Metricon Model 2010/M Prism Coupler
Bulk Material, Thick Film Index/Birefringence/
Thickness Measurement System Standard
Operating Procedure

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# TABLE OF CONTENTS

1. **Introduction** .............................................................................................................. 4  
   1.1 Scope of Work ......................................................................................................... 4  
   1.2 Description ............................................................................................................. 4  
   1.3 Safety ...................................................................................................................... 6  

2. **Hardware** .................................................................................................................. 7  

3. **Requirements** .......................................................................................................... 8  
   3.1 Training .................................................................................................................. 8  
   3.2 System Restrictions .................................................................................................. 8  

4. **Operating Procedures** ............................................................................................ 11  
   4.1 System Pre-Checks ................................................................................................. 11  
   4.2 Operating the Metricon Model 2010/M Prism Coupler/ System Start Up  
       System Configuration Parameters and Table Referencing ........................................ 12  
   4.3 Operating the Metricon Model 2010/M Prism Coupler /  
       Loading Wafers and Measurements ...................................................................... 17  
   4.4 Unloading Wafers and System Shutdown ............................................................... 25  
   4.5 Recipe Creation and Saving .................................................................................... 27
1 INTRODUCTION

1.1 Scope
These procedures apply to the Metricon Model 2010/M Prism Coupler Bulk Material, Thick Film Index/Birefringence/Thickness Measurement System. All maintenance should follow the procedures set forth in the manufacturer’s maintenance and operations manuals. This document is for reference only. Personnel should be trained by authorized staff before operating this equipment.

1.2 Description
The Metricon Model 2010/M Prism Coupler Bulk Material Index, Thick Film Index/Birefringence/Thickness Measurement System utilizes advanced optical wave guiding techniques to rapidly and accurately measure both the thickness and the refractive index/birefringence of virtually any film which is not strongly absorbing at the measurement wavelength (633nm). Practically all films index and thickness can be measured provided the film thickness is adequate to support at least two optical propagation modes. Films are measurable on almost any substrate, including high index or absorbing substrates such as silicon or metals. Virtually any bulk material which is not strongly absorbing at the measuring wavelength is also measurable.

The Model 2010/M data analysis software is completely general permitting measurements of nearly any film without knowing anything about the optical properties of the film or substrate.

The following is a representative list of films, substrates and bulk materials types which can be measured by Metricon 2010/M system. (Free-standing films or bulk samples of any of the below film materials are also measurable):

- **Films:** SiO2 (doped and undoped), silicon nitride, plasma SiN, silicon oxynitride, photoresists, polyimides, polyaniline, liquid crystals, PMMA, holographic gels, sol gels, silicon, SiC, diamond, epi garnets, electro-optic polymers, AlGaAs, BaTiO3, GaN, InP, ITO, KTP, MgO, PZT, PLZT, Si, Ta2O5, TiO2, YIG, ZnS, ZnSe, ZnCdSe, ZnMnTe, ZnMgTe.

- **Bulk or substrate materials:** Quartz, optical glasses, chalcogenide glasses, sapphire, PET, polycarbonate, polyethylene, polystyrene, LiNbO3, LiTaO3, SiC, ZnS, GaP, GGG, MgO, YAG and other laser crystals.
The following lists the advantages, types or measurements, measurement applications and resolutions limits of the Metricon Model 2010/M Prism Coupler

Advantages when measuring refractive index for both thin films and bulk materials:

- Unparalleled index accuracy: ±.0002 to ±.0005 (depends on application)
- Index resolution: ±.0001 to ±.0003 (depends on application)
- Wide refractive index range (1.0 - 3.35) available. Current Prism Coupler part number 200-p-4 (Code = 6561) **index range 1.4 to 2.0.**
- Wavelengths ranging from 405-1550 nm are available. The system is configured with **Class II 632.8nm HeNe red LASER.**
- No advance knowledge or modeling of samples required
- Little/no sample preparation required, no coupling fluids
- Easy to use with flexible samples such Polyimide and Kapton
- Also measures liquids upon approval and appropriate sample preparation.

