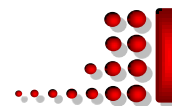


DST3 Desk Sputter Coater

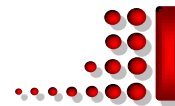
Instruction Manual

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1. Manual Layout

This Operating Manual is divided into eight major sections, each section describes specific topic, as following:

Section 1 - Manual Layout

Section 2 - Health and Safety

Section 3 - Description

Section 4 - Installation

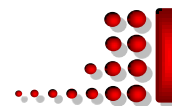
Section 5 - Operation

Section 6 - Service and Maintenance

Section 7 - Appendices

Section 8 - List of Figures and Tables

General section which applies to all Nanostructured Coatings products detailing the very important issues of Health and Safety applicable when using sample preparation equipment.



2. Health and Safety

Safety is very important when using any instrumentation. Nanostructured Coatings is committed to providing a safe working environment for its employees and those that use its equipment and conducts its business responsibly, and in a manner designed to protect the health and safety of its customers, employees and the public at large. It also seeks to minimize any adverse effects that its activities may have on the environment.

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

All service work carried out on the equipment should only be undertaken by suitably qualified personnel. Nanostructured Coatings is not liable for any damage, injury or consequential loss resulting from servicing by unqualified personnel.

Nanostructured Coatings will also not be liable for damage, injury or consequential loss resulting from incorrect operation of the instrument or modification of the instrument.

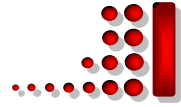
2.1 Control of Substances Hazardous to Health (COSHH)

Regarding the “Control of Substances Hazardous to Health”, it requires Nanostructured Coatings to monitor and assess every substance entering or leaving their premises. Consequently any returned goods of what ever nature must be accompanied by a declaration form Health and Safety Declaration form completed. (Table 8: Declaration of Contamination Form) Without this declaration Nanostructured Coatings reserves the right not to handle the substance/item.

2.2 Hazard Signal Words

The standard three hazard signal words are defined as follows:

- **DANGER** - *imminently* hazardous situation or unsafe practice that, if not

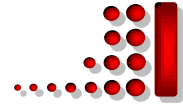


avoided, *will* result in death or severe injury.

- **WARNING** - *potentially* hazardous situation or unsafe practice that, if not avoided, *could* result in death or severe injury.
- **CAUTION** - *potentially* hazardous situation or unsafe practice that, if not avoided, *may* result in minor or moderate injury or damage to equipment.

2.3 Fail Safe

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



3. Description

3.1 Desk Sputter Coater DST3

The DST3 is available in two options:

DST3 S- Linear (or straight) cathodes

The DST3 is a coating system with a large chamber and turbo molecular-pump. it is suitable to sputter large single sample with specimen diameter up to 20 cm. Smaller multiple specimens can be sputtered over a similar diameter.

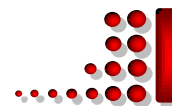
To ensure an even deposition ratio over a large diameter, the DST3 is equipped with three sputtering heads. The system is capable to sputter both oxidizing metals and non-oxidizing noble metals.

DST3 A-30 degree angled cathodes

DST3 model is a desk sputter coater equipped with turbo molecular pump. it can sputter metals, semiconductors and dielectric targets. it is also capable to co-sputter two or three cathodes simultaneously by using three angular cathodes via common focal point.



Figure 2-1: Desk sputter coater **DST3**



3.1.1 Features

- Triplet sputter head
- Large format chamber
- High resolution turbomolecular pumping
- Fully automated colorful touch-screen control
- Able to plot sputtering parameters graphs
- Including USB port for graph and data extraction and software updates
- Thickness monitor system for thickness measuring during coating process

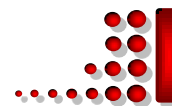
3.1.2 Benefits

- Easy to operate
- Water circulation cathodes
- Precise reproducible coatings
- Fully adaptable to a wide range of specimens
- Repeatable film thickness depositions
- Easy loading and unloading of specimens
- Can pre-set deposition thickness

3.2 Specifications

Table 1: Specifications of the Desk Sputter Coater DST3

Vacuum chamber	Pyrex glass (Thickness: 0.275 inches, Diameter: 6 inches, High: 6 inch)
Ultimate vacuum pressure of rotary pump	15 mtorr (40 mtorr inside the glass chamber)
Layering cathode diameter	2 inches
Maximum applicable voltage	700 V DC



