



PTR205

Automatic Fiber Recoater

User Guide



















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Chapter 1 Warning Symbol Definitions

Below is a list of warning symbols you may encounter in this manual or on your device.

Symbol	Description
	Direct Current
	Alternating Current
	Both Direct and Alternating Current
	Earth Ground Terminal
	Protective Conductor Terminal
	Frame or Chassis Terminal
	Equipotentiality
	On (Supply)
	Off (Supply)
	In Position of a Bi-Stable Push Control
	Out Position of a Bi-Stable Push Control
	Caution: Risk of Electric Shock
	Caution: Hot Surface
	Caution: Risk of Danger
	Warning: Laser Radiation
	Caution: Spinning Blades May Cause Harm

Chapter 2 Safety

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly.



SHOCK WARNING



Unplug the power cord before servicing the unit. Do not operate the unit without all covers and items properly installed.



CAUTION



Before connecting the AC power cord, make sure the source voltage is between 85 and 265 VAC, 47-63 Hz. Input voltages outside these ranges may result in damage to the unit.



CAUTION



The recoat material is a flammable, toxic, acrylate compound. Avoid contact with the skin and eyes.



WARNING



Argon is a chemically inert gas. It is colorless, odorless, tasteless, non-flammable, non-corrosive and non-toxic. However, the work area should be well ventilated so as to ensure that the correct oxygen level is maintained.



WARNING



Ensure that the operator is properly trained for the handling of compressed gases and regulators.

Small transparent fiber shards may be present in and around the work area, and as such, the necessary measures should be taken to ensure the safety of the employee(s).



WARNING



This unit must not be operated in explosive environments. The equipment should be used in a standard laboratory environment with temperature and humidity control.



WARNING



All materials (such as wipes and gloves) that have acrylate material on them should be disposed with solid chemical waste.

Fuses can be replaced by twisting it to release, and then pulling it out of the housing; it is replaced by pushing the fuse into the housing and then twisting it to lock in place. The fuse is 6.4 A, 250 V.

Chapter 3 Description

3.1. Introduction

The PTR205 is an automatic optical fiber recoater. Once the fiber is placed in the fiber holding blocks, all recoating is performed automatically.

The device has two quartz mold plates that, when closed together, form a circular mold cavity around the section of fiber to be recoated. The mold plates are opened and closed using a pneumatically actuated gripper assembly, which requires a compressed air or gas supply of 80 to 120 psi. Once the mold is closed, a volumetric dispensing pump injects a pre-programmed amount of liquid recoat material directly into the mold cavity. The material is then cured by exposure to ultraviolet (UV) light, provided either from tungsten halogen lamps (early models) or from UV LED's (newer models). The end result is a flexible UV acrylate coating that closely resembles the original fiber in both appearance and performance.

3.2. Parts Checklist

When unpacking the PTR205 for the first time, check to make sure that you have the following:

- PTR205 Recoater
- 12.5 V Power Supply
- AC power cord
- DC power cable
- RS-232 communications cable
- 1/8" O.D. pressure supply tubing and fittings kit for compressed air hook-up
- Tool kit containing:
 - UV curable acrylate
 - Lens tissue
 - Quartz mold cleaning brush
 - 5/64" Allen wrench
 - 3/32" Allen wrench
 - 0.035" Allen wrench
- External vacuum pump with vacuum line
- Handset Controller

If you are missing any of the above or need replacements, please contact Thorlabs.

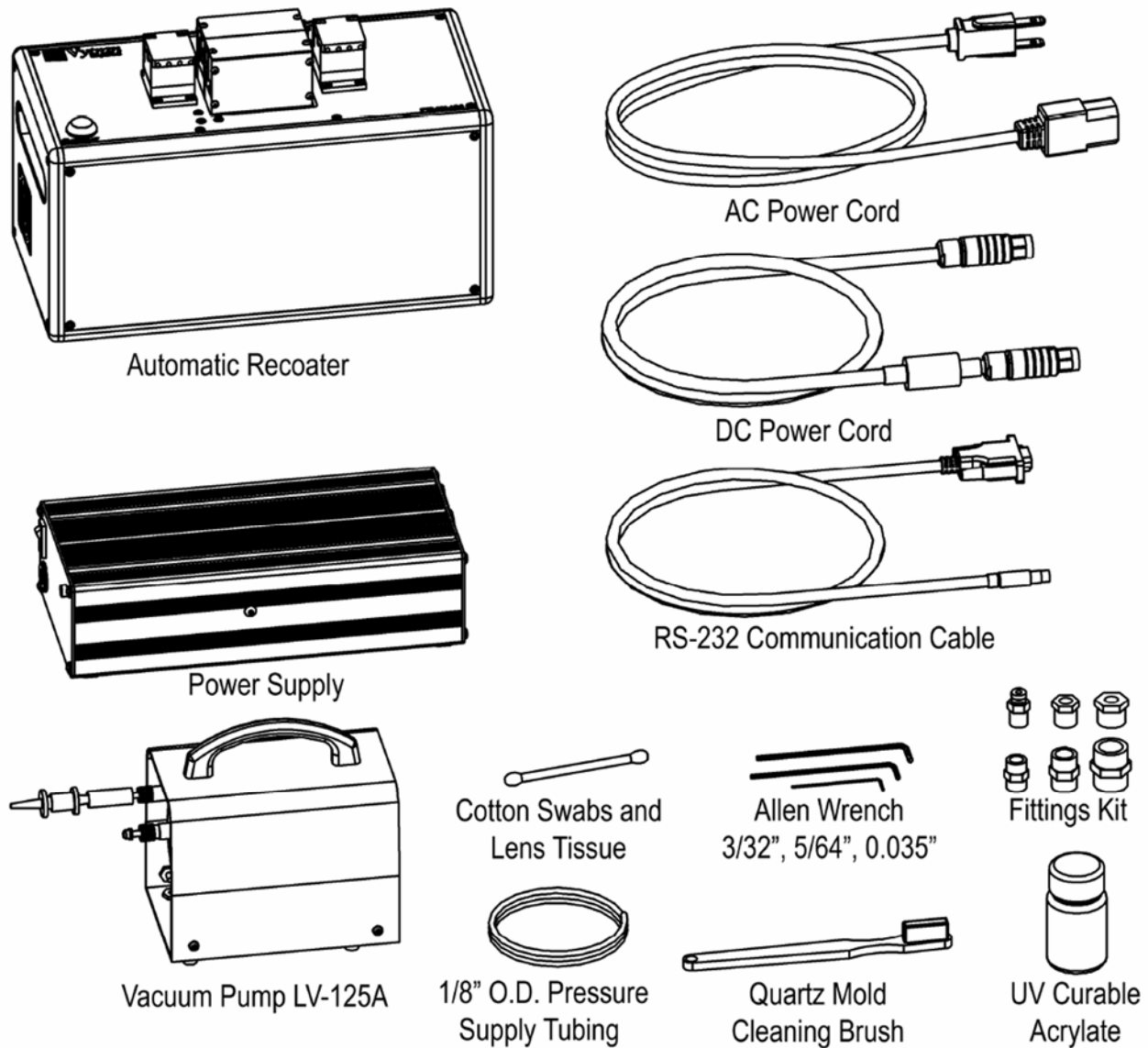


Figure 1 System Components and Accessories

Chapter 4 Usage

4.1. Setting Up the PTR205

1. Connect the DC power cable from the “DC Out” connector on the power supply to the connector labeled “POWER 12.5 V” on the back of the unit. Plug the power supply into an AC source of 85 - 264 volts, 47 - 63 Hertz, using the power cord provided.
2. The pneumatic gripper of the automated recoater requires a clean compressed air (or gas) supply of 80 to 120 psi (not included). Locate the 1/8" quick connect fitting in the fittings kit and connect this into the compressed air/gas source using the adapters provided. Use the 1/8" tubing provide to connect the air/gas source to the fitting labeled “AIR 80-120 PSI” on the back of the device. Make sure to fully insert the tubing into the quick connect fittings and be careful not to crush or pinch the tubing.
3. Connect the external vacuum tubing line by inserting the male quick connect fitting at one end of the line to the lower quick connect fitting on the vacuum pump. Push the other end of the tubing line over the fitting labeled “VACUUM” at the back of the ARC. Attach the small “muffler” by inserting the male quick connect fitting into the upper fitting on the vacuum pump.
4. Determine which display controller option is provided (see Figure 2) and proceed to the appropriate section of Chapter 4 for further set-up.

4.2. Controlling the PTR205

The PTR205 can be operated using either the button on the unit, or via the Handset Controller.

4.3. Unit Control Button

The button on the device can be used to initiate a recoat process. The process parameters stored within the main unit will be used.

Recoat Button: Activates a Recoat with the current parameter settings stored within the main unit. The fiber to be recoated should be properly loaded prior to pressing this button. When the button is pressed, the mold assembly will close, a set amount of recoat material will be injected into the mold, and the recoat lamps (or LED's) will turn on for a set time to cure the recoat material. At the end of the curing period, the recoat process is complete and the mold assembly will open.

