Modular fiber-coupled laser illumination

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Latin American Hub for Bioimaging Through Open Hardware (LIBRE hub)

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Antes de iniciar con la construcción de este sistema de iluminación, usted deberá conseguir todos los componentes que aparecen en esta lista de materiales (

, 

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Instrucciones

Estas instrucciones lo guiarán en cómo ensamblar el sistema modular de iluminación láser acoplada a fibra.

Para acceder a las instrucciones, tiene los siguientes formatos: Google Drive y PDF.

Este sitio web esta basado en la plataforma GitBuilding. El ensamblaje está detallado en los siguientes pasos:

Bill of Materials

Download this as a CSV file

Módulo óptico

> ⚠ **Cuidado** Utilizar guantes de nitrilo para la manipulación de todas las piezas del módulo óptico. Tener especial cuidado con los lentes y la fibra láser.

Step 1: Lente óptico

Calzar anillo interno 1 en herramienta OP. Luego, introducir en tubo óptico y girar hasta una profundidad de 6mm.

Insertar lente en tubo óptico.

Calzar anillo interno 2 en herramienta OP, introducir en tubo óptico y girar hasta el tope.

Step 2: Tubos ópticos

Para este paso, debe disponer del tubo óptico con su lente acoplado, ensamblado en el paso anterior.

Calzar ambos tubos y girar hasta el final.

Step 3: Base

Para este paso, debe disponer del tubo óptico extendido, ensamblado en el paso anterior.

Poner abrazaderas en superficie horizontal a una distancia de 25 mm entre ambas partes. Luego, ensamblar tubo óptico a ambas abrazaderas presionando hacia abajo.

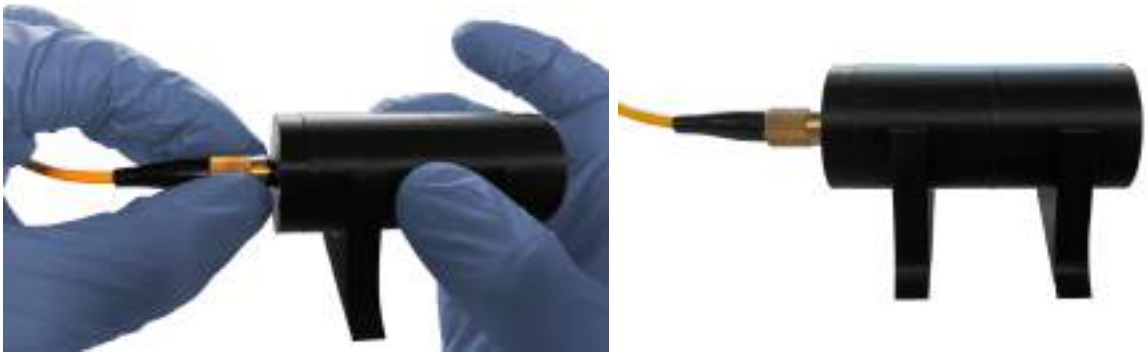
Step 4: Adaptador de fibra láser

Para este paso, debe disponer del tubo óptico extendido con las abrazaderas, ensamblado en el paso anterior.

Calzar adaptador de fibra láser y girar hasta el final.

Retirar tapa de láser, ensamblar láser con adaptador de fibra láser y girar adaptador láser hasta el final.

> ⚠ **Cuidado** No tocar fibra óptica. Manipular componentes como se muestra en las imágenes.



El ensamblaje debe verse como en la imagen inferior.

Step 5: Difusor

Calzar difusor en herramienta OP e introducir en tubo óptico. Girar hasta el final del tubo.

Módulo control de temperatura

Step 1: Acomplamiento disipador láser con la tapa

Posicionar y acoplar disipador de láser en la tapa sin torcer fibra para evitar daños.

Step 2: Pegado de cinta térmica

Pegar cinta térmica adhesiva en disipador de láser acoplado en la tapa.

Step 3: Acomplamiento ventilador con casing

Posicionar y acoplar el ventilador con disipador en el casing, teniendo cuidado de no aplastar los cables del ventilador.

Step 4: Ensamblaje final

Desprender capa azul de cinta térmica adherida al disipador del láser.