Working pressure	50 ~ 70 mtorr
Target	55 mm Dia x 0.1mm Thick (Gold fitted as Standard)
Target Substrate spacing	30-80 mm
Vacuum Gauge Range	ATM - 1×10^{-4} mTorr
Deposition Current Range	0-100 mA
Deposition Rate	0-40 nm/Minute
Sputter Timer	0-5 Minutes
Control of Argon Supply flow	Needle Valve
Electrical specification	Input : 220 V AC – 6A
Controlling system	PLC with 7 inch touch screen HMI
Weight (without pump)	26 kg
Instrument Case	450 mm Wide x 500 mm Deep x 400 mm High

The vacuum sputtering coater DST3 is included of, glass chamber, an aluminum cap which magnetron cathode is installed on it, an aluminum base plate which following accessories installed on it :

Vacuum thermo couple gauge, quartz crystal thickness monitor holder, electrical vent valve, argon gas valve, sample holder and a precision needle valve.

Electric and electronic parts are placed in the metal box of the system and a two stage rotary vacuum pump is connected to the machine (outside of the box).

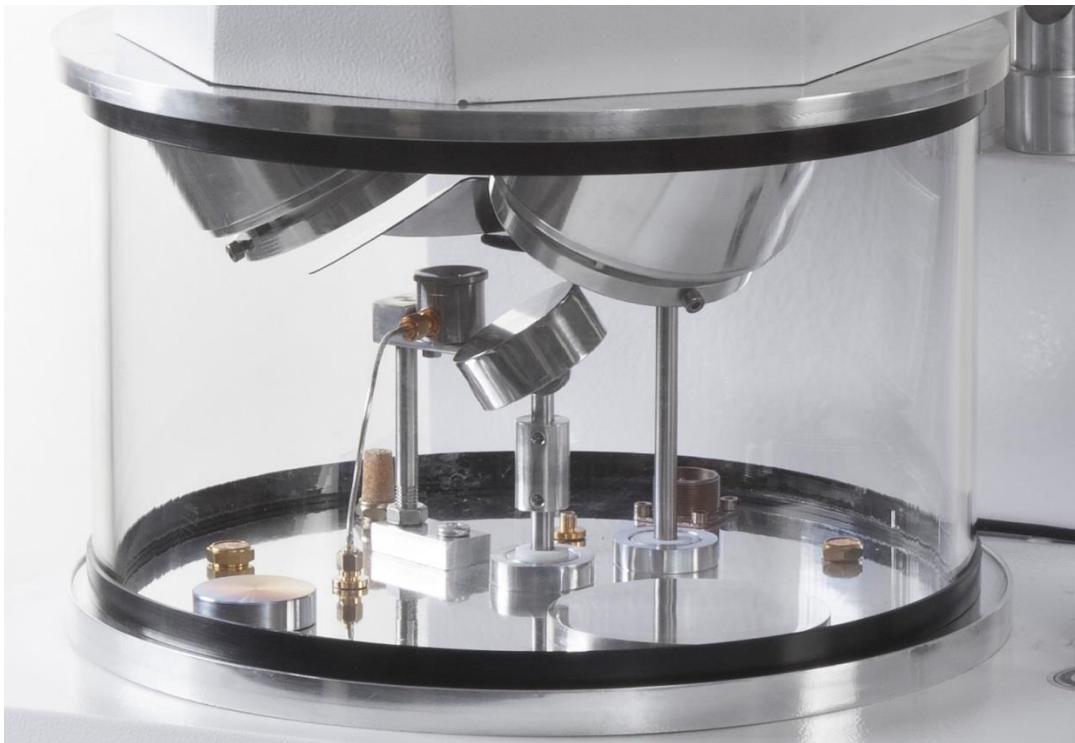
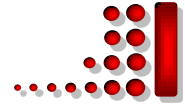


Figure 3-1: Inside the vacuum glass chamber



Figure 3-2: Turbo molecular pump

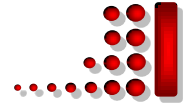


Figure 3-3: Turbo molecular controller

3.2.1. Sputtering Process in Brief

In the basic sputtering process, a target that attached to the cathode plate is bombarded by energetic positive ions generated in glow discharged plasma, situated in front of target.

