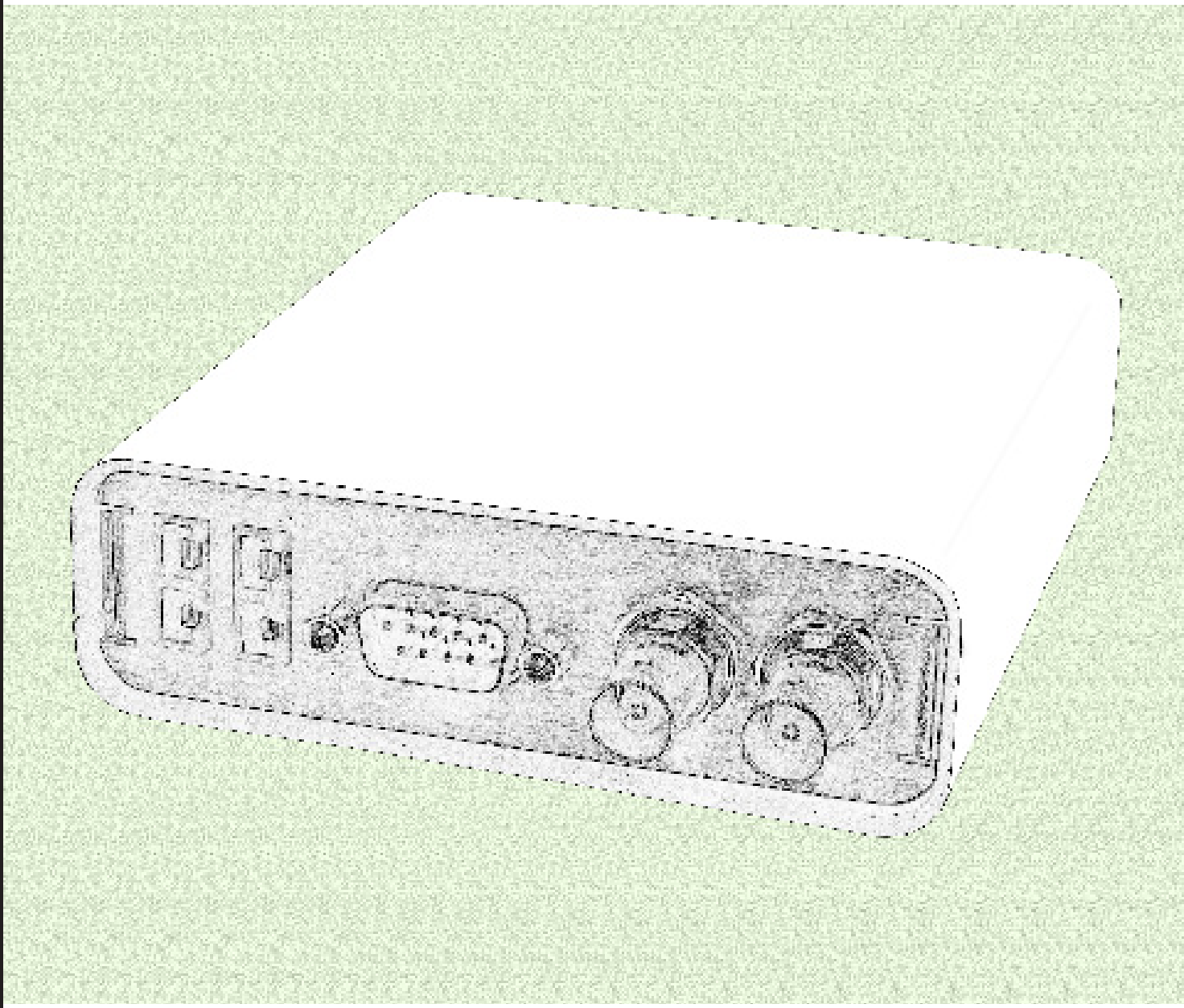
NUCLEUS PLUS™

PC-based film-thickness controller



user manual

Phillip TECHNOLOGIES™

WARNING All electrical components are to be considered extremely dangerous if tampered with in any way. Phillip Technologies is not liable for any injury resulting from product misuse, modification, or disassembly.

WARRANTY LABEL If the warranty label has been tampered with, “VOID” will appear where the warranty label was originally placed. If this is visible at the time of arrival, it is important that you contact Phillip Technologies immediately after receiving the product.

Phillip Technologies gives no condition or warranty, expressed or implied, about the fitness of this technical manual or accompanying hardware product. Phillip Technologies reserves the right to make changes to this technical manual or accompanying hardware or design without notice to any person or company.