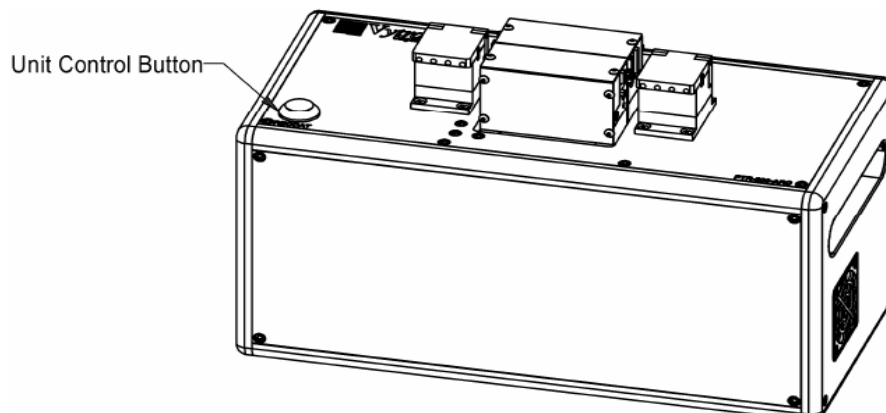


Figure 2 Unit Control Buttons

4.4. Handset Controller

4.4.1. Set Up

Make sure power to the ARC is turned off. Connect the cable of the Handset Controller to the connector on the back of the unit labeled “Display/Serial”.

4.4.2. Power Up

With the Handset Controller properly connected to the recoater:

- Open the compressed air/gas supply to main unit.
- Turn on the external vacuum pump using the switch on the pump.
- Turn on the external power supply using the switch above the output cable.
- Turn on the ARC using the switch located at the back of the unit.

The recoat mold will open (if not already) and the display will become active. The system will go through an initialization process that takes from 15 - 90 seconds, during which time it will home and fill the internal recoat pump and home the linear proof tester. During initialization the serial number of the Handset Controller and version of code in the Controller will be displayed. Once initialization is complete, the display will switch to the Main Menu screen.



Figure 3 **Handset Controller**

4.4.3. User Parameter Files

The Handset Controller provides three user definable parameter files, designated as “User1”, “User2”, and “User3”. The User file can only be checked or changed from Engineering Mode. To select a User file:

- At the Main Menu screen, press ‘0’ to display the Select Set-Up screen.
- Press ‘1’ to scroll through the list of User files until the desired file is displayed.
- Press ‘0’ to select the displayed User file.

The Handset Controller will always start up with the User file that was open prior to shut down.

4.4.4. Recoat Parameters

The recoat parameters are defined as follows:

Quantity:	Volume of recoat material in microliters (μ l) injected into the mold.
Rate:	The speed at which recoat material is injected into the mold in microliters per second (μ l/sec). Maximum inject rate: 1.8 μ l/sec.
Delay Time:	The amount of time in seconds between the end of the injection process and the start of the curing process.
Lamp Time:	The amount of time in seconds that the curing lamps (or LED’s for new models) are on.

Recoat parameters can be checked or changed only from Engineering Mode. Any changes made to the recoat parameters affect only the currently selected User file. To configure the recoat parameters, follow the menu sequence given in Figure 4.

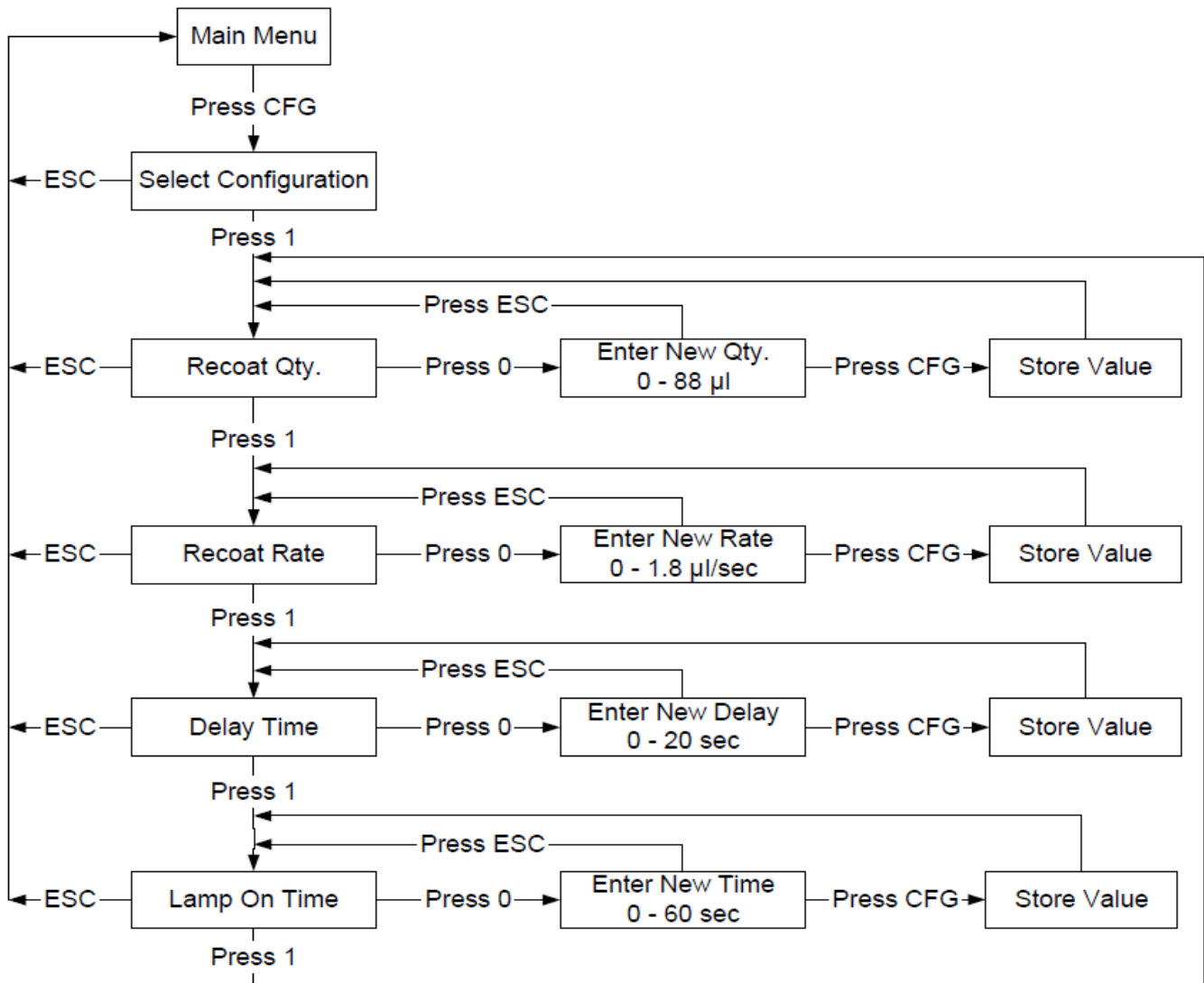


Figure 4 **Recoat Configuration Menu**

4.4.5. Process Selection Menu

Note: Only Recoat process execution is supported on PTR205 models.

The Start button on the Handset Controller will execute one of three processes: Recoat, Proof Test, or Recoat plus Proof Test. The combination process will initiate a proof test immediately after the recoat is completed. The Start button can be programmed by following the menu given in Figure 11. The Handset Controller must be in Engineering Mode to access the Select Menu.

4.4.6. Options Menu

The Options Menu provides individual process commands for set-up and service of the ARC, as well as access to some system level process parameters. A flowchart of the Options Menu for Engineering Mode is given in Figure 6. If the Handset Controller is in Operator Mode, only the Store and Mold commands are accessible. A description of all commands and parameter available in the Options Menu is given below.

Store: The Store function closes the recoat mold and releases pressure from the pneumatic gripper.

Purge: The Purge command initiates a process that cycles recoat material through the recoat injection pump. Enter the desired number of purge cycles. Each purge cycle will empty the contents of the pump back into the top of the recoat bottle, and then draw 100 microliters of fresh recoat material from the bottom of the bottle back into the pump

Inject (µl): The Inject command will inject a specified volume of recoat material out through the mold inject port. Enter the desired amount of recoat material, in microliters, to be injected.

Mold: The Mold function can be used to open or close the recoat mold.

Valve Home: The Valve Home function can be used to position the distribution valve of the recoat injection pump to its Home location.

Lamp: The Lamp command is used to manually turn on the lamps or LED's. Enter the time in seconds that the lamps will be activated for. Make sure that the mold is closed and all shields are in place before executing the lamp command. On LED systems, the unit will lock up if the lamp command is executed with the mold open. Cycle power to correct this situation.

