Laser Safety Manual for the Bambu Lab R1

1. Introduction to Lasers

Laser is light emitted through stimulated emission, characterized by monochromaticity, strong directionality, high brightness, and good coherence. Its principle is to amplify light signals using specific optical media (such as gases, liquids, or solids), ultimately releasing an intense, concentrated beam of light. Laser technology is widely used in various fields. Specifically, laser engraving/cutting equipment uses highly concentrated, high-energy lasers to vaporize the material surface, thereby enabling pattern engraving or material cutting on the material surface.

The Bambu Lab R1 laser cutter uses a CO_2 gas laser with a working wavelength of 10.6μm (far-infrared, invisible light), to engrave patterns or cut materials like wood, leather, acrylic, and stone into desired shapes.

Although lasers have broad application prospects, their high-energy nature also poses certain safety risks. Intense laser beams can cause irreversible damage to the eyes, even leading to blindness, especially when directly or indirectly exposed to them. Furthermore, laser radiation at high power can also cause skin burns, and in specific circumstances, lead to fire or explosions. Therefore, proper use of laser equipment is crucial, and protective measures must not be overlooked. To address the potential hazards of lasers, organizations such as the International Electrotechnical Commission (IEC), the American National Standards Institute (ANSI), and the European Committee for Electrotechnical Standardization (CENELEC) have established strict laser safety standards, stipulating that laser equipment of different power levels must be equipped with corresponding safety protection measures.

2. Laser Classification

Laser Beam Hazards

The CO_2 laser used by Bambu Lab R1 has a wavelength of 10.6μm, belonging to the far-infrared band, and is strongly absorbed primarily by the cornea and the superficial layers of the skin, causing thermal burns to the cornea/skin. Unlike blue light (455nm, which can penetrate the cornea and lens to reach the retina, causing permanent damage), 10.6μm does not reach the retina, but the thermal damage to the cornea is equally irreversible, and because the beam is invisible, it is harder to detect and poses a higher risk. Direct exposure, specular reflection, and diffuse reflection can all cause varying degrees of damage. The higher the power, the stronger the focus, and the longer the exposure, the greater the risk.

Air pollutants generated by lasers: Various potentially harmful fumes are produced during processing and must be filtered by an air purifier or safely discharged outdoors.

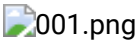
Air Pollutants Generated by Lasers

When processing materials with lasers, various potentially harmful air pollutants may be generated. Please follow the user manual to ensure that all exhaust gases are filtered by an air purifier or safely discharged outdoors for proper dispersal.

Specifications	Laser Power	Description	Applications	Protective Measures
Class 1	Extra low	Safe under all reasonably foreseeable operating conditions (including direct viewing with optical instruments).	Laser printers, CD players	Harmless
Class 1M	Extra low	Safe under all reasonably foreseeable operating conditions, but may be hazardous if viewed directly with optical instruments.	Fiber optic communication systems	
Class 2	<1 mW		Entertainment laser guns, laser pointers, barcode scanners	
Class 2M	<1 mW		Leveling and positioning instruments used in civil engineering	
Class 3R	1-5 mW		Line alignment instruments	
Class 3B	5-500 mW		Lasers used for physical therapy	Requires wearing laser protective equipment for eyes and skin
Class 4	> 500 mW		Laser projection displays, laser surgical equipment, laser cutting equipment	Requires wearing laser protective equipment for eyes and skin

Any laser equipment can be reclassified as a Class 1 laser, provided it is fitted with an appropriate enclosure and safety measures are implemented.

3. Laser Warning Markings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4. Laser Technical Specifications

Parameter	Specification
Laser type	55 W CO2 laser
Processing laser wavelength	9 μm ~ 11 μm
Spot size	Short-focus: Ø 0.11 mm; Medium-focus: Ø 0.17 mm; Long-focus: Ø 0.19 mm
Recommended operating temp	10°C – 30°C
Allowable operating temperature	5°C – 35°C
Max speed	1000 mm/s
Max acceleration	20000 mm/s²
Max cutting capacity	Short-focus: 15 mm black walnut plywood / 20 mm acrylic; Medium-focus: 18 mm black walnut plywood / 20 mm acrylic; Long-focus: 18 mm black walnut plywood / 20 mm acrylic (faster than medium at the same thickness)
Laser safety class	Standalone: Class 1 With riser base: Class 4
Working area	Standalone: 600 × 300 mm; With Conveyor: max. 600 × 3000 mm (3 guide rail extension kits must be purchased separately to support material lengths up to 3 m)
Working height	Standalone: up to 57 mm; With riser base: up to 248 mm (without base tray)
XY positioning method	Dual-camera + dual-laser + dual-encoder system

Parameter	Specification
XY visual positioning accuracy	< 0.2 mm
XY magnetic encoder positioning accuracy	< 0.1 mm
Z ranging method	Fully automatic laser ranging + contact ranging
Z ranging accuracy	± 0.1 mm (laser ranging)
Flame detection	Supported
Coolant temperature detection	Supported
Water level detection	Supported
Flow rate detection	Supported
Lid-open protection	Supported; stops when the lid is opened
Safety key	Standard
Air assist pump	Built-in, 30 L/min @ 30 kPa
Exhaust hose size	Length 2 m, outer diameter approx. 86.5 mm
Supported materials	Cut & engrave: wood, acrylic (incl. clear acrylic), leather, fabric, paper, EVA foam, shell; Engrave only: coated metal (bare metal cannot be engraved), glass, ceramic
Prohibited materials	May release toxic gases: PVC, chlorine-containing plastics, PTFE, etc.; May reduce laser lifespan: highly reflective metals

End Notes

We hope this guide has provided clear and practical support.

If the issue remains unresolved, please submit a support ticket and include your recent printer logs and additional pictures or other details. Our customer support team will review your request and

provide detailed assistance.

You can also visit Bambu AI , which can instantly answer common questions and provide you with operational guidance.