Phillip Technologies shall not be liable for any indirect, special, consequential or incidental damages resulting from the use of this technical manual or the

February 2014
Version 3.0

EXAMINE YOUR NEW NUCLEUS PLUS™ FOR ANY SIGNS OF PHYSICAL DAMAGE. ALSO, ENSURE THAT THE TAMPER-EVIDENT LABELS ARE INTACT Before shipping, your Nucleus Plus™ was calibrated and tested by Phillip Technologies to meet the highest quality standards. It is important that you take a few minutes to inspect the product to ensure that your equipment was not damaged or otherwise

What Is the Nucleus Plus™ Thin-Film

About Nucleus Plus™
With the ability to sense deposition and temperature with high precision, the Nucleus Plus™ thin film monitor is one of the newest advancements in Thin Film deposition monitors. The Nucleus Plus™ provides features that help improve measurement accuracy for better process monitoring.

LabVIEW® Interface
The Nucleus Plus™ offers a simple LabVIEW® interface that provides control and operation that is intuitive, efficient, and impressive. The Nucleus Plus™ is easy to set up right out of the box.

Software Updates
The Nucleus Plus™ interface software can be upgraded on site to provide software improvements. There will be notifications when these updates become available.

Inspection & Initial Setup
Examine Nucleus Plus™ for any signs of physical damage. Also, make sure that the tamper-evident labels are intact. In order to ensure safe, correct operation of your Nucleus Plus™, please follow the step-by-step instructions presented in the Nucleus Plus™ Quick Start guide.

Warranty
Nucleus Plus™ is warranted to the original purchaser to be free of any manufacturing-related defects for one year from the date of purchase. Phillip Technologies reserves the right to repair or replace the unit after inspection.

Contact support@PhillipTech.com for more information.

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Power Supply
Input: 100-200VAC, 50/60Hz, 2.0A
Output: 24V-3.75A, 90W MAX

Nucleus Plus™ Thin Film Monitor
Nucleus Plus™ Monitor, BNC Sensor Inputs, Type K Thermocouple Inputs, Power

Power Supply Cable
North America standard plug (Europlug available on request)

RS-232 Extension Cable
Standard, male-to-female serial cable

USB to RS-232 Adaptor

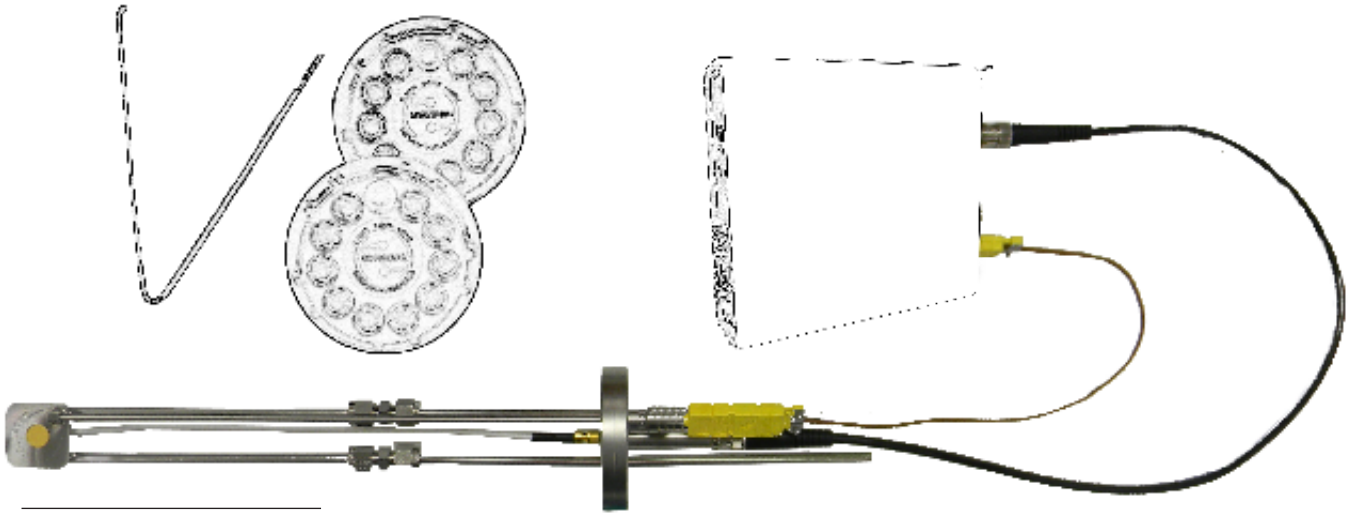
BNC to Microdot Cable

Quartz Crystals

Nucleus Plus™ Quick Start Guide

Nucleus Plus™ Software Disc
Eon LT™ software, Labview runtime, USB drivers, and manual.
Software requires administrative