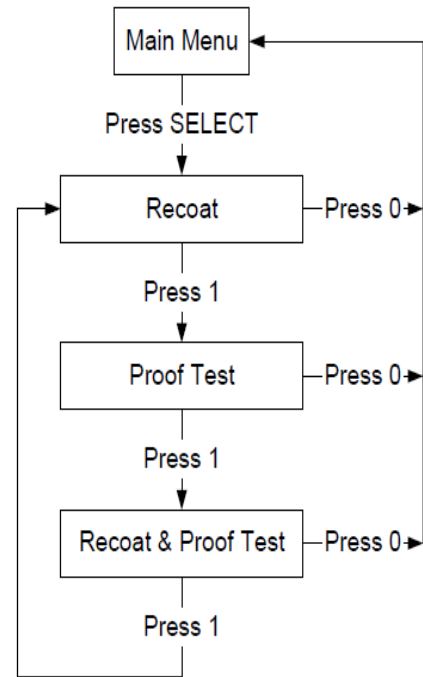


Figure 5 Start Button Process Selection Menu



WARNING

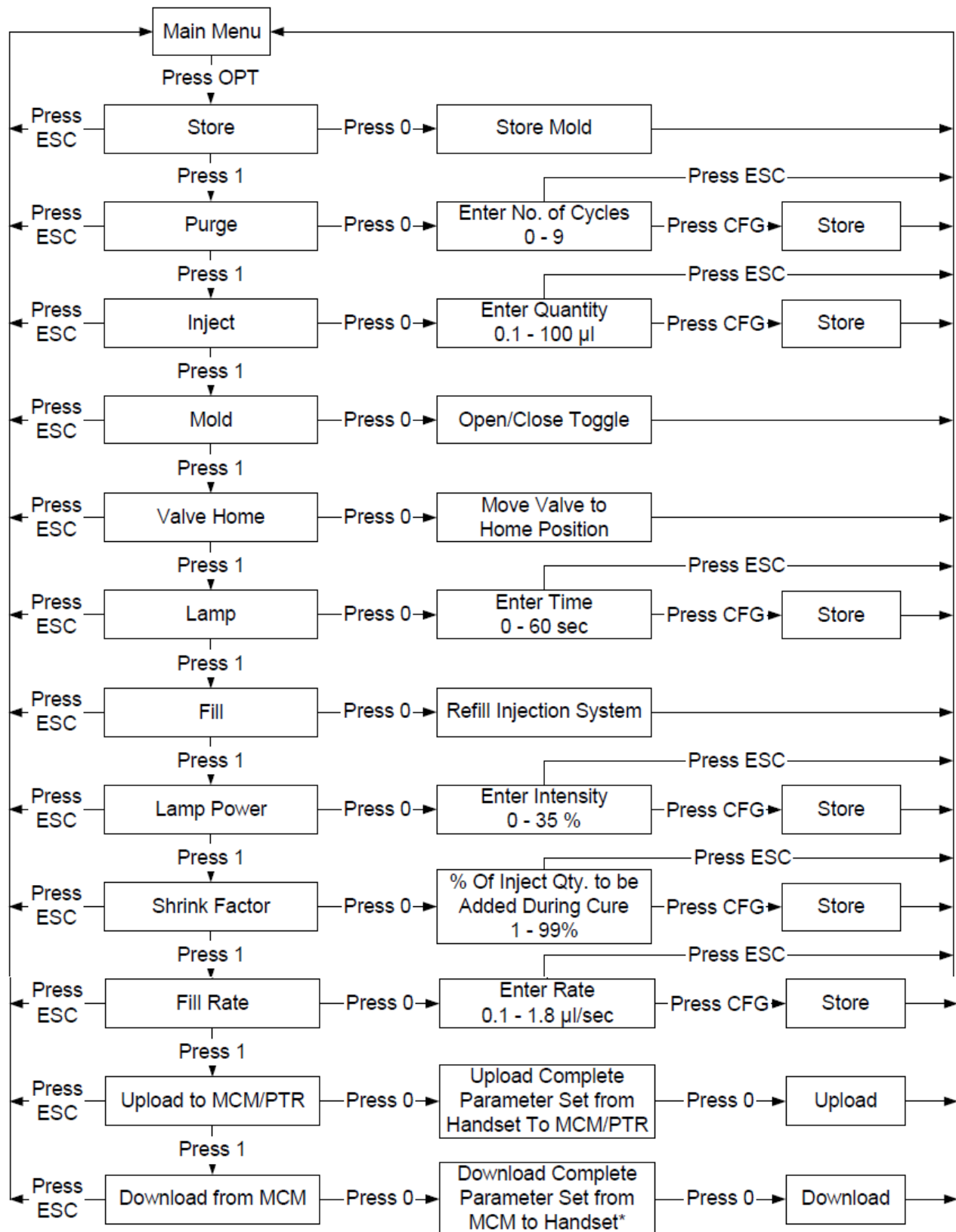


The recoat lamps emit ultraviolet (UV) radiation that can cause damage to the eyes. Make sure the mold is closed and all shields are in place when operating the curing lamps or LEDs. Make sure to wear UV eye protection if servicing the unit with shields off or mold open.

Fill: The Fill command initiates a process that fills the recoat injection pump.

Lamp Power: The Lamp Power command sets the intensity of the two center (vertical) curing lamps. For ARC systems this should be set for 35%. This function does not apply to LED systems.

- Shrink Factor:** The Shrink Factor is the amount of material injected into the recoat mold during the early stages of curing. This is entered as a percentage of the initial Inject volume, and is intended to compensate for material shrinkage during cure. Typical values for Shrink Factor are 3 to 6%.
- Fill Rate:** The Fill Rate command sets the speed at which the pump draws material from the recoat bottle. This is typically set at the highest possible speed of 1.8 microliters/second.
- Upload to PTR:** The Upload function will transfer all parameters from the currently selected User file of the Handset Controller to both the recoater. This command is useful for reprogramming the PTR205 with a known parameter set.



* Values in Handset will be overwritten when downloading

Figure 6 Options (OPT) Menu for Engineering Mode

4.5. Recoat Injection System

The PTR205 has an automatic recoat injection pump fitted inside the unit. The pump is based on an automated syringe and distribution valve that can select one of three ports (Fill, Purge, or Inject) through which it can either draw or inject recoat material. A bottle containing recoat material is installed directly on the pump, with the pump “Fill” tube inserted into the bottom of the bottle. A “Purge” tube runs from the pump to the top of the recoat bottle, and is used for cycling material back into the bottle. An “Inject” tube runs from the pump to the inject port of the recoat mold, which is located at the center of the back mold plate. Once all air is purged from the injection system, the pump provides very accurate control of the volume and velocity of recoat material injection.

The recommended recoat material for use in the ARC is ANGSTRÖMBOND® 950-200, which is manufactured by Fiber Optic Center™, Inc. This is a UV curable multifunctional acrylate coating that has been optimized for recoating applications. Do not attempt to use alternate recoat materials without first consulting Thorlabs on compatibility with the PTR205.

Note: UV Curable recoat materials do have a limited shelf life of approximately 18 months from date of manufacture. Using material that has passed its expiration date may cause both pump performance and recoat quality issues.

4.6. Priming the Injection System

It is very important to remove all air from the recoat injection system prior to performing a recoat. When operating the system for the first time, the pump must be filled with recoat material and cleared of all air in the pump and tubing. In order to clear the inject tube, recoat material must be injected out through the mold inject port and collected and disposed of. Make sure to have cotton swabs and acetone or isopropyl alcohol available for this purpose prior to starting this procedure. An Integrated Module Controller or Handset Controller is required to perform this procedure.

If acrylate is spilled, clean with acetone. Avoid contacting any plastic pieces or the screen printed text. Dispose of the acrylate with chemical solid waste.



WARNING



UV curable acrylate recoat materials can be hazardous to your health if not handled properly. Read the Material Safety Data Sheet provided in Appendix B: Material Data Safety Sheet, and make sure to follow the precautionary guidelines when working with this material.

To prime the recoat injection system:

1. Turn off power to the unit.
2. Remove the front plate of the device by using the 3/32" Allen wrench provided in the tool kit to remove the four (4) black socket-head cap screws located at the corners of the plate.
3. The recoat pump is located on the left side of the PTR205 as shown in Figure 7. Unscrew the brown recoat bottle located at the front of the pump and remove by angling out through the front opening. The red Fill tube will flex to allow removal.
4. For new systems, replace the empty recoat bottle shipped with the unit with a new bottle of recoat material. For systems that have previously been run with recoat material, the recoat injection system should be flushed clean prior to adding new material (see section 5.3.2).
5. Screw the new recoat bottle back into place and replace the front panel and the four (4) socket head cap screws.
6. Connect an Integrated Module Controller or Handset Controller directly to the back of the unit.
7. Turn on power to the recoater and wait for the system to initialize.
8. Execute five (5) Purge cycles (Options menu on Handset Controller). Each purge cycle will draw 100 microliters of recoat material from the bottom of the recoat bottle through the red Fill tube and inject material back into the top of the recoat bottle through the green Purge tube (see Figure 16). Five (5) Purge cycles are required to fill the pump with recoat material and force any air out of the pump system. This will take approximately 15 minutes to complete.
9. After the pump has completed its Purge cycles, the Inject tube that runs from the pump to the mold must also be filled with recoat material and purged of air. Open the recoat mold (Options menu on Handset Controller) and have cotton swabs and cleaning solution (alcohol or acetone) available prior to proceeding.
10. Set the recoat inject Rate to 1.8 $\mu\text{l}/\text{sec}$ (Recoat parameters menu). Make sure to take note of the original inject rate as this will need to be set back after this process is completed.
11. Set the inject quantity to 50 μl (Options menu on Handset Controller).
12. Execute the inject command (press "CFG" on the Handset Controller).
13. Watch for recoat material to emerge from the mold inject port located at the middle of the back mold plate. Make sure to collect the recoat material with a cotton swab as it comes