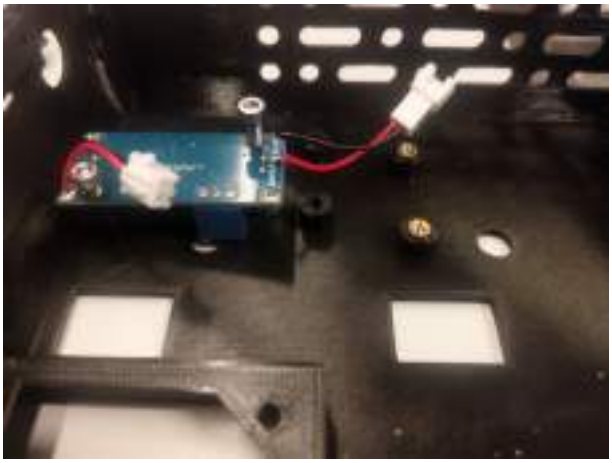
Acoplar “Casing Ventilación Láser” (con el ventilador previamente insertado) con “Tapa Ventilación Láser” (disipador y cinta térmica previamente unidos)

Atornillar pernos M3 de 10 mm para fijar ambas partes.

Módulo interfaz de usuario

Step 1: LM2596

Posicionar LM2596 tal que la posición del potenciómetro sea la correcta. Atornillar placa a la tapa TOP usando llave allen M3 y 2 pernos M3X12.



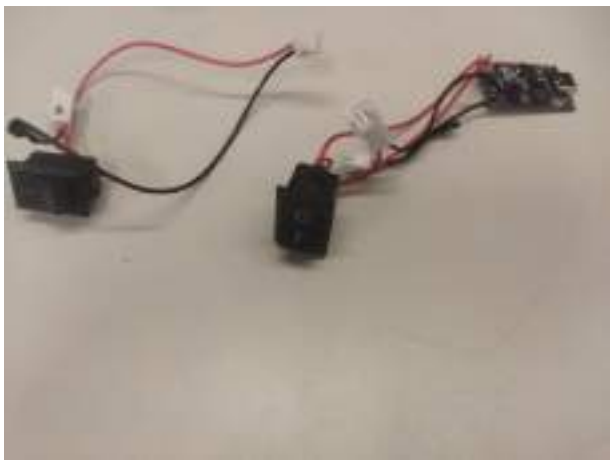
Step 2: Ajuste señuelo de carga

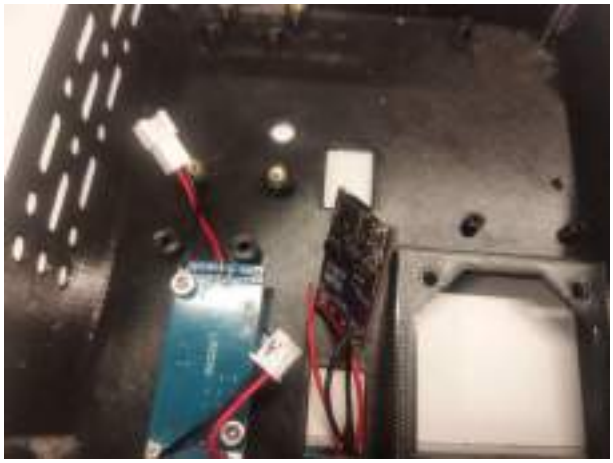
Ajuste de interruptores S1, S2, S3 en las posiciones 1, 0, 1 para que tarjeta electrónica entregue un voltaje de 12 V.

	S1	S2	S3
5V	1	1	0
9V	1	1	1
12V	1	0	1
15V	0	0	1
20V	0	1	1

Step 3: Interruptores

Introducir señuelo de carga (tarjeta electrónica morada) a través de la perforación para el interruptor del motor.

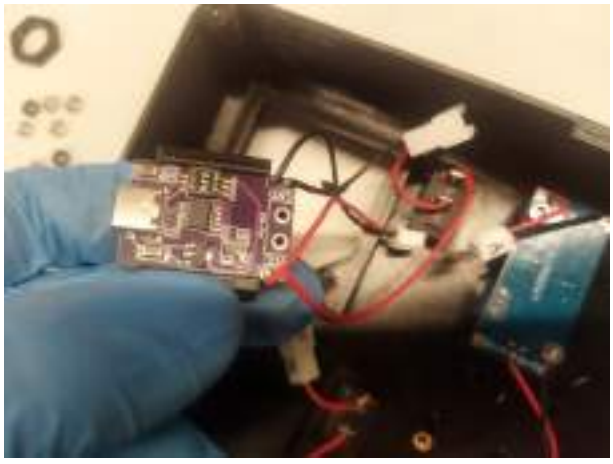




Introducir el segundo interruptor a través de la perforación para el láser y presionar para fijar al panel (tapa TOP).