Figure A: Nucleus Plus™ Package Components



Phoenix Sensor Head
Phoenix™ temperature measuring sensor head

Figure B: Proton™ Package Components

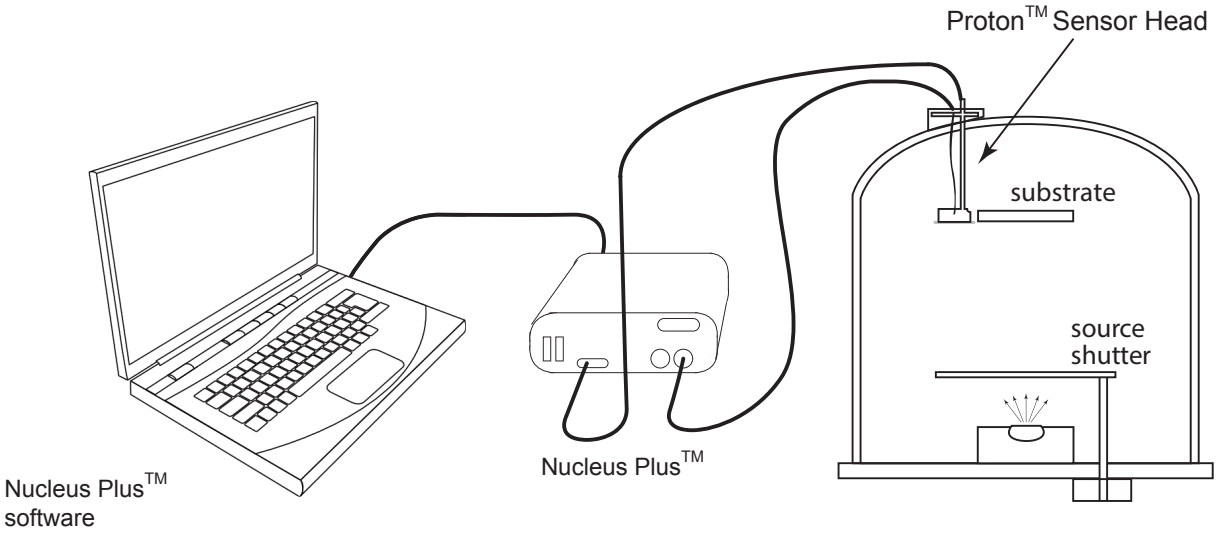


Figure C: Connections Between Proton™ System Components

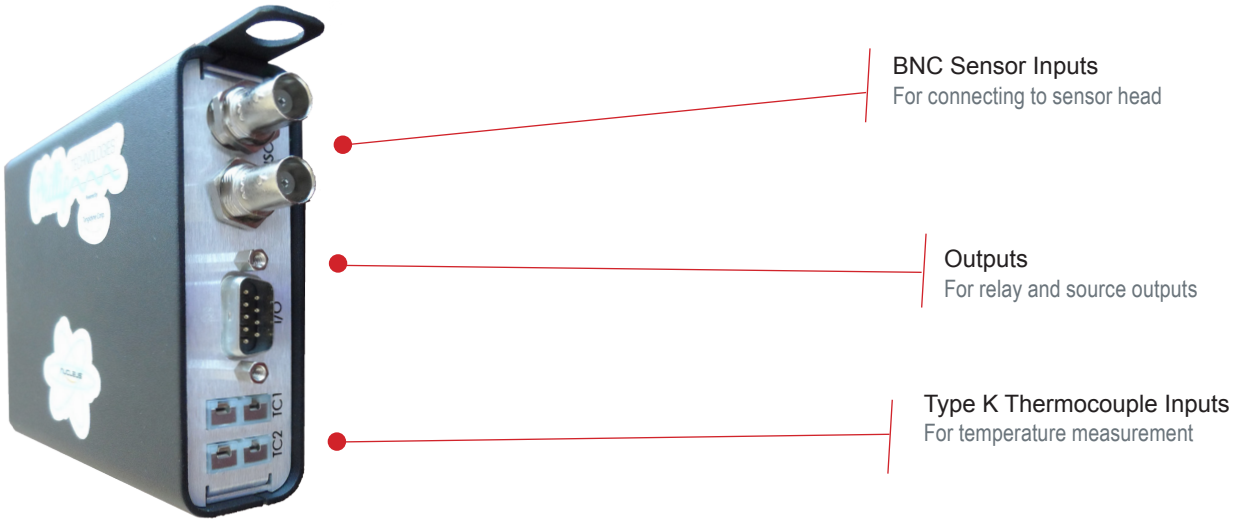


Figure D: Nucleus Plus™ Front Hardware Connections

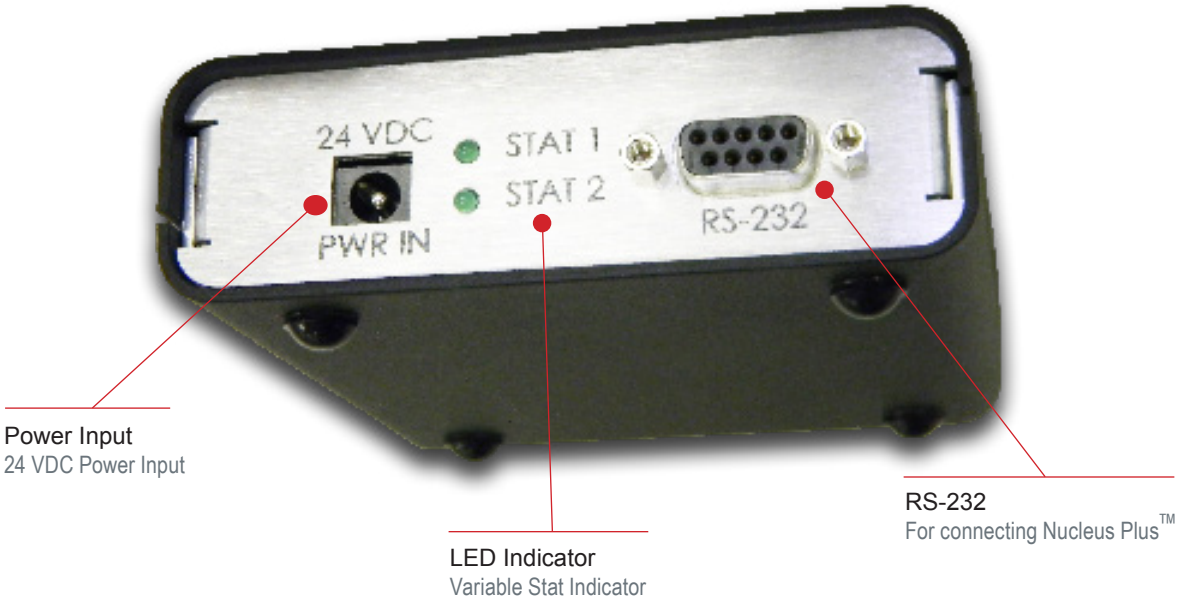


Figure E: Nucleus Plus™ Rear Hardware Connections

Nucleus Plus™ has been designed so that ONLY the correct hardware can be plugged into the appropriate input or output. The following is a guideline on how hardware should be connected in order to prevent damage to Nucle-

2.0 Connecting Inputs

There are four (4) inputs attached to Nucleus Plus™. It is important that the correct hardware is used with these inputs (see Figure E).

2.0.1 Power

Only the provided power supply should be used with Nucleus Plus™. Not doing so will cause hardware damage to Nucleus Plus™ that will not be covered by warranty. Ensure that the power supply has a 24 [VDC].

2.0.2 Comport

Connect an RS232 cable to this port. Always use the provided USB to RS232 cable.

2.0.3 BNC

Nucleus Plus™ has a built in oscillator. (Phillip Technologies also offers an external oscillator for purchase). The cable between Nucleus Plus™ and the crystal should remain as short as possible to avoid noise. The advisable maximum acceptable length for this is one (1) foot or 30 [cm].

2.0.4 TC Connection

Nucleus Plus™ uses a thermocouple probe to measure the temperature of the sensor head.

2.1 Connecting Output

There is one (1) output attached to Nucleus Plus™.

2.1.1 DB9 Connector

Connects the two SPST relays.

3.0 Controls

Change settings, activate controls, and halt process runs.