The bombardment process causes the removal (sputtering) of target atoms from its surface, which may then condense on a substrate as a thin film.

Secondary electrons are also emitted from the target surface as a result of the ion bombardment, and these electrons play an important role in maintaining the plasma.

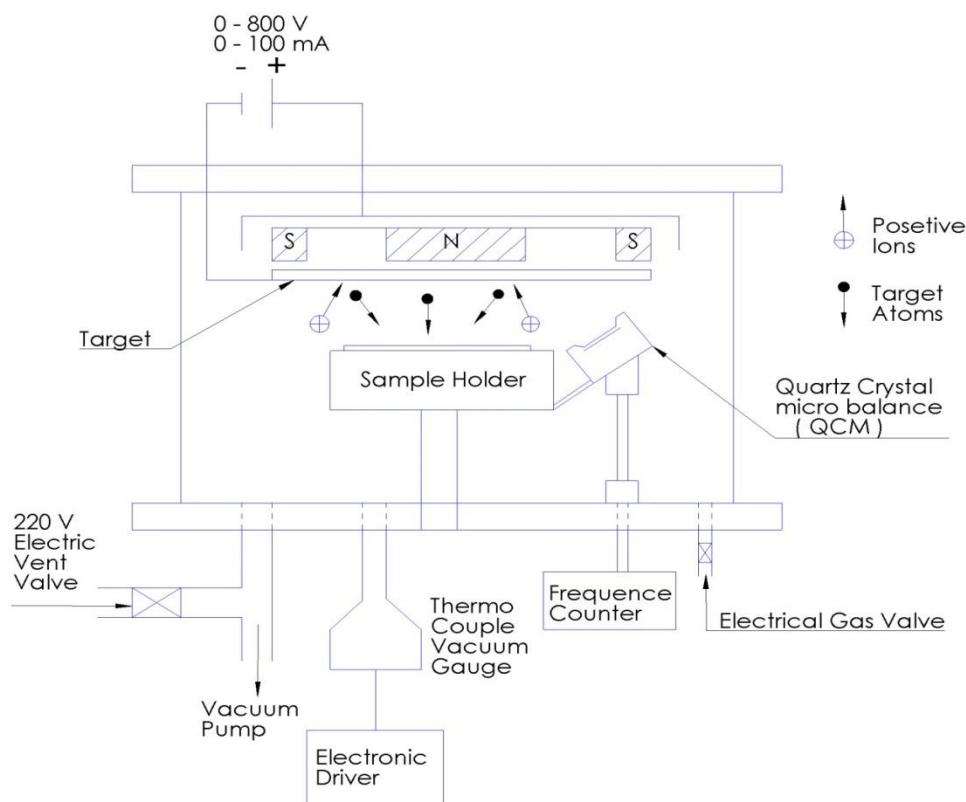
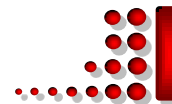


Figure 3-2: Main components of desk sputter coater DST3

The vacuum sputter coater DST3 is included of, glass chamber, an aluminum cap which magnetron cathode is installed on it, an aluminum base plate which accessories are attached to are including:

Vacuum thermo couple gauge, specimen holder quartz crystal thickness monitor, electrical vent valve, argon gas valves and a precision needle valve. Electric and electronic parts are placed in the metal box of the system and a two stage rotary vacuum pump is connected to the machine (outside of the box).

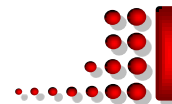
3.2.2 Services

Supply Argon Pressure: Nominal 15 psi

Electrical Supply: 230V 50 Hz 10 Amp max Supply

Vacuum Pump: Two stage rotary vacuum Pump (approx. 8m³/hour) pumping speed. Vacuum Hose: (included with instrument.) is needed.

Note: - A single phase AC supply with Earth is required - selected to the correct voltage for the country of operation.



3.3 FTM Option

The **DST3** used with a film thickness monitor, measures the thickness of coating deposited on a crystal in the chamber, and hence calculates the thickness deposited on the sample to give qualitative repeatable coatings. The quartz crystal microbalance is included of a 6 MHz quartz crystal, the starting frequency decreased when the crystal coated by the sputtered atoms. The frequency counter circuit calculated the change of frequency and converted it into thickness. The FTM can be used in two modes, **Timed** or **Thickness**. In **Timed** mode the coating runs for the pre-selected time and the FTM is enabled so that it can count the deposition and disabled at the end of the coating process. In **Thickness** mode, the required deposition is selected on the FTM. When the required thickness has been deposited, it automatically tells the coater to stop. Before start for another coating, press the zero sensor key to reset the previous thickness.