Step 4: Ensamblaje de Señuelo de carga

Alinear la tarjeta electrónica morada con el adaptador plástico como se muestra a continuación.



Atornillar pernos M2x10 para fijar tarjeta electrónica.

Insertar tuercas M3x10 y posteriormente fijar al panel (tapa TOP).

Step 5: Fijación de cable adaptador M12

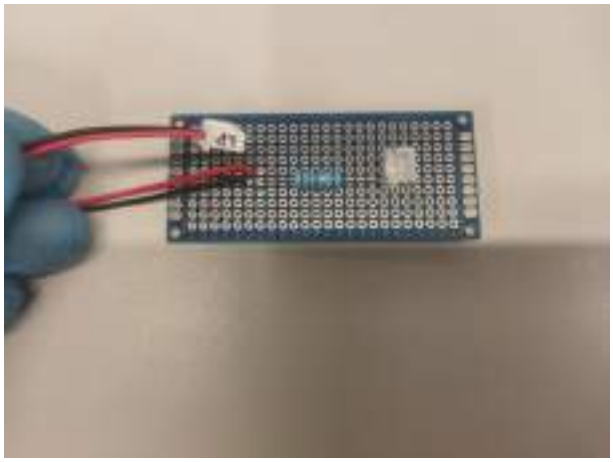
Introducir cable M12 desde el interior de la tapa TOP en su respectiva perforación. Posteriormente fijar la tuerca M12.

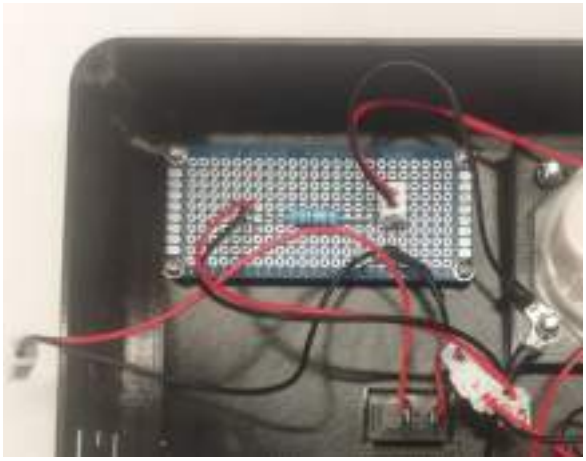
Step 6: Amperímetro

Introducir y presionar amperímetro en el panel (tapa TOP). Fijar amperímetro con tuercas M3.

Step 7: Fijación de circuito limitador de corriente

Posicionar y fijar tarjeta electrónica en panel (tapa TOP) usando 4 tornillos M2x10 incluidos. Respetar orientación acorde a las siguientes imágenes.