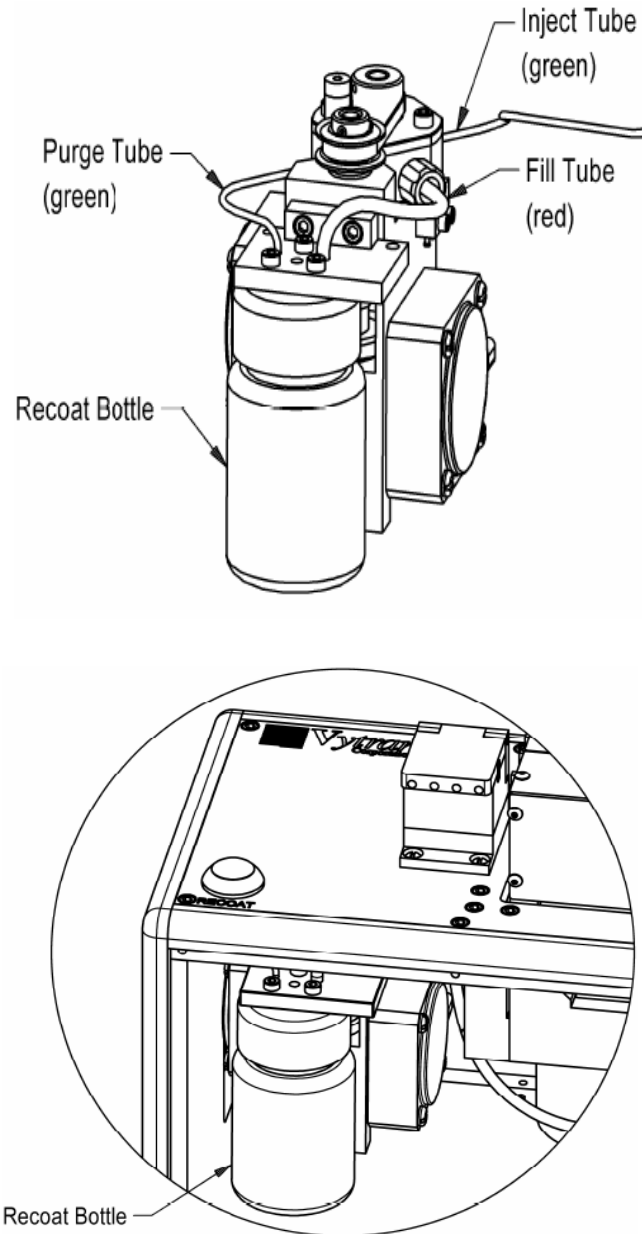


Figure 7 **PTR205 Recoat Bottle Access**

out of the mold injection port. Do not allow recoat material to run down the face of the mold and under the mold plate.

14. Execute three (3) additional “Inject 50” sequences to purge air completely from the inject tube.
Note: Because the injection pump holds 100 μ l of recoat material, there will be a delay of approximately one minute between the second and third inject sequences while the pump refills.
15. After purging the inject tube, the recoat material should run freely from the mold without bubbles. If bubbles are still present, run additional inject sequences.
16. Once the pump and the inject tube are purged, clean the mold plates of all excess recoat material (see Section 4.7).
17. Reset the inject Rate to its original setting.

Note: Because the syringe in the recoat pump is mounted vertically, it is possible that an air bubble may still be trapped at the tip of the syringe after the above priming process. This air bubble will very slowly rise to the top of the syringe after which time it can be Purged out. It is therefore recommended that at least one (1) additional Purge cycle is run the next day after the initial priming of the system.

4.7. Cleaning the Recoat Mold

The recoat mold assembly contains two very flat quartz plates, each with a semi-circular channel running longitudinally down the center of their mating surfaces. When closed, the plates form a circular mold cavity around the section of fiber to be recoated. In order for the mold plates to mate flush together, they must be free of all dirt and/or coating particles.

The quartz mold plates can be cleaned with a cotton swab wetted with acetone or isopropyl alcohol. Acetone cleans more thoroughly than alcohol and will also soften and lift away any cured recoat material. Do not use excessive scrubbing or scraping action to clean the mold plates. Typically a single wipe from left to right across the front and back mold plate is sufficient to clean the plates. If the recoat mold does have an accumulation of cured recoat material stuck to the plates, allow the cleaning solution (preferably acetone) time (60 - 90 seconds) to soften and lift any cured material.

Note: The mating surfaces of the mold plates have an optical coating that blocks UV light. Great care must be taken not to scratch or abrade this coating. Use only a soft cotton tipped swab to clean the mold surfaces. Do not rub any hard objects across the surface of the plates as this could scratch the optical coating or chip the edges of the mold channel and degrade the quality of the recoat.

4.8. Recoat Process

The PTR205 has right and left-hand fiber holding blocks that are used to position the fiber for recoating. Once the fiber is loaded into the fiber holding blocks, the recoat processes is performed automatically.

The purpose of the recoat is to maintain the strength and flexibility of a stripped fiber or fusion splice by protecting the glass surface from damage. The recoat material is nominally the same as the original coating on the fiber, and it will therefore have similar performance characteristics. It should be noted that recoating a splice does not make the splice stronger, it simply protects what strength is already there. The handling and processing of the fiber prior to recoating will therefore determine the strength and reliability of the recoated section.

To perform a recoat, the original fiber must enter into the recoat mold from both sides so that recoat material can be injected up to, and ideally over, the strip interface regions. This means that the original diameter of the fiber must be smaller than the diameter of the recoat mold and that the length of the recoat must be shorter than the length of the mold (50 mm). The standard recoat mold size for nominal 250 micron coated fiber is 280 microns. This provides room for an “overlap” region where the recoat can flow over the original coating. An overlap length of 2 - 5 mm is recommended from a reliability standpoint.

When the recoat process is initiated, the mold will close around the fiber, which is centered within the mold cavity by alignment guides (early models) or alignment pins (newer models) built into the mold gripper assembly. The fact

that the original coating enters into the mold at both sides helps to ensure that the exposed section of fiber is centered within the mold and that the bare glass does not touch the sides of the mold cavity. Once the mold is closed, the programmed Quantity of recoat material is injected into the mold at the programmed Inject Rate. The system then waits for the programmed Delay Time to allow the recoat material time to finish flowing into the mold and to fully “wet” the fiber and interface region. The curing lamps (or LED’s) are then turned on for the programmed Lamp Time to cure the recoat material. In order to account for the fact that the recoat material will shrink slightly during cure, an additional small percentage of the Inject Quantity (the Shrink Factor) is injected into the mold during an initial percentage of the Lamp Time (the Shrink Time). The shrink parameters are pre-set and should not need adjusting. Once the Lamp Time is complete the mold will open and the recoated section of fiber should be free from the mold.

4.9. Loading the Fiber

A vacuum V-groove fiber holding block is mounted on each side of the recoat mold assembly to position the fiber in the mold channel. Vacuum to the fiber holding blocks is automatically turned on when one of the holding tops is raised.

To load a fiber for recoating:

1. Open the recoat mold if it is not already opened.
2. Make sure that the recoat mold plates are clean (see Section 4.7).
3. Raise the tops on both the left and right-hand fiber holding blocks.
4. Hold the section of fiber to be recoated straight between two hands, making sure not to touch the exposed section of fiber (a total separation of approximately 8 inches is a convenient distance).
5. Lower the fiber until it is drawn by the vacuum into the V-grooves of the holding blocks.
6. Make sure the stripped section of fiber is centered left-to-right in the recoat mold and close one of the fiber holding block tops.
7. Make sure that the fiber is straight between the fiber holding blocks and close the second top.
8. Verify that the stripped section of fiber is centered in the mold. Adjust if necessary.

It is important to avoid touching the exposed glass surface as this could significantly lower the strength of the fiber. Care should therefore be taken when positioning the fiber in the fiber holding blocks to avoid rubbing the exposed section of fiber against the mold assembly. If proper care is taken when loading the fiber, the recoat process will not degrade the strength of the fiber.

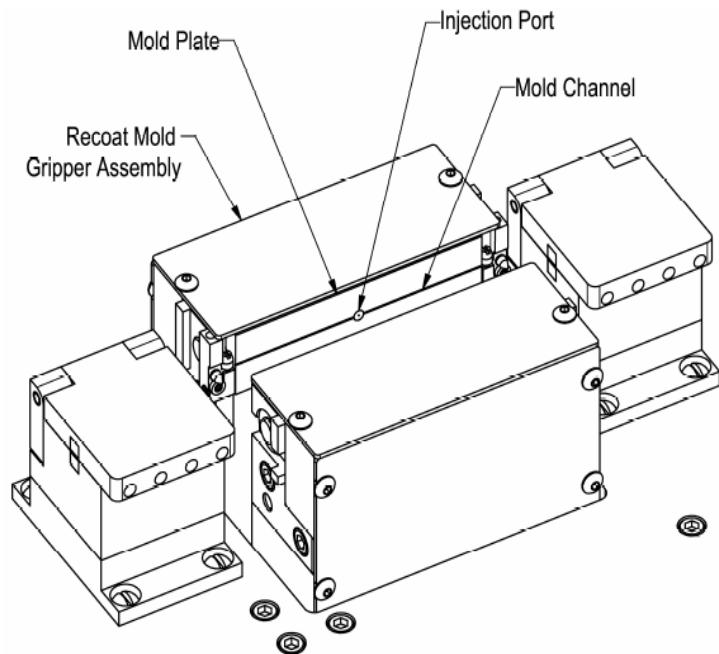


Figure 9 **Recoat and Proof Test Components**

4.10. Recoating

Recommended recoat parameters are preset at time of shipment. Typical values for recoating a 30 mm long stripped section of standard single mode fiber (e.g. Corning SMF-28) in a 280 micron mold are:

Quantity (μl): 1.2

Rate (µl/sec):	0.2
Delay Time (sec):	5
Lamp Time (sec):	20 system with tungsten halogen lamps/15 systems with LED

The correct inject Quantity depends on the diameter of the mold, the diameter of the fiber, and the length of the stripped section of fiber (the recoat length). See Table 1 in Section 7.1: for information on calculating recoat injection quantities.

