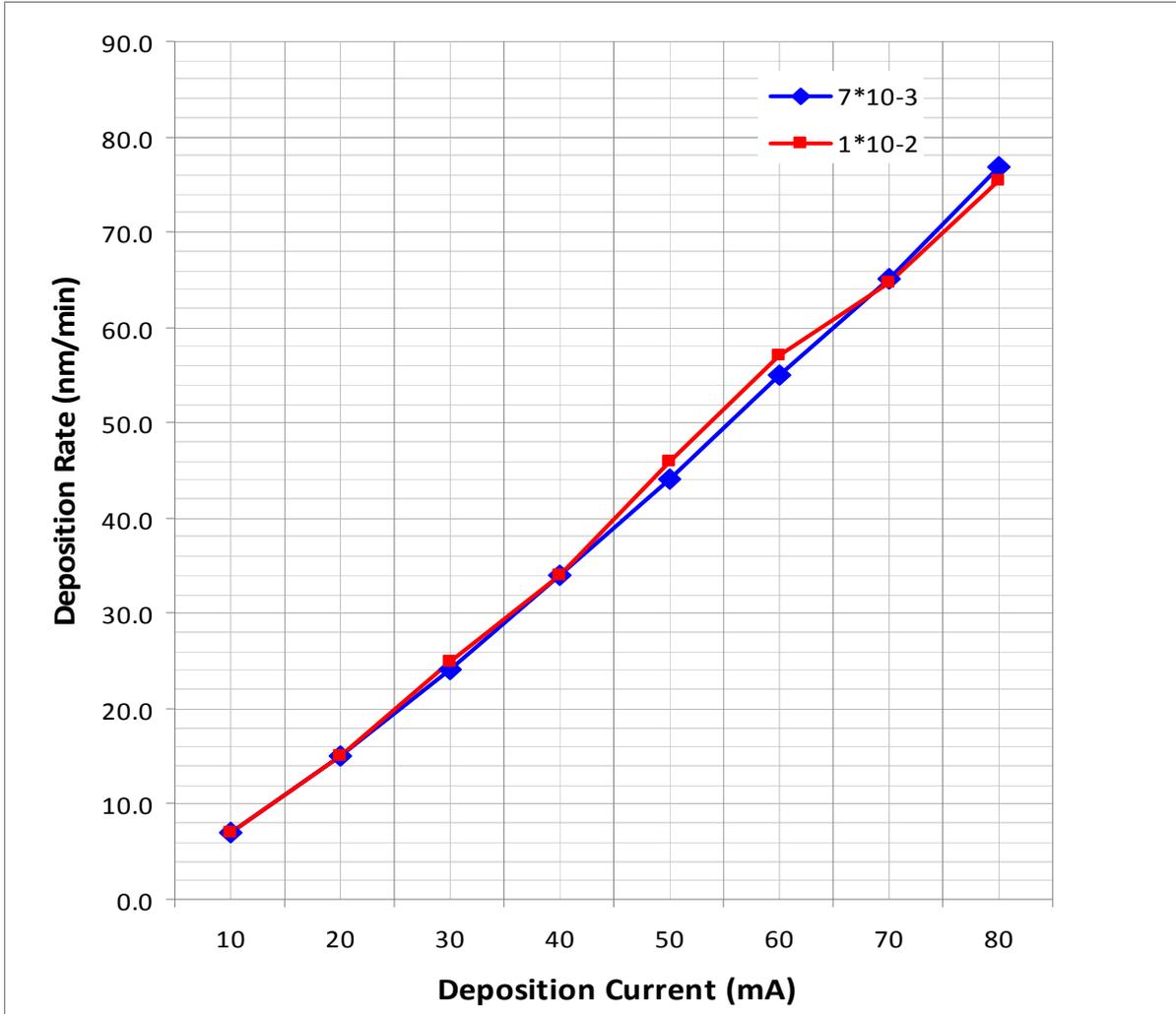
**Table 24 Technical Specification**

<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 125mm 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