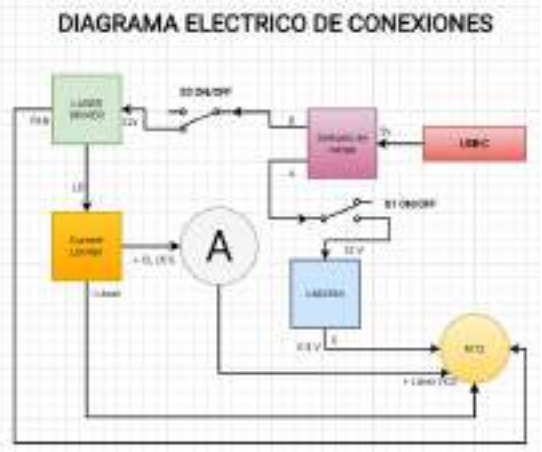


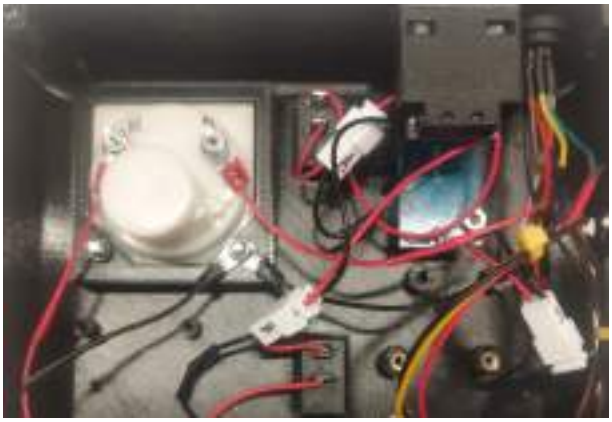


La tarjeta electrónica solo está incluida en los kits cuyo láser tenga una longitud de onda de 405 nm o 638 nm. Para más información ingrese al siguiente enlace Circuito Limitador de Corriente (page 25)

Step 8: Conexión de cables

Conectar cables A, B, C en la misma letra según corresponda. Conectar golillas K1 y K2 en las posiciones señaladas en amperímetro. Para la conexión de las golillas utilizar tuercas M3. Considerar el diagrama de conexiones eléctricas detallado a continuación:





Conectar cables 12V y FAN a tarjeta Laser Driver en puertos de alimentación de 12 V y ventilador respectivamente.

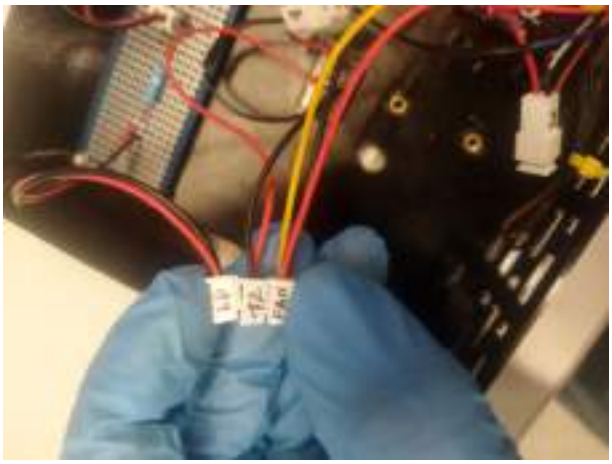
Para la conexión del puerto LD que corresponde a la salida de la fuente de corriente ajustable que alimenta el láser. Considerar lo siguiente:

En caso de que se incluya el circuito limitador de corriente: Conectar puerto LD del "laser driver" directamente a la tarjeta con el circuito limitador de corriente. Y posteriormente desde el puerto de salida del circuito limitador de corriente, conectar el pin + al amperímetro (K1) y el pin - al

ánodo del láser, tal como se ilustra en diagrama eléctrico anteriormente descrito.

En caso de no incluir circuito limitador de corriente: Conectar pin + del puerto LD del "laser driver" directamente al amperímetro (K1), y el pin - al ánodo del láser.

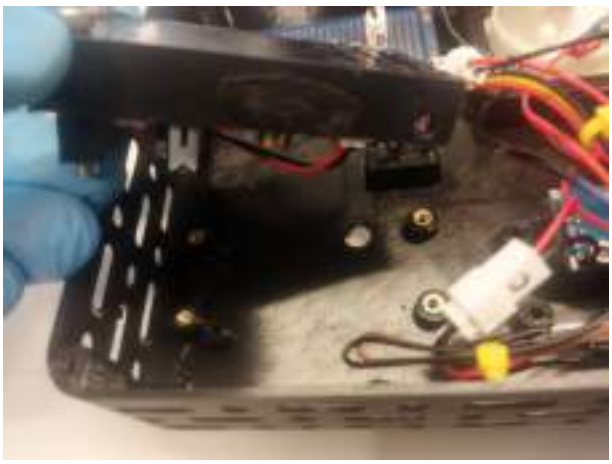
A continuación, se muestran fotografías del "laser driver" incluido en kit, junto a imagen representativa de las conexiones.



Los cables utilizados corresponden al modelo XH54 de 2 pines macho/hembra, pero se puede utilizar otro modelo que se disponga.

Step 9: Fijación del driver de láser

Voltear tarjeta de laser driver orientándola tal que el potenciómetro quede bien posicionado. Ensamblar separadores con pernos M3x8 para fijar tarjeta.



> La versión de los separadores puede variar, sin embargo, el resultado final es el mismo.