To perform a Recoat:

- Check that the recoat parameters are set correctly.
- Make sure the recoat mold is open.
- Load the fiber in the fiber holding blocks, making sure the section of fiber to be recoated is centered left-to-right in the in mold (see Section 4.9)
- Press the “RECOAT” button on the PTR205 or execute a Recoat command from the handset controller. The mold will close and the recoat process will be initiated. When the mold opens the recoat process is complete.
- Raise the fiber holding block tops and remove the recoated fiber.
- Gently wipe the recoat with a dry lens tissue or Kimwipe to remove any uncured recoat material or light flashing. Do **not** wipe the recoat with acetone.
- Visually inspect the recoat to make sure the recoat reached both coating interfaces and, if an overlap is required, that it is sufficient length. Also check for voids or bubbles in the recoat, paying particular attention to the area around the injection port.

If the recoat did not reach the coating interface it may be necessary to increase the inject Quantity. It is common for the first recoat after the system has not been used for some time to come up short. Try a second recoat before adjusting the inject Quantity. If the overlap region is too long or the mold plates are excessively “wet” with recoat material, reduce the inject Quantity. When trying to determine the correct inject Quantity, it is recommended that the inject Quantity be initially set to “come up short”, and then incrementally increased to achieve the desired overlap length. Injecting excess material into the mold will necessitate more frequent mold cleaning and, if too extreme, can cause recoat failures due to the buildup of recoat material beyond the mating surfaces of the mold plates.

The optimal curing (Lamp) time will vary depending on the diameter of the mold, the age of the recoat material, and, for systems with tungsten halogen curing lamps, the age of the lamps. The size of the “nub” at the mold inject port is a good indicator of correct cure (Lamp) time. Make sure to check this before dry wiping the recoat as this could “wipe away” the nub. A small protrusion of several “tens” of microns is an ideal nub size. Increasing the Lamp Time will increase the nub size. Make sure not to increase the Lamp Time too high or the nub could break off in the inject port and plug the mold. On early models with tungsten halogen curing lamps, the Lamp Time will need to be increased as the lamps age. Do not increase more than 50% of the original cure time (30 seconds for a 280 mold). See Table 2 in 7.1: for approximate lamp times of various diameter recoat molds.

Note: The mold plates do not need to be cleaned after every recoat. Excessive cleaning can shorten the life of the mold through damage to the coatings on the mold plates or chipping of the mold channel. It is recommended that the mold plates be thoroughly cleaned at the start of a shift and then visually checked before each use for obvious signs of dirt, dust or excessive recoat material. It is typical that after several recoats a slight “misting” of recoat material will appear between the plates. This is acceptable and does not require cleaning. If the “misting” approaches the top or bottom edges of the mold plates, or if the mold plates are “wet” with recoat material, cleaning is required.

Note: It is recommended that while the recoater is in use that the mold plates remain open between subsequent recoats. If the system will not be used for an extended period (more than several hours), it is recommended that the mold be “Stored” with lens tissue between the plates (see Section 4.11).

Note: The mating surfaces of the mold plates have an optical coating that blocks UV light. Great care must be taken not to scratch or abrade this coating. Use only a soft cotton tipped swab to clean the mold surfaces. **Do not rub**

any hard objects across the surface of the plates as this could scratch the optical coating or chip the edges of the mold channel and degrade the quality of the recoat.

Note: It is not possible to abort a recoat once it has been started. Recoats involving large inject quantities (large diameter molds) and slow inject rates may take over 60 seconds to complete.

4.11. Store Unit

If the recoater will not be in use for more than several hours, it is recommended that the recoat mold be “Stored” as follows:

- Clean both front and back recoat mold plates thoroughly with a soft cotton swab wetted with acetone. Any residual recoat material will be captured on the wipe; any acetone remaining on the plates will quickly evaporate.
- Place lens tissue or a soft wipe between the mold plates. Use several sheets or fold several times to get multiple layers.
- Execute the “STORE” command from a display controller.
- Turn off the vacuum pump.
- Turn off the power switch on the back of the PTR205.
- Turn off the power supply.

Chapter 5 Maintenance

The purpose of the maintenance section is to define the planned maintenance requirements of the PTR-200-ARC. Where appropriate maintenance procedures are included.

5.1. Planned Maintenance

The PTR205 is designed to give trouble free operation in a production environment provided normal planned maintenance is adhered to. Maintenance/repair procedures should only be performed by trained personnel. Improper service and/or repair could result in safety features being disabled and can also lead to damage that will not be covered under warranty.

Planned Maintenance Schedule

Maintenance	Every Cycle	Every Shift	Daily	Monthly	3 Months	6 Months
Check Mold Cleanliness ¹	✓	✓	✓	✓	✓	✓
Check Mold End Plates for Fouling with Recoat Material ¹		✓	✓	✓	✓	✓
Check/Clean Fiber Holding Block Inserts ¹		✓	✓	✓	✓	✓
Run Purge (5 Cycles)				✓	✓	✓
Replace UV Lamps ²				✓	✓	✓
Flush Recoat System						✓
Replace Recoat Material						✓

5.2. Cleaning

5.2.1. Clean/Check Mold

Keeping the mold plates clean is vitally important for proper recoat performance and quality. The mold plates should be thoroughly cleaned at the start of a shift and then visually checked before each use for obvious signs of dirt, dust or excessive recoat material. The mold plates do not need to be cleaned after every recoat. It is typical that after several recoats a slight “misting” of recoat material will appear between the plates. This is acceptable and does not require cleaning. If the “misting” approaches the top or bottom edges of the mold plates, or if the mold plates are “wet” with recoat material, cleaning is required.

Note: The mating surfaces of the mold plates have an optical coating that blocks UV light. Great care must be taken not to scratch or abrade this coating. Use only a soft cotton tipped swab to clean the mold surfaces. Do not rub any hard objects across the surface of the plates as this could scratch the optical coating or chip the edges of the mold channel and degrade the quality of the recoat.

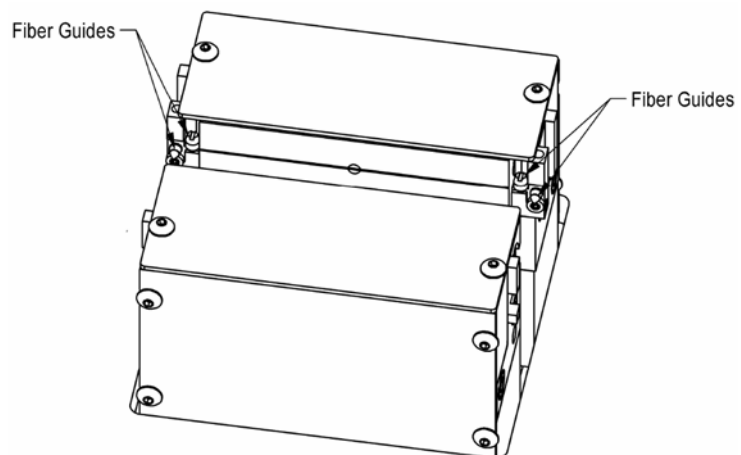


Figure 10 Fiber Guides for Systems with LEDs

¹ Maintenance Operations can be Performed by the Operator

² Only for Systems with Tungsten Halogen Lamps

Cleaning the mold:

Clean the mold plates only with a soft cotton swab soaked in acetone or isopropyl alcohol. Acetone is the preferred solution for cleaning the mold plates. Acetone cleans more thoroughly than alcohol and will also soften and lift away any cured recoat material. Do not use excessive scrubbing or scraping action to clean the plates. Give the cleaning solution time (60-90 seconds) to soften and lift any cured material. If recoat parameters are selected properly, and the mold plates do not pick up stray dust or dirt, the recoat mold should only need cleaning at the start and end of a shift. Excessive cleaning can shorten the life of the mold through damage to the coatings on the mold plates or chipping of the mold channel.

Check mold end plates:

System with LEDs (see Figure 10):

The mold end plates have fiber guides that consist of a vertical and horizontal pin. If the mold ends or pins collect dirt or recoat material it could pinch or damage the fiber. These should be checked prior to each shift for fouling, and, if required, should be cleaned with a soft cotton swab soaked in acetone or isopropyl alcohol.

System with tungsten halogen lamps (see Figure 11):

The mold end plates have fiber guides that consist of a "V" leading to a slot. The slot is typically just slightly wider than the diameter of the fiber. If this slot collects dirt or recoat material it could pinch or damage the fiber. These slots should be checked prior to each shift for fouling, and, if required, should be cleaned with a soft cotton swab soaked in acetone or isopropyl alcohol.