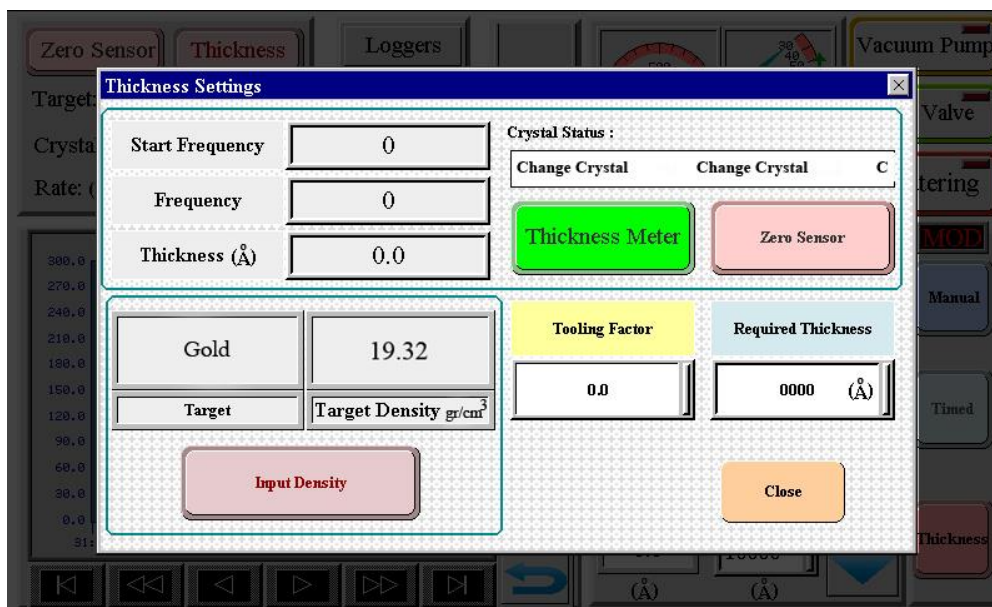
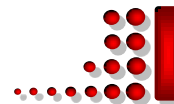


Figure 3-3: Film Thickness Monitor Options

If you plan to use a new material as a target, it is required to select the correct target in the Thickness Setting part, Input Density menu. If the new target is not



in the data base of the system, add density of the new material and then press the OK.

Tooling factor by default is adjusted on 1 (when distance of sample holder is 10 cm from the base plate). If this distance changed, in order to show the correct thickness it should be calibrated again.

“Crystal life” shows the rest life of the quartz crystal sensor, when it ended, the system will send a message “change crystal”.

If electric connection between crystal sensor and oscillator disconnected, the message of check crystal will be shown. If you press the Thickness Meter key, the thickness monitor system will be disable and it will be able if press it again.

3.4 Screen pages of display

3.4.1 Main page

All the parameters of vacuum and coating procedure are observable in this page (Figure 3-4).

By pressing the vacuum pump, it will turn on and start to evacuate the glass chamber.

Two analog and one digital indicators show the vacuum pressure of the system. At first, it takes 20 seconds that vacuum sensor to be response. If there is no leakage, the pressure should be reached to 70 mTorr in about 3 minutes. at first time, it may be take double the previous time).