Measurement types available with a single Model 2010/M system:

- Refractive index and thickness for thin films/coatings
- Refractive index for bulk materials (glasses, rigid/flexible polymers, silicones/epoxies)
- Birefringence for thin films/coatings and bulk materials
- Dispersion (index vs wavelength), Abbe number. Available option but not configured.
- Index vs temperature (δn/δT). Available option but not configured
- Loss for optical waveguides
- Index gradient determination
- SPR (surface plasmon resonance)
Measurement applications in a broad range of end markets and research topics:

- Displays and storage devices
- Polymer materials/coatings (PET, polyethylene, polypropylene...)
- Encapsulants (silicones, gels, epoxies...)
- Optical Waveguides
- Semiconductor processing
- LCDs
- Energy (solar cells, LEDs)
- Glass and polymer optics (visible and infrared)
- Ophthalmics (contact and eyeglass lenses)
- Nanomaterials and Biological sensors

### 1.3 Safety

1.3.1 This machine is connected to **120 VAC** so be very careful and aware of electrical hazards. If you encounter any electrical malfunctions, open leads, disconnected power cords contact NRC staff immediately.

1.3.2 This machine has **NO EMO** (Emergency Off), if electrical power must be removed from system it must be unplugged or the surge protector switch ON/OFF switch be turned OFF.

1.3.3 This machine uses **Class II 632.8 nm HeNe Laser emitting 1 mWatt (milli-Watt) of low power radiation.** Do not stare into the LASER beam or its reflection.

1.3.4 The stage is capable of movement, take care not to pinch your fingers.

1.3.5 During LASER table reference or film/bulk measurement scans always place the isolation box lid on the top chamber opening.
1.3.6 Read any posted **NRC Engineering Change Notices (ECN)** for any hardware, process or safety changes before running the tool.

2 HARDWARE

2.0 Optical module dimension are 15 in (38 cm) wide, 22 in (56 cm) deep, 12 in (30 cm) tall/40 lbs (18 kg). The unit rest on a vibration isolation table.

2.1 The HeNe LASER and alignment mirrors, prism coupler and wafer holder are mounted in a noise isolation chamber/box with lid to block out clean room ambient light from reaching Si detectors and confining the LASER beam from propagating around the room.

2.2 The tool is configured with Class II 632.8nm HeNe Laser:

Class 2 lasers are CW and repetitively pulsed lasers with wavelengths between 0.4 µm and 0.7 µm that can emit energy in excess of the Class 1 AEL, but do not exceed the Class 1 AEL for an emission duration less than 0.25 seconds and have an **average radiant power of 1mW or less**.

2.3 The tool is configured with Prism Coupler part number 200-p-4 (Code = 6561).

**Index range 1.4 to 2.0.**
2.4 The Metricon Model 2010/M is equipped high resolution table (0.6/0.3 minutes). The higher resolution table is better when film thickness exceeds 5-7 microns, or when improved index resolution and accuracy are required.

2.5 The measurement and referencing operations are controlled by Pentium 486 processor using DOS commands.

2.6 The measurement time is 20-75 seconds with the high resolution table.
3 REQUIREMENTS

3.1 Training

You must be a qualified user on the Metricon Model 2010/M Prism Coupler. The training is supplied by a Nanofab staff member please contact the tool owner to schedule training.

3.2 System Restrictions

3.2.1 Metricon Model 2010/M Prism Coupler designed to rapidly and accurately measure both the thickness and the refractive index/birefringence of virtually any film which is not strongly absorbing at the measurement wavelength (633nm).

3.2.2 The tool can be used to measure refractive index and thickness on 1" to 6" diameter wafer and small sample pieces (minimum ½" by ½" samples). All samples must be loaded symmetrically in the left to right direction and the height adjusted with the height adjustment knob so the center of gravity is at the coupling spot or slightly below the coupling spot (this prevents sample vibration or rotation of the sample during table movement).
3.2.3 User are **ONLY** allowed to adjust the LASER position by using the front panel x and y laser positioning micrometers to align the LASER to the upper right of the prism and/or the intimate contact spot (**coupling spot**) on the wafer. Call staff for assistance.