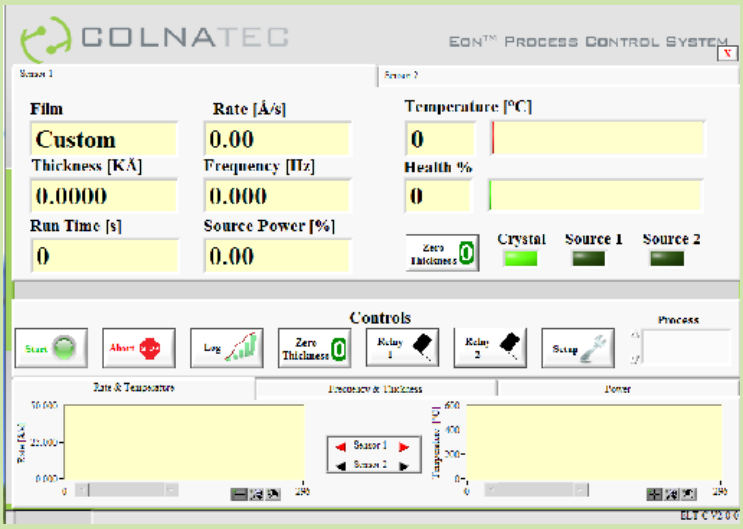


Figure F: Front Panel

3.0.1 Start

Initiates the selected deposition process. Each time a deposition process is initiated, a new log file is created.

3.0.2 Abort

Manually cancels the deposition process and closes the log file

3.0.3 Log

Logs the current running process. New log files can be found on the hard drive under “Eon Log” files.

3.0.4 Zero Thickness (ZT)

The interface contains three ZT buttons - one on each sensor tab (2) and one on the control tab. The control tab ZT button zeroes both sensors simultaneously.

3.0.5 Relay 1

Actuates Relay 1.

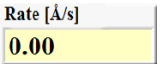
3.0.6 Relay 2
Actuates Relay 2.

3.0.7 Setup
Change settings to materials, processes, etc.

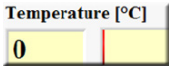
3.0.8 Process
Select the active process

3.1 Status Displays

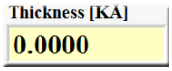
3.1.1 Film
Displays the current film being deposited.



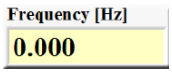
3.1.2 Rate
Displays the current rate of deposition in angstroms per second.



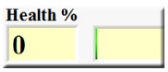
3.1.3 Temperature
Displays the TC temperature reading numerically and graphically (the fill bar covers a range of 0°C to 500°C).



3.1.4 Thickness
Displays the current thickness of the material in kilo-angstroms or angstroms.



3.1.5 Frequency
Displays the current frequency of the crystal in hertz.



3.1.6 Health
Displays the crystal health in graphical and numeric form (the fill bar covers a range of 0 to 100%).

3.1.7 Crystal
Displays if the crystal health is below 50%.

3.1.8 Source 1
Displays if Source 1 is active (above 0% power) for the current sensor.

3.1.9 Source 2
Displays if Source 2 is active (above 0% power) for the current sensor.

3.2 Graphs

These items represent the same values as the indicators, but in graphical form. Click on the tabs (graph titles) to switch between graphs. During the run you have the ability to change the scale of the x-axis and y-axis.

3.2.1 Rate Graph
Displays a graphical representation of the rate as a function of time*.

3.2.2 Temperature
Displays a graphical representation of TC temperature as a function of time*.

3.2.3 Thickness Graph
Displays a graphical representation of thickness as a function of time*.

3.2.4 Frequency
Displays a graphical representation of frequency as a function of time*.

*Unit time is dependent on sample period

4.0 Setup Menu: Layer Tab

Change layer materials, display material density, and Z-Factor

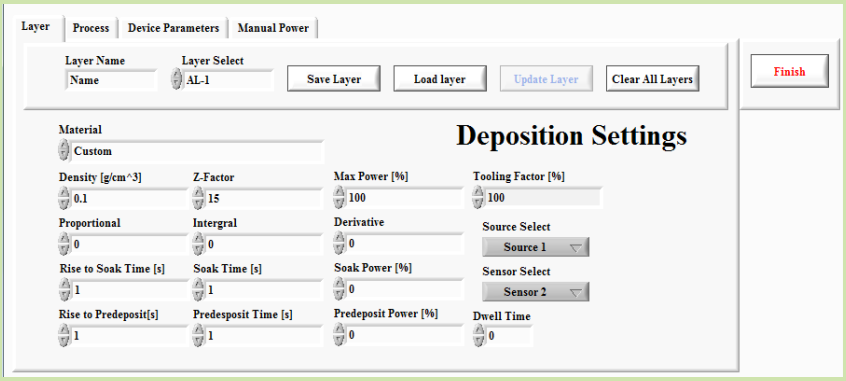


Figure G: Layer Tab

4.0.1 Save Layer
Saves the deposition settings under a new layer named as stated.

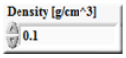
4.0.2 Load Layer
Loads the layer name selected under the Layer Select dropdown menu.