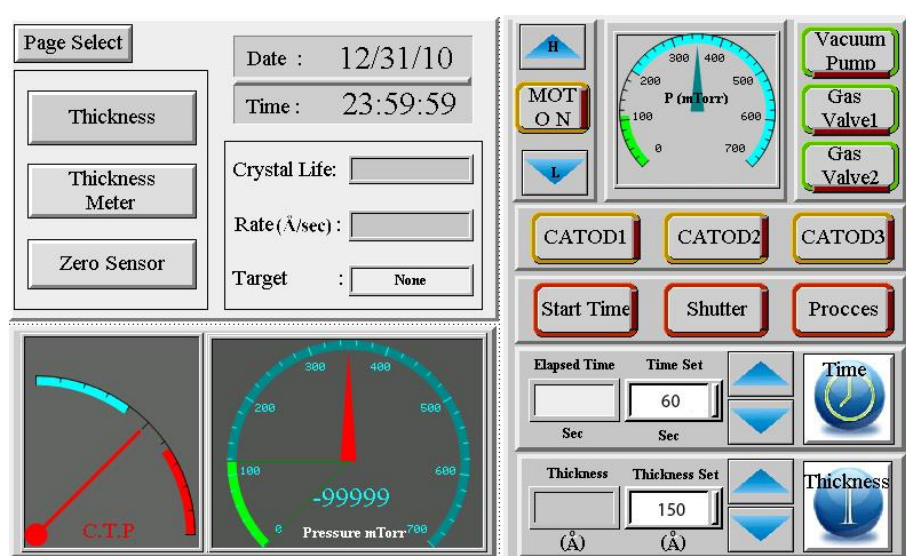
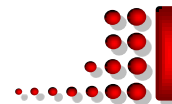


Figure 3-4: Main page



3.4.2 Logger page

The graphs would be seen better in this page and also save the data and graphs by pressing the “Save logged Data” or “Print screen”. so the scale could be changed in this page (Figure 3-5).

The vertical red line in the screen is movable horizontally, if touch and move it shows the data of the graphs in the three small rectangular windows upper side of the page.



Figure 3-5: Logger page

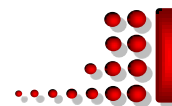


Table 2: Vertical toolbar Graph signs

	Change graphs to data
	Start to draw the graphs
	Decompressed the graphs step by step (upward)
	Compressed the graphs step by step (downward)
	Delete the graphs
	Decompressed the graphs completely

3.4.3 Operation page

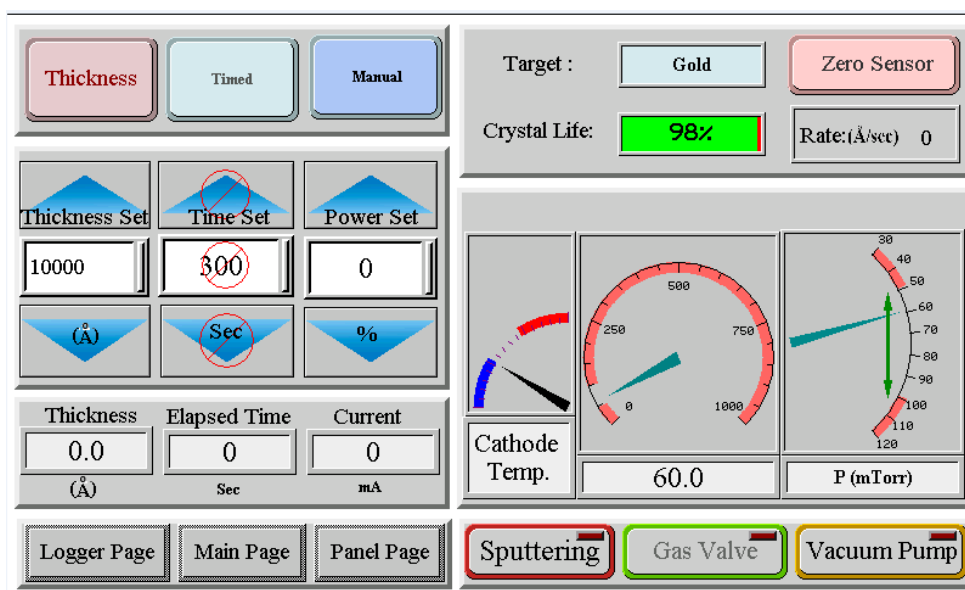


Figure 3-6: Operation page

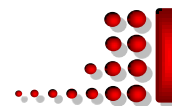


Table 3: DST3 Front touch Panel Controls

MENU	OPERATION FUNCTIONS
UP KEY	Whilst a parameter is displayed increments
DOWN KEY	Whilst the parameter is displayed decrements its value by the
ENTER KEY	Pressing this key will accept the current value of the parameter

3.4.4 Panel page

Main settings will be done in this page (Figure 3-7).