3.2.4 Users are **NOT** allowed to adjust the LASER tube position at the base or alignment mirrors located at the base of the measurement box.

3.2.5 Users are **NOT** allowed to clean the prism base with any cleaners such as Acetone or Isopropanol alcohol (chemical will leave a thin layer that will affect the measurement). If you suspect the prism needs to be cleaned call staff to check.

3.2.6 User are not allowed to adjust the wafer holder piston **CDA** pressure.

3.2.7 User are **NOT** allowed to adjust the **GAIN** or **OFFSET** of the prism coupler controller (Table controller and Si sensor signal)
3.2.8 Measure only clean dry films and bulk material capable of being measured.

3.2.9 The films and bulk material must be capable of being measured. To a rough approximation the angular location of the 1st mode (dip) determines the film index while the angular difference of subsequent modes determines the thickness and standard deviation of the thickness calculations. If you are not sure ask staff to check.

3.2.10 For most film /substrate combinations a thickness of 100nm to 200nm is required to support the 1st mode for determining refractive index only.

3.2.11 Films/substrate combinations with a thickness of 300nm to 500nm (depending on the film/substrate type) can support two or more modes for determining refractive index and thickness measurements.

3.2.12 Films/substrate combinations of 500nm to 15μm can support 4 to 5 modes for determining multiple estimates of refractive index, thickness and standard deviation calculations for these estimates can then be determined. For standard deviation measurement that are low, typically 0.3% for thickness and 0.1% for index there is small chance that an appreciable error occurred.

3.2.13 For thicknesses greater than 15μm up to 150μm-200μm thickness range index can be measured using bulk measuring method.
4 Operating Procedures

4.1 System Pre-Checks

4.1.1. The tool power cords should always be plugged in to long surge protector outlets. If the power cords are not plugged in call staff to check.

4.1.2. Open the compressed air (CDA) valve by turning the knob CCW two turns. Check to ensure the wafer holder piston CDA pressure gauge located on the right side of the chamber box is between 45-55 psi.

4.1.3. Check to ensure the isolation chamber/box lid is place on the box top opening. Remove the lid and inspect the interior base for and broken wafers or debris. If any broken wafer pieces are found call staff to check and clean.
4.1.4 Check to ensure the LASER power supply output connector (white two lead connectors) is connected to the laser power supply. If disconnected call staff immediately. This is a high voltage lead.

4.2 Operating the Metricon Model 2010/M Prism Coupler / System Start Up / System Configuration Parameters and Table Referencing

4.2.1 Turn ON the 633nm HeNe LASER by moving the red switch to the ON (1) position as shown. The switch light will turn On. Allow the LASER to warm up 10 minutes.

4.2.2 Turn ON the Metricon Prism Coupler controller by moving the back panel switch to the ON position (1) as shown. The controller front panel green led will illuminate.

The Gain setting should be > 1 milliamperes ( 1 mA) . Do not adjust the GAIN or OFFSET call staff to obtain approval to change.
4.2.3 Turn **ON** the System Computer by pressing the ON push button. Check the computer power supply fan is ON by feeling for fan air flow. Check to ensure the computer monitor is **ON**.

4.2.4 The Computer will begin to boot up and initialize displaying "**Model 2010 Configuration Screen**" as shown. The cursor (blinking) will automatically default to the top of the screen is the Data storage file name line.

4.2.5 At the Data Storage File Name line enter a **filename** for your film and press the Enter key twice (2X) on the keyboard.

4.2.6 The cursor will automatically move to the next configuration field by pressing Enter key twice (2X) on the keyboard to save the data entry value or by pressing the Tab key to move the cursor (no saving).

4.2.7 The next field is the **Substrate Index**. Use the number keypad to enter the substrate index and press the Enter key 2X.

4.2.8 The next field is prism code. Use the number keypad to enter **6561** and press the Enter
The next field is the **Start Scan** position. Enter a number between 400 to 700 on the number keypad and press the Enter key 2X. Entering **700** is optimal and should work best.