4.0.3 Update Layer
Updates any changes to the selected layer.

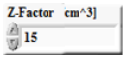
4.0.4 Clear All Layers
Clears all of the saved layers.

4.0.5 Finish
Closes the Setup Menu.

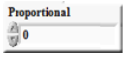
4.0.6 Material
Dropdown option enables selection of the material being deposited.



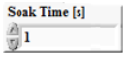
4.0.7 Density
Density of the material to be deposited is automatically populated when a material is selected. For custom densities, select “Custom” under material and enter the desired density.



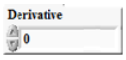
4.0.8 Z-Factor
Z-Factor of Material 1. The field automatically populates with the value selected under Material 1. The Z-Factor can be manually adjusted using the dropdown arrows.



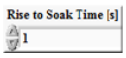
4.0.9 Proportional
Indicates the Proportional of the source.



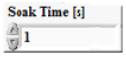
4.0.10 Integral
Indicates the Integral of the source.



4.0.11 Derivative
Indicates the Derivative of the source.

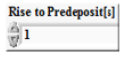


4.0.12 Rise to Soak Time
Defines the rise to soak power in seconds.

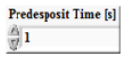


4.0.13 Soak Time
Defines the amount of soak time in the soak power.

4.0.14 Soak Power
Defines Soak power.

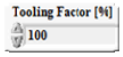


4.0.15 Rise to Predeposit
Defines the Rise to Predeposit power in seconds.

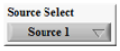


4.0.16 Predeposit Time
Defines the amount of Predeposit Time in predeposit power.

4.0.17 Predeposit Power
Determines the Predeposit Power.

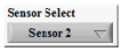


4.0.18 Tooling Factor
Selects the Tooling Factor for the material.



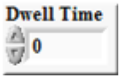
4.0.19 Source Select

Select the source which will control the material deposition



4.0.20 Sensor Select

Select the sensor that will monitor the deposition.



4.0.21 Dwell Time

Select the time delay between the predeposit and automatic deposition. This is useful when a shutter is used.

5.0 Setup Menu: Process Tab

Create a deposition process. Multiple layers (up to 10) can be added in sequence. Two layers can be selected for codeposition.

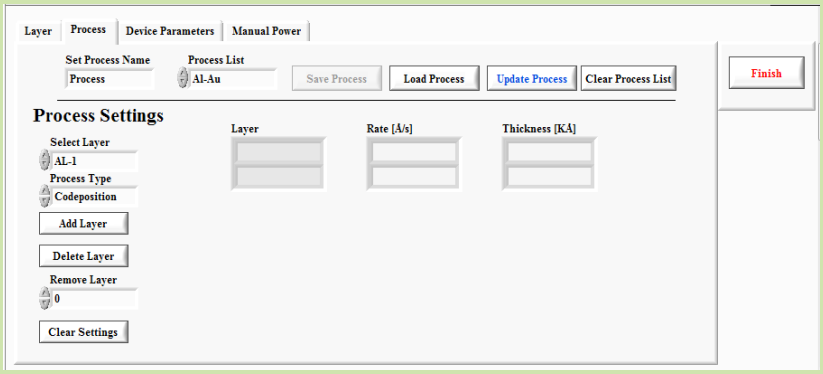
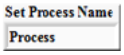


Figure H: Process Tab



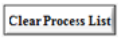
5.0.1 Set Process Name
Enter a process name.

5.0.2 Process List
This list contains the current saved processes.

5.0.3 Save Process
When a new process name is entered, this button will be enabled to save a new process.

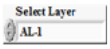
5.0.4 Load Process
When a process is selected from the process list, this button will be enabled to load the process. Processes are automatically loaded. If the process is changed, press the Load Process button to reload the previous settings.

5.0.5 Update Process
When the process has been changed, press the update process button to save the changes

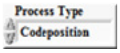


5.0.6 Clear Process List
This button deletes all of the saved processes.

5.0.7 Finish
This exits the setup window. Save any changing before pressing Finish.



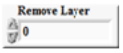
5.0.8 Select Layer
Select the layer for the process



5.0.9 Process Type
Selected if user intends to add multiple layers.

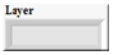
5.0.10 Add layer
Adds the currently selected layer

5.0.11 Delete layer
Deletes the current “remove layer” number.



5.0.12 Remove layer
Selects the layer to be removed after pressing the “Delete Layer” button

5.0.13 Clear settings
Clears all of the currently active processes settings.



5.0.14 Layer
Displays the name of the layer to receive deposition.

5.0.15 Rate [A/s]
The target deposition rate for the active layer

5.0.16 Thickness [KA]
The target thickness for the active layer. (This field displays information only and cannot be changed).