The following parameters could be set or selected in this page :

- **Language.**
- **Set time & Date.**
- **Brightness** of the screen and save the favorite brightness.
- Active or inactive the **beep sound**.
- **Admin Page:**

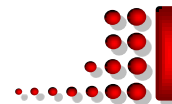
Shows how many hours the vacuum pump and switching power supply had worked.

- **Update OS & AP (Operational System & Application):**

Operator will be able to save all information of the coatings and vacuum processing, included of graphs, data text and print screen of loggers. In order to update the new version of software, it should be uploaded by following this procedure:

- After receiving the new version of software from the Nanostructured Coatings company , save it to your flash memory and connect it to the USB port of the system.
- Press the update OS & AP (**O**perational **S**ystem & **A**pplication). If the system is working may be it can not to recognize the flash memory, at this time press the Restart panel AP.
- Select the new file (with .prp extension) and when OK activated to select it, the system started to update automatically and will replace the new version by the old one.

✓ **Copy OS-AP:**



It is recommended to save a copy of the old version, before up load the new one.
You can do it by pressing Copy OS-AP.

- **Restart panel AP:**

Restart the system and come back to the start page.

- **Main button:**

To save the changes and come back to the previous page.



Figure 3-7: Panel page

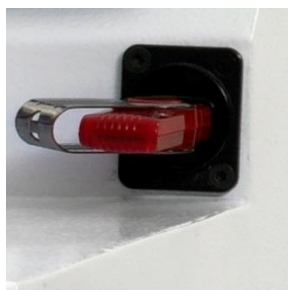
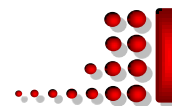



Figure 3-8: USB port



Figure 3-9: Metering valve



4. Installation

	<p style="text-align: center;">WARNING – MAIN LEADS</p> <p>This Equipment must be Earthed and fitted with the correct lead for the country of operation. This will normally be achieved from the correct mains supply socket.</p>
---	---

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

A suitable location should be provided for the unit - either operated on a bench or the recommended trolley. The total weight of the system is 24 kg. The system operating environment must be in ambient temperature range (15°C to 25°C) in a non-condensing relative humidity of not more than 75%. Sufficient ventilation is required, and positioning should be out of direct sunlight. The system is rated for continuous operation other than those supplies specified.

4.1 Preliminary Checks

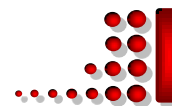
Remove Instrument from packing and place on appropriate operational position. Carry out visual inspection for any signs of transit damage.

Remove Accessories Pack and check contents against **DST3** Accessories Pack Shipping List.

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

Where a vacuum pump has been supplied, carry out preliminary checks in accordance with manufacturers recommendations. (Refer to: section 4-2-1)

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



4.2 Connections



WARNING – EARTH CONNECTOR

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

Connections should only be made in accordance with instructions. Refer To Figure 4-1 and Table 2.

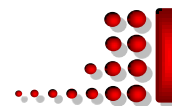


Figure 4-1: DST3 Side Panel Connections

UNDER NO CIRCUMSTANCES SHOULD ANY OTHER CONNECTIONS OR OUTLETS/INLETTES BE USED FOR ANY OTHER EQUIPMENT OR SERVICES



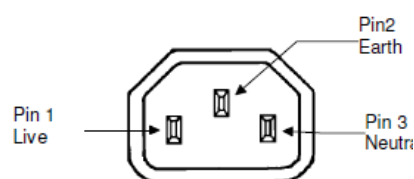
Figure 4-2: Main power switch and electric vacuum pump connection

**WARNING - OUTPUT**

This is for the pump supply only and is the main voltage at a maximum of 5 Amps

4.2.1 Pump Plug Wiring

Table 4: Pump Plug Wiring



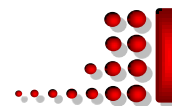
PIN	UK AND EUROPE	U.S.A. AND CANADA
Pin 1 (Live or Hot)	Brown	Black
Pin 2 (Earth)	Green / Yellow	Green
Pin 3 (Neutral)	Blue	White

Note: - A single phase AC supply with Earth is required.

Be sure the vacuum pump connections are correct. If the vacuum pump is fitted with an **ON/OFF** switch, ensure that it is left in the '**ON**' position as the Instrument will carry out required control.