4.2.10 The next field **Scan Stop** position. Enter the letter “**D**” and press the Enter key 2X. The “**D**” entry is the default position setting of - **952**. Entering “**D**” (-**952**) is optimal and should work best. From 700 to - 952 with roughly scan **70°** of table rotation.

4.2.11 The next field is Printout Format. Use the number keypad to enter **3** press the Enter key twice 2X

4.2.12 The next field is Disk Save Format. Use the number keypad to enter **3** press the Enter key twice 2X

4.2.13 The next field is Record results in ASCII file. Disk Save Format. Use keyboard to enter **yes** press the Enter key 2X

4.2.14 The next three fields are Sort key1, Sort key 2 and Sort key3. To keep the default values press keyboard Enter key twice 2X for all three fields.

4.2.15 The last field is “**enter access code for protected configuration screen**”. Use keyboard press the Enter key 2X to skip.

4.2.16 The cursor will scroll back to the first field at the top of the screen: Data storage file name. To make any changes to the filename or measurement parameters follow steps **4.2.5 to 4.2.15**

4.2.17 When you are done setting the filename and measurement parameters press the Esc key to return to the Results screen.

4.2.18 The Prism Couplers rotatable table needs to be referenced after each powering up
sequence. Once the table referencing has been completed it is NOT necessary to reference the table again, however to re-check or test the table referencing press the Home key on the keyboard to perform a table reference.

The Prism Coupler table referencing locates-determines the angles where the LASER retro-reflects the maximum intensities from the prism, as the table rotates in a CW then CCW directions the LASER retro-reflects two bright spots from the prism back to mirror #3 and then downward passing the reference slit onto the Si photo sensor. The brighter of the two reflected intensities determines the reference zero angle. This occurs when the LASER beam is perpendicular to the entrance face of the prism.

4.2.19 In the Results screen the screen will display "Prism Coupler Table Referencing " At the bottom of this screen are F1 to F9 function keys to change film measurement modes, substrate indexes, plot screen limits, table angle resolution and step skips.

To perform an automatic table referencing press the F1 keyboard key. “Looking for peak on reference detector” will be displayed

4.2.20 During the referencing the rotary table will rotate CW then CCW, the two bright LASER retro-reflections will pass the reference slit and be detected by the Si photo sensor.
The screen will display Intensity versus Angle plot as shown.

The table zero reference angle is defined as the angle (0˚) where the brightest retro-reflection is detected by the Si sensor displaying a maximum intensity and is notated by a red line marker on the Angle axis as shown. A good intensity measurement should be peak at 50% of the Intensity axis screen limit.

4.2.21 Before and after (and during) the automatic table referencing the Metricon Prism Coupler controller GAIN should be near 0.2 mA.

4.2.22 After the table referencing has completed the software will display the message “reference peak located. Press any key to continue “.

4.2.23 If the signal looks normal (a good intensity measurement should be peak at 50% of the Intensity axis screen limit) then press any key to continue.

4.2.24 If the table reference Intensity signal is low or the system displays “Reference not Detected “ message, check to ensure the LASER is striking the prism in the upper right corner of the prism as shown.
4.2.25 To make small adjustments to the LASER position striking the prism, carefully rotate the appropriate LASER positioning adjustments knobs located on the front of LASER box/chamber. The knobs will move the LASER position horizontal and vertically. If necessary use a small piece of lint free paper as a contact/spot guide on the prism contact spot (upper right corner of the prism).

4.2.26 If you have any questions about the LASER position/location on the prism call staff.

4.2.27 To retest an automatic table referencing press HOME key the F1 key on the keyboard.

4.2.28 **If the signal look good press any key to continue.**

4.2.29 If you encounter any other error messages “Table does not move smoothly or stalls”, "Analog meter signal weak" , or continues to have "Reference not Detected" call staff to check.