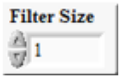
6.0 Setup Menu: Device Parameters Tab

Change tooling factor, name log file, select crystal frequency type, and adjust period manually

Figure I: Device Parameters Tab

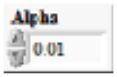
6.0.1 Append Log Name

Log files can be named in the Append Log Name box.



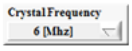
6.0.2 Filter Size

The buffer size for averaging time



6.0.3 Alpha

Alpha is a data-smoothing parameter. Increase Alpha for **quicker** response. Decrease Alpha for **smoother** response.

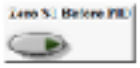


6.0.4 Crystal Frequency

Crystal frequency range can be selected on the dropdown (6MHz or 5 MHz option).

6.0.5 Zero Before Run

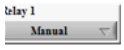
Zeros the thickness before a process starts.



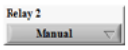
6.0.6 Zero S1 before PID

Zeros Sensor 1 before entering into automatic deposition.

6.0.7 Zero S2 before PID
Zeros Sensor 2 before entering into automatic deposition.



6.0.8 Relay 1: Operation mode for relay
Actuates Relay 1 (see Table 1 for functions)



6.0.9 Relay 2: Operation mode for relay
Actuates Relay 2 (see Table 1 for functions)

6.0.10 Update Parameters
Updates Nucleus Plus™ with any changes made in the Device Parameters tab. In order to implement any changes to the device parameters, Update Parameters must be selected.

Table 1 - Coating

Function	Description
Manual	No automatic action. The relay button must be pressed to actuate
Start	Triggers the relay when a process is started
After Predeposit	Triggers the relay after a predeposit is complete
Predeposit Trigger	Triggers the relay when the predeposit starts.

7.0 Setup Menu:
Manual Power Tab
Change deposition power manually using Manual Power tab.

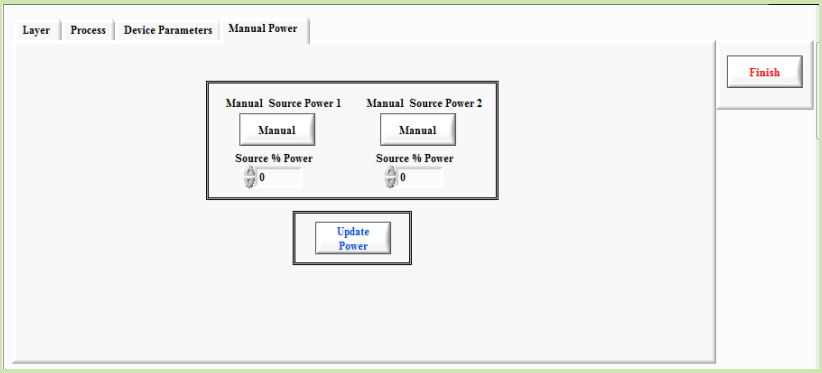
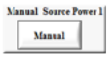
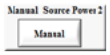


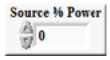
Figure J: Manual Power Tab



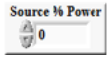
7.0.1 Manual Power 1
Enables manual power for Source 1.



7.0.2 Manual Power 2
Enables manual power for Source 2.



7.0.3 Source 1% Power
Sets the percent power for Source 1.



7.0.4 Source 2% Power
Sets the percent power for Source 2.

7.0.5 Update Power
Sets manual power. If left unselected, power will remain unchanged. As a safety feature, if power is changed and the button is unselected, power will return to 0%. Power also returns to 0% when exiting the setup window.

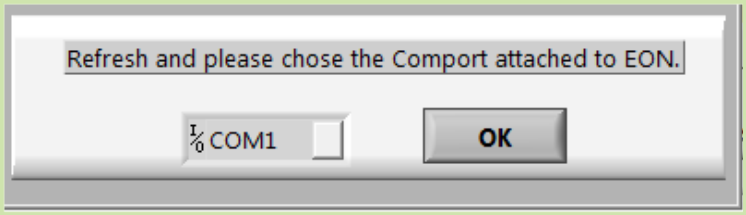


Figure K: Comport Selection Prompt

8.0 Communication Port Selection
The COMPORT prompt will appear when you start the software for the first time. (**Note:** The software will save your settings for future operations. The prompt will NOT appear during subsequent starts. The COMPORT prompt, however, will re-appear if Nucleus Plus™ is

8.1 Procedure

1. Plug in the Nucleus Plus™ and all of its components

2. Open on the Nucleus Plus™ software and select the correct COMPORT

3. Click the Setup button and open the Setup Menu.

4. Select the material and make sure the Density and Z-Factor is correct and save layer

5. Switch to the Device Parameters tab

6. Select the correct Crystal Frequency, Tooling Factor, and name the log file, alpha values, and filter

7. Press the update parameters button.

8. Press FINISH when all changes are saved

9.0 Adding a Layer

This guide will instruct on how to add a new layer to be used in the deposition process. This is done from the “Layer” tab in the Setup window.