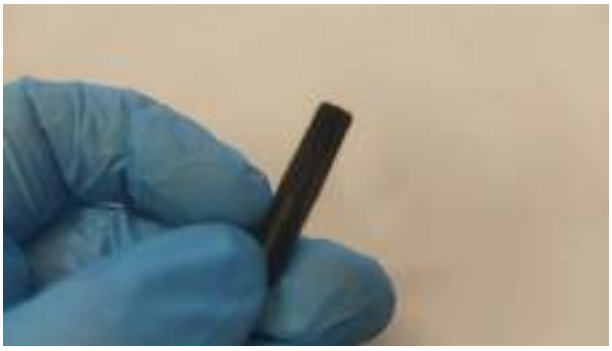
Step 10: Montaje de tapa acrílica

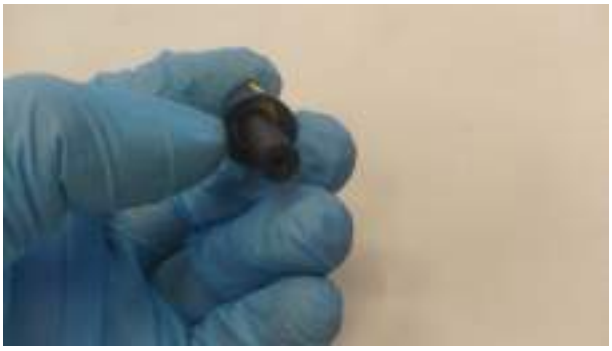
Posicionar 4 tuercas M3 como se muestra en la siguiente imagen.

Orientar tapa BOTTOM de acrílico como se muestra en la siguiente imagen. Apretar pernos M3x10 y posteriormente pegar gomas antideslizantes en cada perno.

Step 11: Ensamblaje de perillas

Posicionar y presionar cada perilla en cada orificio de la tapa TOP.





La interfaz de usuario ensamblada debe verse como en las siguientes imágenes.

Láser Azul

Corriente Máxima: 135 mA

Longitud de Onda: 488 nm

Potencia Óptica: 55 mW

Precaución

No se incluye circuito limitador de corriente, ya que la fuente de corriente ajustable no supera los 200 mA. Sin embargo, se recomienda no operar con corrientes mayores a las recomendadas por el fabricante para evitar daños en el láser.

Láser Violeta

Corriente Máxima: 400 mA

Longitud de Onda: 405 nm

Potencia Óptica: 300 mW

Precaución

Debido a que el circuito limitador incluido en el kit presenta problemas se recomienda usar el láser sin esta tarjeta electrónica. Tomando precaución que la corriente registrada en el amperímetro análogo incluido no supere los 400 mA para evitar dañar el láser.

Laser cut the acrylic parts

Tool

- 1 Laser cutting machine

Material

- 1 Acrylic sheet

Step 1: Set your laser cutting machine settings

Laser-cutting acrylics is relatively simple. The basic steps for achieving good-quality cut acrylic parts are listed here.

Settings for laser cutting acrylics will vary according to the machine. The table below lists the settings we used:

Setting	Value
Material	Acrylic 3mm
Power (W)	40
Speed (mm/s)	20

We recommend testing the parameters for acrylic laser cutting using a test matrix. Download and laser cut the test matrix (page 44) file. This will only use about an 8x9x0.5cm acrylic sheet.

The result should look like this:

Step 2: Laser cutting

Now you have tested your laser cutting machine and acrylic sheet you can laser cut the following parts:

Remove film

- If there is protective film on the acrylic, remove it now.
- Your plates are now prepared and ready to use.

Use cases

Please Note: This site is under construction.

Láser Rojo

Corriente Máxima: 625 mA

Longitud de Onda: 638 nm

Potencia Óptica: 300 mW

Para limitar la potencia óptica del láser, se considera una resistencia **R1= 2 ohm**. De acuerdo a las especificaciones técnicas del fabricante este láser puede alcanzar una potencia óptica de 700 mW con un consumo de corriente de 1 A.

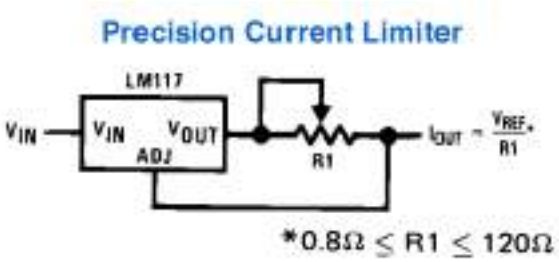
Circuito Limitador de Corriente

Se diseña tarjeta electrónica que limita la corriente que entrega la fuente de corriente ajustable (laser driver) por 2 motivos.