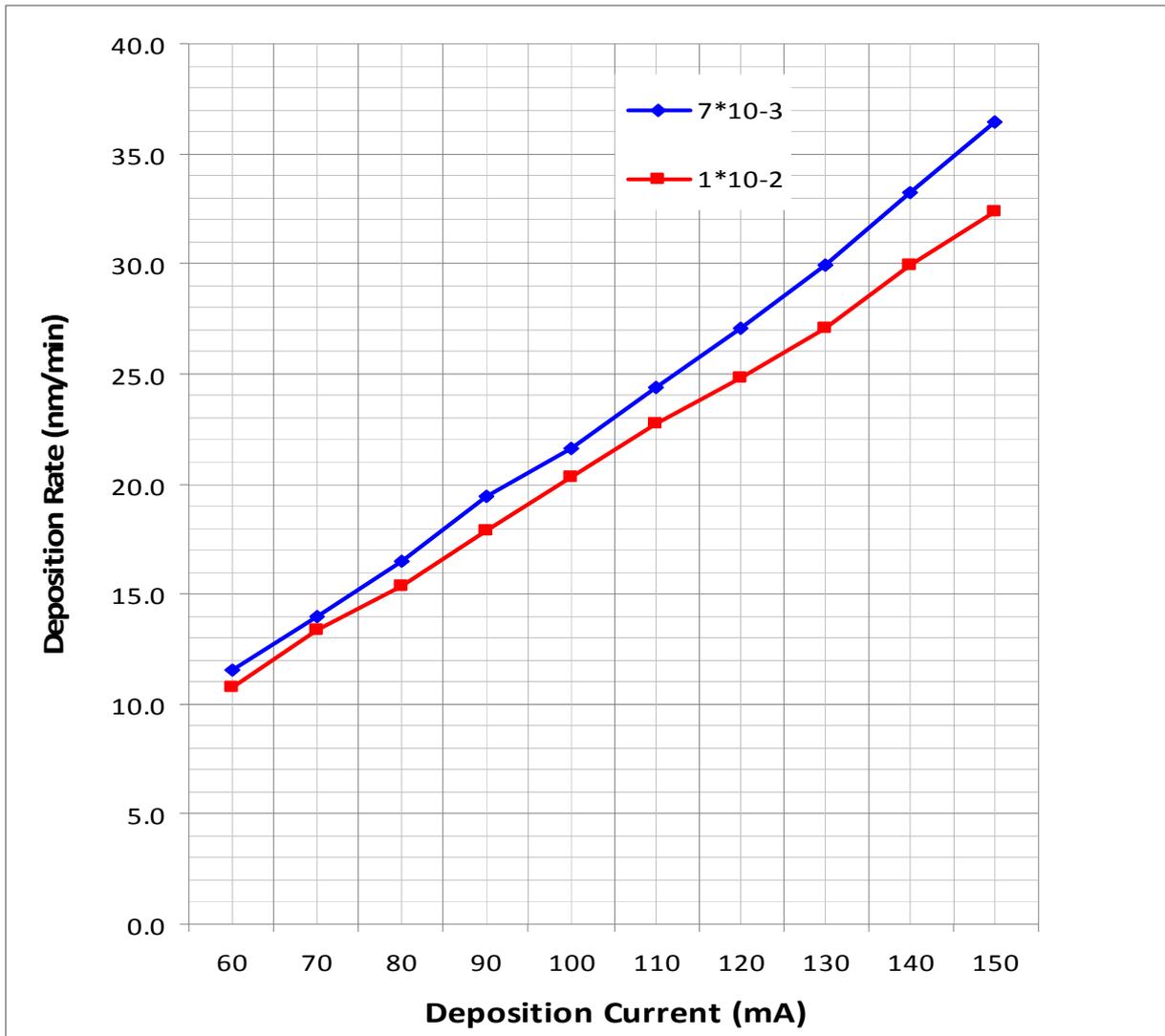


Figure 9-2. Sputtering Deposition Rate using Chromium

Chromium tooling factor = 2.28

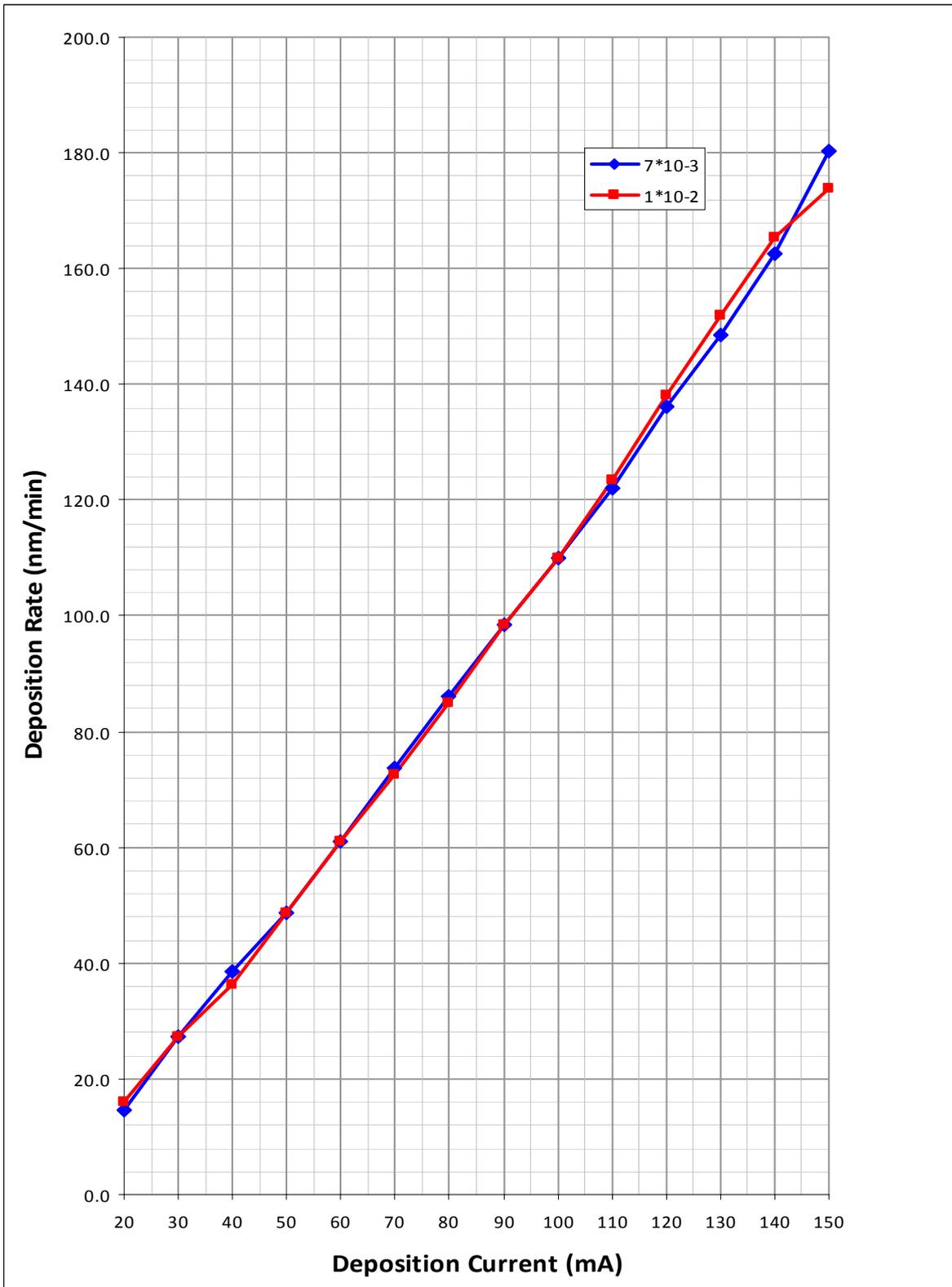


Figure 9-3. Sputtering Deposition Rate using Silver

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 25 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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