9.0.1 Enter the desired layer name in the “Layer Name” Field

9.0.2 Press the “Save Layer” button to save the new layer

9.0.3 Enter the desired information for the process.

9.0.4 Press “Update Layer” to save the changed settings.

9.0.5 Press “Finish” if there are no more changes to save.

9.1 Adding a Process

This guide will instruct on how to add a deposition process. This is done from the “Process” tab in the Setup window.

9.1.1 Enter the desired process name in the “Set Process Name” field.

9.1.2 Press the “Save Process” button to save the new process.

9.1.3 Select the layer to be added under “Select Layer”

9.1.4 Select the process type under “Process Type”

9.1.5. If using codeposition, only 1 more layer will be available to be added.

9.1.6 If using sequential, up to 10 layers will be available to be added.

9.1.7 Press “Add Layer” Button.

9.1.8 In the “Rate [A/s]” Field for the newly added layer enter the target rate for the deposition

9.1.9 In the “Thickness [K/A]” field for the newly added layer, enter the target thickness for the deposition.

9.1.10 Repeat steps 9.1.2 to 9.1.7 to add more layers.

9.1.11 When all changes are saved, press “Finish” to exit the setup window.

9.2 Starting a Deposition

This guide will instruct on how to begin a deposition process. This action is performed in the front panel. The setup window should not be open when starting a deposition.

9.2.1 Select the process to be deposited from the “Process” Selection

9.2.2 Ensure that the correct sensor tab is selected.

9.2.3 Press “Start” to start the deposition

9.2.4 If the processes needs to be aborted, press the “Abort” button.

9.2.5 Wait for the process to complete and the “Process Complete” window to appear.

9.2.6 Repeat stops 9.2.1 to 9.2.6 to start other processes.

Table 2 - Troubleshooting*

Symptom	Cause	Solution
Frequency reads -2.0 [Hz]	Sensor not detected	Check sensor connection
No information displayed	Wrong comport selected	Restart and select the correct comport.
Rate reads -1	Improper settings	Restart software and Nucleus Plus™

*If you cannot resolve an issue, please contact Phillip Technologies support at support@PhillipTech.com, or call (480)

11.0 Device Parameters

Table 3 - Device Parameters

Density	0.10 to 99.99 [g/cm3]
Z-Factor	0.00 to 15.00

11.1 Deposition Settings

Table 4 - Coating

Density	0.10 to 99.99 [g/cm3]
Z-Factor	0.00 to 15.00
Rate Setpoint	0.00 to 9999.99 [Å/s]
Thickness Set Point	0.00 to 9999.99 [KÅ]
Proportional Gain	0.00 to 999.99
Integral Time	0.00 to 999.99 [s]
Derivative Time	0.00 to 999.99 [s]
Rise to Soak	0.00 to 999.99 [s]
Soak Time	0.00 to 999.99 [s]
Soak Power	0.00 to 99.99 [%]
Rise to Predeposite	0.00 to 999.99 [s]
Predeposit Time	0.00 to 999.99 [s]
Predeposit Power	0.00 to 99.99 [%]

11.2 Measurement

Table 5 - Measurement

Frequency Resolution	+/-0.002 [Hz]
Display Rate	10x to 1x per second
Crystal Frequency Range	5 or 6 [MHz]
Filter	0-1
Alpha	0-1

11.3 Display

Table 6 - Process Display

Film	Selected Material
Rate	0.00 to 99.9 [Å/s]
Thickness	0.00 to 999.9[KÅ]
Frequency	-3.00 to 6,500,000 [Hz]
Run Time	Hh/mm/ss
Temperature	0 to 999.9 [°C]
Health	0.00 to 100 [%]

11.4 Communications

Table 7 - Communications

Factory Set	RS-232 [PC version]

11.5 Deposition Settings

Table 8 - Inputs and Outputs

Voltage input	24 [VDC]
RS232 Input	One Half Duplex
Sensor Input	Two BNC Connector
TC Output	2 Type K Connectors
0-5 [VDC] Control Output	One DB9 Connector
Dual Relay Output	

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