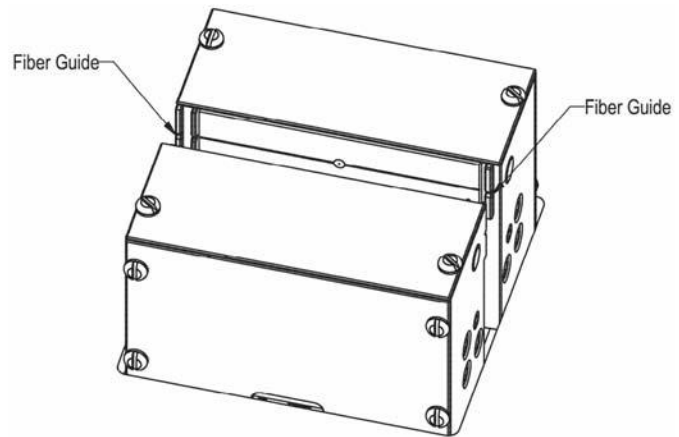


Figure 11 *Fiber Guides for Systems with Tungsten Halogen Lamps*

5.2.2. Clean FHB Inserts

Turn OFF the recoater and raise the top of both fiber holding blocks. Visually inspect the vacuum V-groove inserts for debris or damage. If debris is present, clean the V grooves with a cotton swab wetted with acetone or alcohol.



Warning



Do not clean the V-Groove insert with solvent when the unit is turned on. The solvent will be drawn into the vacuum system and will cause internal damage. If the V-Groove inserts appear to be damaged, replace the inserts

5.3. Recoat System

5.3.1. Purge

The purge cycle is a process of emptying the recoat material of the Automatic Injector back into the recoat material bottle and refilling the pump with fresh recoat material drawn from the bottom of the bottle.

If the recoater is not used in a high volume application (less than 200 recoats per month), it is recommended that the system be purged monthly in order to circulate fresh recoat material into the pump. Running 5 purge cycles is sufficient to entirely fill the pump with fresh recoat material.

5.3.2. Flush Recoat System

The recoat injection system should be flushed clean every 6 months as part of the recoat material replacement procedure. Before flushing the system, make sure to have lens tissue and cleaning solution (acetone or alcohol) available prior to proceeding. To flush the system:

1. Remove the internal recoat bottle and clean all exposed tubing and fittings with acetone.
2. Install a bottle filled $\frac{3}{4}$ full with acetone on the pump.
3. Run 5 purge cycles.
4. Remove the bottle and fill with clean acetone.
5. Run 5 more purge cycles.
6. Make sure the recoat mold is open.
7. Run several inject 50 sequences until acetone runs clear from the mold inject port. Dispose of waste with solid chemical waste.
Note: Make sure to collect material as it comes out of the inject port. Do not allow any material to run under the mold plates.
8. Remove the bottle of acetone from the pump.
9. Run several more inject 50 sequences until no more acetone exits the injection port.
10. Run one purge cycle. Make sure to collect any acetone that comes out of the green purge tube at the top of the bottle fitting using a Kimwipe; the Kimwipe can be disposed of with ordinary waste as the acetone evaporates quickly.
11. Clean all bottle tubing and fittings with acetone.
12. Prime the system by following the instructions in 4.6.

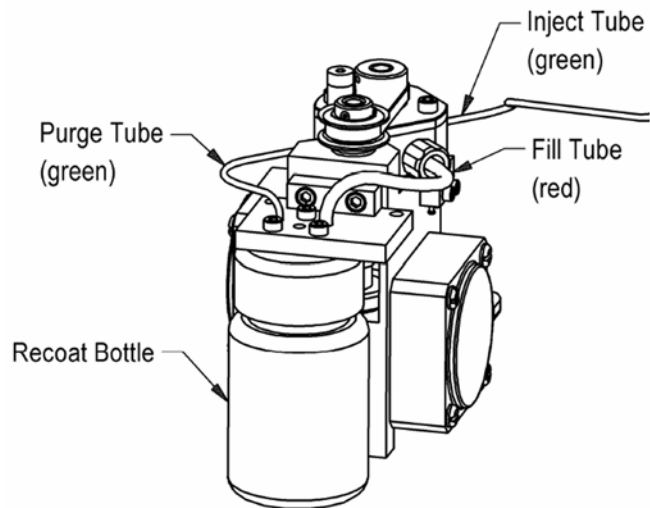


Figure 12 Recoat System

5.3.3. Replace Recoat Material

Recoat material has a finite shelf life and should be replaced every 6 months. To replace the recoat material, first flush the system as outlined above. Once the system is flushed, fill a clean recoat bottle $\frac{3}{4}$ full with fresh recoat material and follow the procedures in chapter 4.6.

Note: The one-ounce internal recoat bottle holds approximately 30,000 μl when full. The number of recoats per fill and the approximate time before the material needs to be refilled can be determined based on the volume of material per recoat (typically 1.2 μl for a 280 μm mold) and the number of recoats per month. For most applications the material will need to be replaced before it runs out. Even if fresh material is added to the internal bottle prior to the 6-month Planned Maintenance schedule, the material should still be replaced since mixing of the old and new materials occurs. Dispose of material with solid chemical waste.

5.3.4. Replace Tungsten Halogen Lamps

Early models use tungsten halogen lamps as the UV source for curing the recoat material. These lamps have a useful lifetime of 500 minutes (30,000 seconds) and degrade linearly to 50% of their initial output over this period. For a standard cure time of 20 seconds on a 280 micron mold, this is a useful life of 1,500 recoats. If the lamps collect dirt and/or recoat material due to improper use and/or cleaning, this lifetime can be even further reduced. For production environments, it is recommended that a fixed lamp replacement schedule of 1000 recoats be implemented (shorter if using longer recoat cure times for larger mold). Also note that during this period the cure time will need to be increased to compensate for reduced lamp output. The size of the recoat inject nub is a good indicator of proper cure time.

Newer models use UV LEDs as the UV source. These have a useful life of 100,000 hours (over 15 million recoats) with no degradation in UV output. They do not need replacement unless damaged.

Note: It is recommended that all ten (10) recoat lamps be replaced at the same time ensure uniform curing. Make sure the new lamps are cleaned prior to installation and avoid touching with bare fingers. Fingerprints and dirt can shorten lamp lifetime. Clean with lens tissue wetted with alcohol or acetone.

Lamp replacement:

1. Close or store the recoat mold.
2. Make sure power to the unit is turned off.
3. Remove the front, back and two (2) top mold shields by removing the twelve (12) screws securing them in place. (0.050" Allen wrench required.) See Figure 13.
4. Remove the two screws per board securing the front and back lamp boards. (1/16" Allen wrench required.)
5. Pull the lamp boards straight out. The boards will have to be angled upward slightly at the end to free them and gain access to the lamps.
6. Remove the old lamps and install new ones by fully seating the two pin lamp leads into the lamp socket. Make sure the lamps are clean and sit straight side-to-side. Re-clean after installation if necessary. Note: Do not install lamps in the center two sockets of the back lamp board. They are not required and, if installed, they will have a detrimental effect on the recoat quality.
7. Re-install the lamp boards. The lamps tend to get bent downward when the board is re-inserted. The lamps should be straightened by over angling the lamp board forward once the lamps clear their entry ports.
8. Re-install the lamp board screws.
9. Remove the two vertical lamps at the center of the front gripper plate by raising them up via the access ports in the plate. See Figure 14. A small Allen wrench is convenient for lifting the lamps high enough so they can be removed. A vacuum tube placed on top of the bulb may also aid the removal process.
10. Replace the two (2) vertical lamps by noting the orientation of the 2-pin socket at the bottom of the vertical lamp ports. Make sure the lamps are clean and that the lamp pins are straight and spaced correctly for the socket. Once the lamp is orientated correctly it can be pushed down fully into the socket. (This can be a bit challenging.) The top of the lamp should sit approximately 1/8" below the top of the gripper plate when seated properly.
11. Re-install the mold shields. Make sure to leave a slight gap (approximately 0.01") between the top shields.