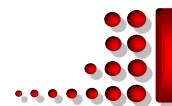
Figure 4-3: Rotary Pump Main power Switch



4.3 Initial Operating Checks

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

- Install the vacuum ball valve on the side panel and tighten with a wrench Figure 4-1 .Install brass nozzle connection on the inlet pump and tighten with a wrench (ensure its sealing O-ring is in it)
- Connect vacuum pipe to the pump and system truly and firmly fastened its clamps.
- Open the mechanical vacuum ball valve.
- Switch power on located on side panel of Instrument. The L.C.D. should illuminate showing power to the instrument, press start to enter the main page.
- Adjust the Thickness setting (Refer to section 3-3)
- Press **Vacuum Pump**, If There is no leakage the pressure should be reached to 70 mTorr in about 3 minutes, in first time it may be take double the previous time). The best pressure to start the sputtering is 50-70 mtorr and the System let to start the sputtering only after the pressure passed the 200 mtorr then sputtering button could be activated.
- Press **gas valve** sputtering could be done in Ar or Air atmosphere, In order to protect of target against oxidizing suggested to use Ar gas (to protect the gas valve from excessive heat, after 15 minutes it will turn off automatically). Adjusted the pressure by mechanical needle valve (It is very vulnerable, so it should not be too strong) . In order to decrease the residual gases inside the chamber its offering to increase the pressure of chamber by injection of Argon gas and receive to the pressure of upper than 400 mtorr hold the system in this pressure for 30 second and evacuated the chamber again.
- Coating operation can be selected based on required thickness or time. when the system received to the selected thickness or selected time, the power will automatically turn off.
- Set the power by using up and down buttons or press the power number box and inter the required power.
- Press sputtering, a pink color plasma will be formed inside the chamber and if there was enough power the coating will be started.
- In order to take the coated sample, press the “vacuum pump” then it will turn off the pump and chamber will vent automatically. (if user forget to turn off the system the vacuum pump will turn off automatically after 1 hour).



5. Operation

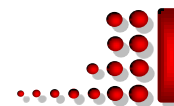
5.1 Setting Operating Parameters

There are a number of user programmable options that can be altered by the touch panel (Figure 3-4)

Table 5: Setting Operating Parameters

PARAMETER	ALLOWABLE VALUE
Coating power	0-100% (Default value 0%)
Coating Time	0-5 Minutes (Default value 300 second)
Required thickness	0-10000 Angstrom (Defaulted value 10000)
Tooling factor	0 -2 (Defaulted value 1)
Target	Target Density

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



6. Service and Maintenance

For technical and applications advice plus our on-line shop for spares and consumable parts, please visit our website for details www.PVD.IR

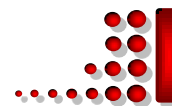


CAUTION
Ensure the main electrical power is off during any maintenance and service activities

Table 6:- Maintenance Tasks

PROCEDURE	FREQUENCY
Clean the glass chamber and the 'L' gaskets as required using Velin tissue and foam cleanser or similar. Do not use vacuum grease on 'L' gaskets.	Monthly
Check vacuum pump oil level. Change oil every 6 months	Monthly
Check the condition of the target material. The wear will depend on use. This is mainly over an outer annulus, accounting for some 70% of the surface area. When the backing plate shows at the edges, it may still be used. When this becomes excessive and sputtering is affected, the target should be replaced.	Monthly
inspect electrical power cords and plugs for general	Regularly

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



6.1 Changing the Target

Firstly, turn off the system. loosen the one small Allen screw around the electric net shield , then loosen the four small Allen screws circumference of the target holder using the Allen key provided with your spares kit.

Replace with the new target, ensuring that the screws are tightened equally and evenly and good mechanical connection.

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

6.2 Troubleshooting the DST3

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

- ☐ Check fuse: Refer to Section 6.7.
- ☐ Check vacuum pump: Local switch should be in 'On' position.
- ☐ Check chamber sealing for vacuum leaks.
- ☐ Check operating conditions of Instrument controls.
- ☐ Check Allen screws to target and connections.
- ☐ Check correct conditions for sputtering that have been set (i.e. vacuum and gas pressure).
- ☐ Check all connections.
- ☐ Check Pump Hold Enabled is set to NO.

In the event of all checks proving negative, please contact Nanostructured Coatings Co., or your local Distributor.