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**4.3 Operating the Metricon Model 2010/M Prism Coupler / Loading Wafers and Measurements**

4.3.1 To load your wafer to be measured, 1st removed the chamber/box lid and set aside.

4.3.2 Using tweezer carefully place your wafer on the adjustable wafer holder support with the film side facing the prism base.
4.3.3 All samples must be loaded symmetrically in the left to right direction and the height adjusted with the height adjustment knob so the center of gravity is at the intimate contact (coupling spot) or slightly below the contact/coupling spot. (this prevents sample vibration or rotation of the sample during table movement).

4.3.4 If you need to adjust the wafer holder height for different wafers, sample sizes, or to find best center of mass at the intimate contact spot rotate the height adjustment knob CCW, then carefully slide the wafer support holder UP or DOWN to the optimum height and re-tighten the adjustment knob CW as shown.
4.3.5 Gently move the wafer (film facing the prism base) against the prism base so that the wafer is level and making contact with the prism base. Flip the switch on side of prism box to enable the metal rod coupling head to make contact with the back of the wafer.

4.3.6 Flipping the switch on the side of the prism box the metal rod coupling head will push on the back of the wafer so it is pressed tightly against the prism creating an intimate contact spot.

The coupling head has a spherical shape and it deforms (bends) the sample so that only the part of the sample directly in front of the coupling head tip makes really intimate contact with the prism. The coupling head tip is aligned not to the center of the prism but to the upper corner of the prism closest to the user so the contact spot can be seen by looking in the upper right hand corner of the prism.

4.3.7 Check to ensure the wafer surface intimate contact spot (black spot) is present at base of prism and the LASER red light is hitting the black spot or very near (1mm) the black intimate contact spot as shown.
The coupling head tip is aligned not to the center of the prism but to the upper corner of the prism closest to the user so the contact spot can be seen by looking in the upper right hand corner of the prism.

4.3.8 Replace the chamber/box lid back to cover the chamber/box opening blocking all ambient light. If the lid hits the top of the wafer you will need to make slight adjustments the wafer height level.

4.3.9 From step 4.2.28  **If the signal look good press any key to continue.**

4.3.10 To load and measure from previously stored recipes go to section 4.5 **Recipe Selection and Saving** and follow **steps 4.51 to 4.53**

4.3.11 In the Main Measurement screen the fields along the bottom of the Main Screen (sample ID, wavelength, etc.) show the Parameters of the **next** measurement. The fields at the top of the screen show the parameters of the **current** measurement (the measurement currently displayed on the screen).

4.3.12 Tab to cursor to bottom screen to “**Enter new sample ID**”
4.3.13 Use keyboard to enter next measurement filename then press the Enter key.

4.3.14 Check the GAIN control to give 70-80% of reading on analog meter (0.7 to 0.8 mA). If analog meter goes over scale during a measurement scan, reduce GAIN and scan again. The OFFSET should also be already at highest value.

4.3.15 To start the automatic scan measurement from Main screen press the F1 button. The measurement time is 20-75 seconds with the high resolution table.

4.3.16 The rotary table will begin to rotate through the SCAN START and SCAN STOP angular rotation limits (Integer numbers entered are interpreted as rotary table steps angular range of scan). The display will plot Intensity versus Table Steps Integer values (angular range of scan). The Modes will automatically be located and they will appear as valleys (dips) on the screen and a red line marker will be displayed at the transmission mode angle as shown.

4.3.17 The valleys (dips) should fit nicely on the graph of the screen. If the dips are too shallow the wafer coupling head pressure may need to be increase, if the dips are too deep the pressure may need to be deceased. Ask staff to check.

4.3.18 To remove erroneous dips move the left or right arrow keys on the keyboard and press enter.
4.3.19 Depending on the sample thickness below the plot will be displayed the positions of all the modes located, index of refraction, thickness (µ) and standard deviation (SD) of index and thickness.

![Image](image_url)

**Notes:**

**Mode pattern appearances:**

Thick film modes appear as a series of sharp dips on the intensity vs angle curve. The angular location of the first mode depends primarily on the film index (for example, as film index increases, the mode pattern shifts to the left). The spacing between the modes is determined primarily by the thickness (spacing decreases as thickness increases). However, it is normal for the distance between the modes to increase by 25-50% as you move from left to right on the curve.

