

PRINTING PROTOCOL

PEGDA X

This is a suggested procedure; please adjust according to your experimental needs. PEGDA X is light-sensitive. Minimize ambient light exposure and follow standard laboratory safety practices.

Protocol aim

The aim of this protocol is to provide step-by-step instructions to print PEGDA X using LUMEN X with recommended starting parameters optimized for the best feature resolution.

Materials needed

- LUMEN X Gen 3
- PEGDA X photoink*
- LUMEN X vat (clean, empty)*
- LUMEN X Glass Build Platform (clean)*
- Nitrile/latex gloves and lab coat
- 3 mL syringe + compatible nozzle/needle or positive displacement pipette
- Calibrated pipettes and tips (0.1 mL accuracy)
- 1 and 15 mL amber Eppendorf tubes or light-protected container
- USB drive containing STL files of models intended for printing
- Plastic razor blade
- Deionized water
- Ethanol
- Compressed air (optional)
- Spirit/bubble level and magnetic vises

*Components available individually or as the PEGDA X — see <https://www.cellink.com/product/pegda-x/>

1. Safety and preparation

- PEGDA X is a light-sensitive photoink. Keep refrigerated until use. Keep sealed until ready to begin.
- Wear gloves and a lab coat to protect skin and clothing.
- Ensure printbed temperature does not exceed 30°C and temperature control is OFF.
- Homogenize the vial with a photoink before printing: vortex or vigorously shake/invert 20 times, then let rest briefly to allow bubbles to rise/settle.

2. File setup (import model)

- Insert a USB drive into the LUMEN X front USB port or open DNA Studio Illuminate on your computer.
- Confirm that the LUMEN X is connected to DNA Studio Illuminate by clicking the Connection button at the top of the main screen (local connection).
- On the LUMEN X display: Home → New Print Protocol → select Model.
- Select between small, medium, or large Build Platform as the print surface according to the size of your model → press Next.
- In the Geometry screen, press Import (next to Geometries).
- Navigate to the USB drive and open the desired STL or OBJ.

3. Set print parameters

- Set Layer Height and Exposure per the recommended print parameters table below (Table 1).
- Set Light Intensity per the Recommended print parameters table below.
- Enable Build Platform adhesion using the recommended adhesion value (starting point: 6 s).

Table 1. Recommended starting print parameters for PEGDA X on LUMEN X Gen 3.

Layer thickness (µm)	Exposure (s)	Build platform adhesion (s)	Power (mW/cm ²)	Intensity (%)
100	3.0	6.0	≈ 20	70
50	2.0	6.0	≈ 20	70
20	1.5	6.0	≈ 20	70

Notes:

- Exposure should not exceed 6 s.
- Build platform adhesion should not exceed 6 s.
- Intensity (%) is valid only for a calibrated LUMEN X Gen 3. Verify that the printer has been calibrated with a CELLINK light meter within the last 6 months.
- On LUMEN X, 70% light intensity corresponds to approximately 20 mW/cm².
- To achieve smaller features, you can slightly increase exposure time or power, or you can reduce the layer thickness.

△ Always validate a single centered part before printing arrays. Stray light from adjacent features can cause over-curing and dimensional inaccuracy. Confirm single-part quality first, then increase inter-part spacing incrementally.

4. Slice and start

- Press Next to move to Slicing.
- Press Slice and wait until the slicing process is complete.
- Once completed, press Next again.
- On the Summary page, verify all settings, then press Go to Print.

5. Build platform leveling calibration (auto-levelling)

- When prompted, select Yes to start calibration; the print arm will “home”.
- When prompted, insert the clean, empty vat and press Yes. Use the magnetic vises and a spirit level to verify that the vat is correctly installed and free of tilt.
- When prompted, insert the Glass Build Platform. Do not tighten the levelling screw yet and ensure that the build platform is correctly aligned and installed.
- When prompted, make sure the build platform levelling screw is unlocked, then press Yes to begin auto-levelling.
- When prompted, tighten the levelling screw and confirm that it is locked. The build arm will then rise.

△ A loose levelling screw is the most frequent cause of model detachment. Verify the screw is fully tightened before proceeding.

6. Photoink preparation and loading

- Take a pipette or attach a nozzle to an empty 3 mL syringe.
- Homogenize the vial with PEGDA X before printing. Load the recommended volume of PEGDA X prompted in the UI and deposit it into the center of the vat.
- Use a fume-dispensing wash bottle containing 70% isopropanol to burst any remaining bubbles, ensure that only small amounts of IPA vapor are dispensed.
- On the display, press Confirm, material added.

△ Do not confirm material loaded if bubbles are visible on the vat window. Remove them with a syringe or IPA vapor before continuing.

7. Print execution

- Press Start Print.
- Never reuse excess PEGDA X from a previous print. Fully clean the vat before starting a new print.
- Close the enclosure door during printing.
- When the print is complete, the dialog box displays “Print complete” with a green checkmark.
- At print completion, the front LED strip turns green.

8. Post-print inspection

- Remove the magnetic build platform carefully. Inspect the print:
 - The model should be attached to the build platform.
 - Ensure that the lattice is centered on the build platform (e.g., for Schwarz model).
 - Model is fully printed - no missing sections.
 - Layers are intact - no splitting or delamination.

9. Print removal and cleaning

- Using a plastic razor blade, gently slide under the model corners and slowly lift the print free.
- Clean the vat by washing it with deionized water only. Do not use IPA. Leave it to air dry and do not use paper towels as it can leave debris or fibers on the vat surface.
- Clean the build platform by spraying it with ethanol, rinsing it with deionized water, and then allowing it to air dry or drying it with compressed air. Do not use paper towels.

- Do not dispose of PEGDA X residue down the sink or allow it to enter drains. Dispose of it according to local regulations and institutional waste disposal guidelines.

10. Documentation

- Press Add print comments to annotate the run. Press Save protocol to save the record; press Close protocol to exit
- Restart the print if required or save the protocol for later use to repeat the print with the same settings and image slicing included.
- Record batch/lot numbers for PEGDA X.