An Advance Delivery Modular Exchange Service Scheme is operated for the complete single module control electronics.

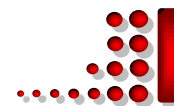
This can normally be customer installed in accordance with instructions provided.

NOTE: Spare items can be obtained from Nanostructured Coatings Co. or approved Distributor.

Nanostructured Coatings Co. recommended items should be used. For technical assistance and advice – contact company.

For fuse ratings and voltages refer to: Table 7 Fuse Listings.

If required, carry out process gas connections to side panel (Refer To: Figure 4-1) with tubing and connectors provided. The connector is push-fit and will 'snap'



into a locked position. It can be released by pushing the plastic tongue, hold it and push the tube to the outside. Any gas connected should be regulated at a nominal pressure of 10 psi. (approx. 0.8 bar)

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

Ensure the plugs are firmly placed in. Check the voltage is correct voltage for country of operation, which should correspond to the voltage label on the Instrument.

The vacuum connection is made by 1 Meter length of vacuum hosing. This is a push-on fit to the Instrument. Ensure that this is firmly in place to the full length of the vacuum connector. Then firmly tightening the clamps from two side

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

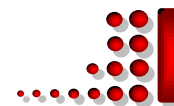
Check that the vacuum pump is filled with correct oil. If the vacuum pump is fitted with an **ON/OFF** switch, ensure that it is left in the '**ON**' position as the Instrument will carry out required control.

6.3 Spares

The following items are available from Nanostructured Coatings Co, or your local distributor.

Table 7: Spare Parts for DST3

Spares for DST3	Quantity
Glass Cylinder 6"	Each
'L' Gaskets	Pair
220 V Fuse	Pack
Targets	
Gold	Each
Silver	Each
Platinum	Each



6.4 Fuse Listings

Table 8: Fuse Listing for the 230 Volt DST3

Title	Rating	Function
Fuse1: 5 X 20 mm Glass Tube	T 6A	Main Power, located in inlet unit

7. Appendices

7.1 Return of Goods

Safety information for the return of Preparation Equipment and Accessories.

7.1.1 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 or service. The contamination of Preparation Equipment and Accessories has to be declared and the Health and Safety Declaration form completed. (Appendix -7.3.5 for the form)

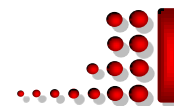
7.1.2 Health and Safety Declaration

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

7.1.3 Dispatch

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

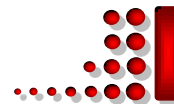
- Drain the vacuum pumps.
- Neutralize the flushing with gas.
- Seal all outlets.
- Pack glass components safely.
- Pack loose attachments securely.
- Seal in heavy duty polythene or a bag



7.1.4 Declaration of Contamination Form

Table 9: Declaration of Contamination Form

Declaration of Contamination of Preparation Equipment and Accessories. The repair and/or service of Preparation Equipment and Accessories can only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer reserves the right to refuse acceptance of consignments submitted for repair or maintenance work where the declaration has been omitted. This declaration may only be completed and signed by authorized and qualified personnel.		
1. Description of component - Equipment type/model: <hr/> - Code No.: <hr/> - Serial No.: <hr/> - Invoice No.: (if known) <hr/> - Delivery Date: (if known) <hr/>	2. Reason for return: <hr/> <hr/> <hr/> <hr/> <hr/>	
3. Equipment condition - Has the equipment been used? Yes/No - What type of operating medium was used? <hr/> - Is the equipment free from potentially harmful substances? Yes/No (If Yes go to Section 5) (If No go to Section 4)	4. Process related contamination of Equipment/ Accessories.	
	- Toxic	Yes/No
	- Corrosive	Yes/No
	- Explosive*	Yes/No
	- Microbiological*	Yes/No
	- Radioactive*	Yes/No
	- Other harmful substances	Yes/No
<hr/>		
* We will not accept any Equipment/Accessories which have been radioactively,		



explosively, or microbiologically contaminated without written evidence that such Equipment/Accessories have been decontaminated in the prescribed manner.

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

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

5. Legally Binding Declaration.

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

Name of Organization: _____

Address: _____

Post Code: _____

Tel.: _____

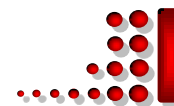
Fax: _____

Name: _____

Job Title: _____

Date: _____

Company Stamp:



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