Each mode is characterized by a quantity called effective index defined as \( n \times \sin(\theta) \) where \( n \) is the index of the film and \( \theta \) is the angle of propagation angle of the laser beam inside the film. The effective index for each mode is shown in parentheses after the mode location (mode location is shown in rotary table steps).

To measure thickness and index the system needs to find the angular locations of at least the first two modes. If more than two modes are found the software will make multiple estimates of thickness using mode pairs 1-2, 1-3, 1-4 and will show the average and the standard deviation (SD) of the multiple estimates.

Thickness SD is typically less than 1% but if it is greater than 2% there is some problem with the result and a warning message will be printed.

After a measurement is complete, look at the thickness standard deviation (SD) after every measurement. If it is low (less than 1-2%), the measurement is reliable. If higher than 1-2 % the film either has an index gradient or initial modes have not been found.

Look at the pattern and add any missing initial shallow modes by centering the cursor on the bottom of the mode and press return key.
4.3.20 Refer to **sections 3.2.8 to 3.2.13** to determine required film thicknesses needed to support the optical transmission modes.

3.2.8 Measure only clean dry films and bulk material capable of being measured.

3.2.9 The films and bulk material must be capable of being measured. To a rough approximation the angular location of the 1st mode (dip) determines the film index while the angular difference of subsequent modes determines the thickness and standard deviation of the thickness calculations. If you are not sure ask staff to check.

3.2.10 **For most film/substrate combinations a thickness of 100nm to 200nm is required to support the 1st mode for determining refractive index only.**

3.2.11 Films/substrate combinations with a thickness of 300nm to 500nm (depending on the film/substrate type) can support two or more modes for determining refractive index and thickness measurements.

3.2.12 Films/substrate combinations of 500nm to 15μm can support 4 to 5 modes for determining multiple estimates of refractive index, thickness and standard deviation calculations for these estimates can then be determined. For standard deviation measurement that are low, typically 0.3% for thickness and 0.1% for index there is small chance that an appreciable error occurred.

3.2.13 **For thicknesses greater than 15μm up to 150μm-200μm thickness range index can be measured using bulk measuring method.**
At the bottom of the Measurement Screen are the abbreviated descriptions of the keyboard **F1** to **F12** function keys. To enable a function press the appropriate function key on the keyboard, after a function key has been pressed the function characters at the bottom of the display will change from **White** to **Green**. Some of the functions are **ON/OFF** functions and other require parameters to be entered.
Any changes in function or parameters will used on the next measurements.

The Function key definitions are as follows:

<table>
<thead>
<tr>
<th>Function Key Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F1 (Auto)</strong></td>
</tr>
<tr>
<td><strong>F2 (Help)</strong></td>
</tr>
<tr>
<td><strong>F3 (Dual)</strong></td>
</tr>
<tr>
<td><strong>F4 (Offset)</strong></td>
</tr>
<tr>
<td><strong>F5 (Skip)</strong></td>
</tr>
<tr>
<td><strong>F6 (Step)</strong></td>
</tr>
<tr>
<td><strong>F7 (ClrData)</strong></td>
</tr>
<tr>
<td><strong>F8 (ChgPlot)</strong></td>
</tr>
<tr>
<td><strong>F9 (SubsN)</strong></td>
</tr>
<tr>
<td><strong>F10 (VAMFO)</strong></td>
</tr>
<tr>
<td><strong>F11 (TE/TM)</strong></td>
</tr>
<tr>
<td><strong>F12 (Menu)</strong></td>
</tr>
</tbody>
</table>
4.3.22 If you are finished measuring all your wafers and want to remove it from the chamber proceed to section 4.4 Unloading Wafers and System Shutdown. If you want to measure another sample precede to the next step 4.3.22

4.3.23 To remove your sample, remove the chamber/box lid cover and place it aside.

4.3.24 To unload your wafer carefully support the wafers with a tweezer or hold the wafer edge supporting the wafer while flipping the wafer holder coupling head switch to release pressure on the backside of the wafer. The metal rod will retract releasing the wafer. *Careful not to drop and break your wafer.*

4.3.25 To measure another sample go back to steps 4.3.1 to 4.3.21

4.3.26 If you are finished measuring all wafers proceed to section 4.4 Unloading Wafers and System Shutdown
4.4 Unloading Wafers and System Shutdown.