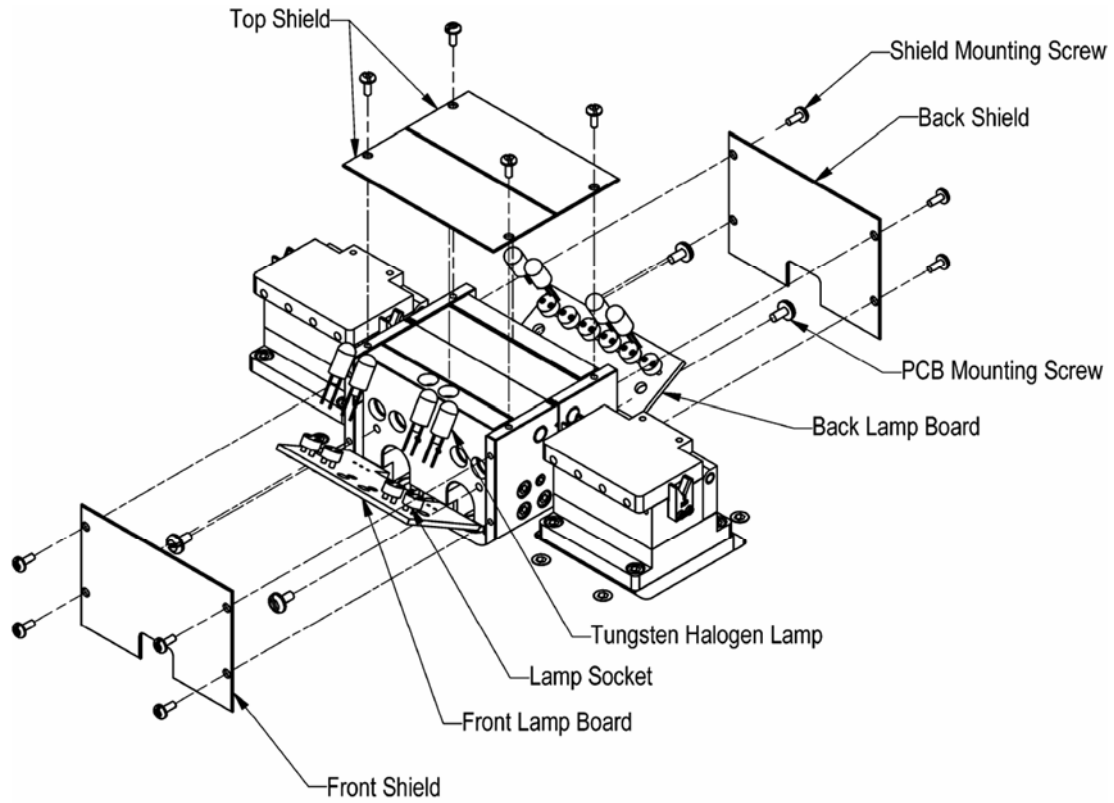


Figure 13 **Horizontal Lamp Replacement**

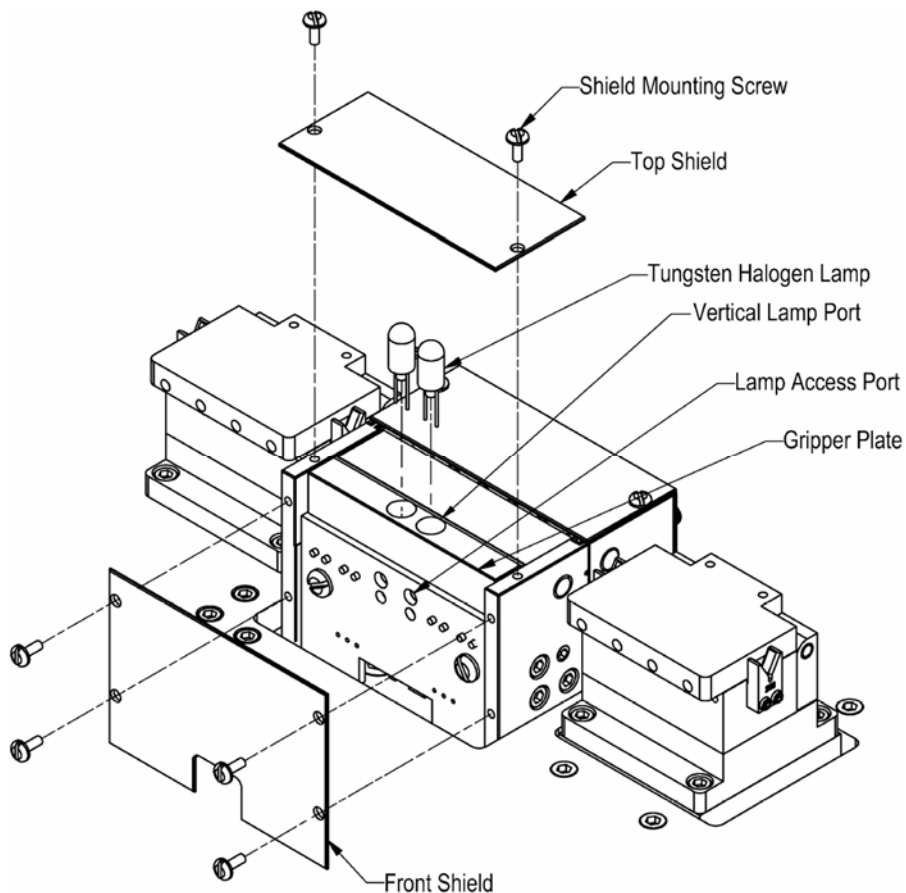


Figure 14 **Vertical Lamp Replacement**

5.3.5. Replace Vacuum V-Groove Inserts

The fiber holding blocks contain replaceable V-groove inserts which are designed to hold a specific coating size. To change the inserts, loosen the four (4) set screws (using a .035" Allen wrench) in the base of each holding fixture and remove the inserts. Install the new insert (V-groove side up) and gently tighten the four set screws. When clamping large diameter coatings, it may be necessary to change inserts located in the top of each holding fixture using the above procedure.

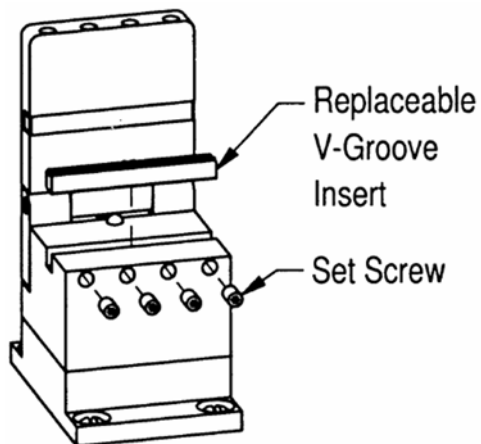


Figure 15 **Replace V-Groove Inserts**

Chapter 6 Trouble Shooting

6.1. Recoat Diagnostics

Problem	Possible Cause	Solution
Fiber snaps when mold closes.	Fiber not loaded properly.	See “4.9 Loading the Fiber”
	Grooves on recoat mold plates do not line up.	Contact Thorlabs for recoater servicing.
Material flows excessively outside of mold cavity or does not flow down mold cavity (“puddling”).	Recoat mold plates are dirty.	Dirt between quartz mold plates will not allow them to close, causing the acrylate to flow excessively outside the mold cavity. The recoat mold plates should be cleaned as described in the “5.2.1 Clean/Check Mold”.
	Grooves on recoat mold plates do not line up.	Contact Thorlabs for recoater servicing.
Flashing forms along the length of the recoat.	Cure time too long.	Decrease the cure time. This flashing can generally be removed by wiping the recoated section with a dry lens tissue. <i>Do not use a solvent!</i>
Recoat feels tacky or can be easily rubbed off by pulling the fiber between fingers.	Cure time too short.	Increase the cure time.
	One of the recoat bulbs is burned out.	Replace the recoat bulb (refer to the “5.3.4 Replace Tungsten Halogen Lamps” section for instructions).
Fiber sticks to recoat mold consistently.	Recoat mold plates are dirty.	Clean the recoat mold plates as described in “5.2.1 Clean/Check Mold”.

Chapter 7 Appendix

7.1. Process Parameters

Table 1 gives the approximate injection quantity in μl for different length recoats (strip lengths) and different mold sizes. A $125\text{ }\mu\text{m}$ fiber diameter is assumed for all mold sizes except $160\text{ }\mu\text{m}$, which is calculated based on an $80\text{ }\mu\text{m}$ fiber diameter. The formula for calculating injection volumes is also given.

Recoat Length	Mold Size				
	160 μm	260 μm	280 μm	430 μm	900 μm
5 mm	0.08 μl	0.20 μl	0.25 μl	0.66 μl	3.12 μl
10 mm	0.15 μl	0.41 μl	0.49 μl	1.33 μl	6.24 μl
15 mm	0.23 μl	0.61 μl	0.74 μl	1.99 μl	9.36 μl
20 mm	0.30 μl	0.82 μl	0.99 μl	2.66 μl	12.48 μl
25 mm	0.38 μl	1.02 μl	1.23 μl	3.32 μl	15.60 μl
30 mm	0.45 μl	1.22 μl	1.48 μl	3.99 μl	18.72 μl
40 mm	0.60 μl	1.63 μl	1.97 μl	5.32 μl	24.96 μl

Table 1: Approximate injection quantity in microliters (μl) required for different length recoats.

The volume of recoat material required can be calculated as follows:

$$Vol(\mu\text{l}) = \left(\frac{\pi D_{Mold}^2}{4} - \frac{\pi D_{Fiber}^2}{4} \right) \cdot Length_{Recoat}$$

Diameter and length of recoat in millimeters.

Table 2 gives the approximate curing time (Lamp time) for different mold sizes. For systems with tungsten halogen lamps with new lamps, start with the “New Lamp” recommendation below and adjust as necessary based on the length of the inject “nub”. As the lamps age the curing time will need to be increased, up to a maximum 50% of the original cure time, as given in the table below. Also listed in the table are the recommended curing times for systems equipped with LED’s. While the UV output of the LED’s does not degrade with time, the curing time may still need to be adjusted slightly to account for the age of the recoat material.

	Mold Size				
	160 μm	260 μm	280 μm	430 μm	900 μm
New Lamps	15 s	20 s	20 s	30 s	45 s
Max Time	20 s	30 s	30s	45 s	60 s
LED Units	12 s	17 s	17 s	25 s	40 s

Table 2: Approximate cure times (Lamp time) in seconds, for different recoat mold diameters.