4.4.1 To remove your sample, remove the chamber/box lid cover and place it aside.

4.4.2 To unload your wafer carefully support the wafers with a tweezer or hold the wafer edge supporting the wafer while flipping the wafer holder coupling head switch to release pressure on the backside of the wafer. The metal rod will retract releasing the wafer. **Careful not to drop and break your wafer.**

4.4.3 Replace the chamber/box lid.

4.4.4 Close the compressed air (CDA) valve by turning the knob CW until it stops.

4.4.5 Turn **OFF** the LASER power supply by switching the **red switch** to the **OFF** position.
4.4.6 Exit the Metricon Measurement screen by pressing the **F12** keyboard key.

4.4.7 Turn **OFF** the Metricon Computer by pressing the computer **ON/OFF** power button as shown.

4.4.8 Turn **OFF** the Metricon Prism Coupler 2010 Controller by switching the power switch located on the back panel to the **OFF** position as shown. Controller front panel **green** led will turn off.

4.4.9 Turn **OFF** the DPU-411 printer by switching the power switch to the **OFF** position.
4.4.10 Fill the required information into the logbook.

4.5 Recipe Creation and Saving

4.5.1 At the bottom the Measurement screen are the abbreviated descriptions of the keyboard F1 to F12 function keys. To create or run a previously saved recipe press the F12 keyboard key to display the **Recipe Selection Screen**.

4.5.2 In this screen there are three options as follows:

- Use the ↑ ↓ (arrow up and down) keyboard keys to select a recipe and press Enter to load the recipe.
- Press F12 keyboard key to create a new recipe.
- Press Esc keyboard key to return to Measurement Screen.

4.5.3 After pressing the F12 keyboard key a message will be displayed prompting “enter name of recipe to create”. Enter the name of your recipe and press the Enter key.

4.5.4 After entering recipe name the **Recipe Definition** screen will be displayed.
Recipe Definition

Please check that configuration screen and function key settings are correct for recipe. Recipes make use of:
- substrate index, prism type (code), wavelength, scan limits, disk save and printout formats and sort keys from the configuration screen.
- the states of F3(Dual), F4(Offset), F5(Skip), F6(Step), and F11(TE/TH).

Recipe description: thermal oxide imm

If only a single node is found, assume (I)ndex, assume (T)hickness, (D)ecide at time of measurement? (I/D) Decide

Parameter limits

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum N</th>
<th>Maximum N</th>
<th>Minimum T</th>
<th>Maximum T</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.2000</td>
<td>1.7000</td>
<td>0.1000</td>
<td>3.0000</td>
</tr>
</tbody>
</table>

Press Enter to accept data, Tab to move, ESC to save recipe or exit.
4.5.5 Check to ensure the Configuration settings in the “Model 2010 Configuration Screen” and the Function key setting are correct.

For configuration screen settings refer to section 4.24 to 4.2.16

For Function key settings refer to section 4.3.21
4.5.6 Below the recipe description (recipe name) a message will be displayed
“if only a single mode is found, assume (I)ndex, assume (T)hickness, or (D)ecide time of measurement”
Enter either (I)ndex, (T)hickness, or (D)ecide time of measurement press Enter.

- **If you have reliable information about film properties or thickness choose Index or Thickness and enter/verify data.**
- **If you have no information about the film properties of thickness choose Decide time of measurement.**

4.5.7 Below this prompting line will be displayed Parameter Limits section.

4.5.8 Enter Minimum and Maximum values for index of refraction (N)

4.5.9 Enter Minimum and Maximum values for Thickness (T)

4.5.10 If all recipe parameters, configuration and function settings are correct for this recipe press the **ESC** keyboard key to save the recipe file. After pressing the **Esc** key you will be back in the Measurement Screen and can proceed to take a measurement.