7.2. Material Data Safety Sheet



950-200 from AngströmBond®
Page 1 of 3

Adhesives

The only adhesive line developed exclusively for fiber optics

1. MATERIAL IDENTIFICATION

Product Name:

950-200 from ANGSTRÖMBOND®

Emergency Phone:

For product emergencies involving spill, leak, fire, exposure, or accident call CHEMTREC at (800) 424-9300. For all other inquiries call **Fiber Optic Center™, Inc.** at (800) 473-4237.

2. COMPOSITION

Hazardous Components	CAS No.	Percent	Exposure Limits	
			ACGIH TLV-TWA	OSHA PEL
Multifunctional acrylate(s)		20-80	NE	NE
Monomers		20-80	NE	NE
Photoinitiator(s)		1-10	NE	NE
Additive(s)		0.01-10	ne	NE
Glycol Ether acrylate		28.5	NE	NE
Abbreviations: N.E. = Not Established				

3. HEALTH HAZARDS IDENTIFICATION

Primary Routes of Exposure:

Eyes: yes

Skin: Yes

Inhalation: Yes

Eye Contact: Contact may cause irritation. Inflammation of the eye is characterized by redness, watering, and itching.

Skin Contact: Avoid prolonged or repeated contact with skin. May cause skin irritation or sensitization.

Inhalation: Irritating to respiratory tract, coughing shortness of breath. Vapors and aerosol can produce mucous membrane, nose and throat irritation.

Ingestion: May cause mild gastric irritation, abdominal spasms, nausea and faintness.

4. FIRST AID MEASURES

Eyes: Flush eyes thoroughly with water for 15 minutes while holding eyelids open. Seek medical attention.

Skin: Wipe excess from skin, and flush the affected area with water. Follow by washing with soap and water. Wash contaminated clothing thoroughly before reuse. If irritation persists obtain medical attention.

Inhalation: Remove to fresh air, and provide oxygen or artificial respiration if needed. Obtain medical attention.

Ingestion: Do Not Induce Vomiting. Obtain immediate medical attention.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

Flash Point: higher than 93.3°C

Explosive Limits: Not determined

Auto – Ignition Temperature: Not determined

Hazardous Decomposition Products: Carbon oxides, nitrogen oxides

EXTINGUISHING MEDIA and FIRE FIGHTING INSTRUCTIONS

When sufficiently large quantities are present, firefighters should be equipped with full bunker gear, including a positive pressure, NIOSH approved, self-contained breathing apparatus. Fire-exposed containers may be cooled with water.

Extinguishing Media: Use water spray, fog, dry chemical powder, or an appropriate foam.

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Rev. A 10/2002

Fiber Optic Center™, Inc., 23 Centre Street, New Bedford, MA, 02740-6322, USA

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Toll Free: (800) IS-FIBER or (800) 473-4237 • Phone: (508) 992-6464 • Fax: (508) 991-8876 • Website: www.focenter.com



THE ONLY ADHESIVE LINE DEVELOPED EXCLUSIVELY FOR FIBER OPTICS

6. ACCIDENTIAL RELEASE MEASURES

Ventilate the spill area, and evacuate if necessary. Shut off the source of the leak if it is safe to do so. Remove all ignition sources. Dike and contain large spills. Absorb with clay, sand, or another suitable material, and dispose of properly.

Clean-up personnel should use adequate protective equipment.

7. HANDLING AND STORAGE

Store between 16-27°C, away from ignition sources and high temperatures. Avoid contact with incompatible materials. Wear protective eyewear, chemical-resistant gloves, and other protective clothing as appropriate. Do not breathe fumes. Avoid contact with eyes skin, and clothing. After handling always wash hands thoroughly with soap and water.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering / Ventilation Controls: General ventilation may be acceptable under most conditions, although local ventilation is required to control exposure whenever vapors, mists, or dusts are generated.

Respiratory Protection: When local ventilation is unavailable and airborne limits are exceeded, a NIOSH-approved respirator for organic vapors, a supplied-air respirator, or a self-contained breathing apparatus is required.

Skin Protection: Chemical resistant (nitrile) gloves. Lab coat

Eye Protection: Chemical splash goggles or safety glasses with side shields should be worn as appropriate.

9. STABILITY AND REACTIVITY

Chemical Stability: Stable under normal conditions and use.

Conditions and Materials to Avoid: Keep away from direct sunlight or strong incandescent light. Keep away from heat. Incompatible With peroxides, and oxidizing agents.

Hazardous Decomposition Products: Carbon oxides, nitrogen oxides

Hazardous Polymerization: Not likely under normal conditions.

10. PHYSICAL AND CHEMICAL PROPERTIES

Appearance / State: Clear viscous liquid
Odor: not determined
pH: Not determined
Vap. Pressure (mmHG): Not determined
Vap. Density (air = 1): > 1

Boiling Point: Not determined
Freezing Point: Not determined
Specific Gravity: Not determined
Solubility in Water: Not determined
Evaporation Rate: <1 compared to Butyl acetate

11. DISPOSAL CONSIDERATIONS

Keep out of surface waters, sewers, and waterways entering or leading to surface waters. Notify authorities if any exposure to the environment occurs or is likely to occur. Utilize an appropriate disposal facility, in compliance with applicable federal, state, and local environmental control regulations.

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950-200 from AngströmBond®
Page 3 of 3

Adhesives

The only adhesive line developed exclusively for fiber optics

12. TOXICOLOGICAL INFORMATION

Toxicity to Animals:

Acute Oral toxicity (LD50): >5000mg/kg[rat] (Multifunctional acrylate)

Acute Dermal toxicity(LD50): >5000mg/kg[Rabbit] (Multifunctional acrylate)

Multifunctional acrylate: chronic health effects information:

This component has been reported to be mutagenic in the mouse lymphoma (in vitro) assay, but negative in the Ames test.. A dermal carcinogenicity study was also negative.

WEEL =1mg/m3,skin 8hours

Based upon physical and chemical properties and the manner in which this product will be used, considering foreseeable emergencies, airborne exposure at or approaching the WEEL is unlikely to occur. Skin contact is possible. Users should take appropriate precautions to prevent skin contact.

Chronic exposure:

Chronic effects to humans:

None classified by IARC, none by NTP, None by OSHA

Acute Effects on humans:

May cause irritation to skin , eyes, and respiratory tract.

13. TRANSPORTATION INFORMATION

DOT/IATA Proper Shipping Name: Not regulated.

14. REGULATORY INFORMATION

TSCA

The chemical components of this product are included in the TSCA Chemical Substance Inventory, as required.

SARA TITLE III

Section 313 – Toxic Chemicals

Pursuant to Section 313, this product contains Glycol Ether 28.5%

HMIS Hazards: Health: 2 Flammability: 1 Reactivity: 1

Fiber Optic Center™, Inc. urges each customer or recipient of this MSDS to study it carefully in order to become aware of and understand the hazards associated with the product. The reader should consider consulting reference works or individuals who are experts in ventilation, toxicology, and/or fire prevention, as necessary to use and understand the data contained in this MSDS.

To promote safe handling, customers and recipients should: 1 – notify their employees, agents, contractors, and others whom they know or suspect will use this material or the information in this MSDS and any other information regarding hazards or safety; 2 – furnish this same information to each of their customers for the product; and 3 – request their customers to notify their employees, customers and other users of the product of this information.

The information contained herein is based on the data available to **Fiber Optic Center™, Inc.**, and is believed to be correct. However, **Fiber Optic Center™, Inc.** makes no warranty, expressed or implied, regarding the accuracy of this data or the results to be obtained from the use thereof. **Fiber Optic Center™, Inc.** assumes no responsibility for injury from the use of the product described herein.

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Chapter 8 Declaration of Conformity



EU Declaration of Conformity

in accordance with EN ISO 17050-1:2010

We: Thorlabs Inc.

Of: 56 Sparta Avenue, Newton, New Jersey, 07860, USA

in accordance with the following Directive(s):

2006/42/EC	Machinery Directive (MD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: **PTR205 and PTR208 family products**

Equipment: **Recoater, Rotary Proof Tester and combination**

is in conformity with the applicable requirements of the following documents:

EN ISO 12100	Safety of Machinery. General Principles for Design. Risk Assessment and Risk Reduction	2010
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
EN 62471	Photobiological Safety of Lamps and Lamp Systems	2008

and which, issued under the sole responsibility of Thorlabs, is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, for the reason stated below:

does not contain substances in excess of the maximum concentration values tolerated by weight in homogenous materials as listed in Annex II of the Directive

I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications, and complies with all applicable Essential Requirements of the Directives.

Signed:

On: 28 July 2016

Name: Ann Strachan

Position: Compliance Manager

EDC - PTR205 and PTR208 family products...



Chapter 9 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



Wheelie Bin Logo

As the WEEE directive applies to self-contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

9.1. Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

9.2. Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

Chapter 10 Thorlabs Worldwide Contacts

USA, Canada, and South America

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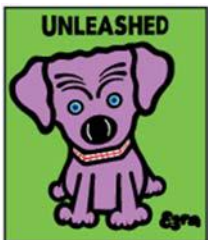
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