1.- Limitar potencia óptica de láser a 300 mW correspondiente a **class 3B** según norma internacional, tal que se disminuyan los riesgos de manipulación con lásers de mayor potencia óptica.

2.- Evitar dañar láser cuya corriente máxima de operación sea menor a la que entrega la fuente de corriente ajustable (láser driver)

La topología que se utilizo es la siguiente:



- Vin corresponde a pin + de la salida LD que alimenta al láser desde la fuente de corriente ajustable (láser driver)
- Iout se conecta al cátodo del láser
- La tierra del láser driver (pin - LD) se conecta directamente al ánodo del láser
- R1 se calcula de acuerdo a la corriente que se desea limitar.

Troubleshooting

Please Note: This site is under construction.

Use your laser module

Please Note: This site is under construction.

Print the plastic parts

Tool

- 1 Precision wire cutter
- 1 RepRap-style printer
- 1 Utility knife - Not a scalpel!

Material

- 200 gr of PLA filament

Step 1: Set your printer settings

Almost all station parts can be printed out of PLA filament on most RepRap-style printers.

We recommend the following printer settings:

Setting	Value
Material	PLA
Material Colour	Black
Material Temperature	Recommended by the PLA brand
Layer height	0.2mm or less
Infill	Printer default or more
Brim	Recommended for all parts
Slice gap closing radius	0.001mm

Test whether your printer can print the pieces for this station or other open-source designs. Download and print the leg test file. This will only use about 5 grams of PLA.

The result should look like this (this has been printed with a brim):

As a general rule, strength is more important than surface finish, so very thin layers (less than 0.15mm or so) are unlikely to result in a station that performs any better, though it may improve the appearance.

Step 2: Printing

Now you have tested your 3D printer and filament you can print the following parts:

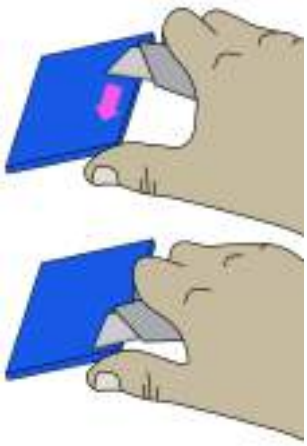
You can download all the STLs as a single zipfile.

Step 3: Clean-up of printed parts

> ⚠ **Be careful when removing brim:** To avoid injury, first remove the bulk of the brim without a knife. Remove the remaining brim with a peeling action as described below.

Carefully remove the printing brim from all parts. To remove brim:

1. Use precision wire cutters to remove most of the brim from the part.
2. Clean up the remaining brim with a utility knife:
    - Hold the knife in your dominant hand with 4 fingers curled around the handle, leaving your thumb free.
    - Hold the part in your other hand, as far away from the surface, to be cut as possible.
    - Support the part with the thumb of your dominant hand.
    - Place the blade on the surface to be cut, and carefully close your dominant hand, moving the blade, under control, towards your thumb.



El sistema modular de iluminación láser acoplada a fibra es un dispositivo libre y de fuente abierta. Este sistema puede utilizar láseres con varias longitudes de onda, acopladas en una sola fibra óptica, lo que permite una fácil selección digital sin modificaciones estructurales. Su diseño modular permite reutilizar y mejorar piezas individuales, combinarlas, intercambiarlas o utilizarlas fácilmente por sí solas.

Nota: Este sistema esta basado en algunos recursos de la plataforma SQUID.

Para aprender más sobre este sistema y otras tecnologías libres para bioimágenes, te invitamos a visitar la página web de LIBRE hub.

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3D Models

List of Contents

Precision wire cutters

Precision wire cutters, sometimes called flush cutters, are wire cutters that come to a sharp point and have a flat back surface. This allows small wires (or 3D-printed supports) to be cut flush against another surface. These are very useful for removing small 3D-printed ties used to hold the microscope together during printing.

Utility knife

Any standard utility knife should work for simple jobs like removing a brim.

Any retractable or fixed blade untility knife should work. This is probably safer than scalpel, but should still be used with caution! A Stanley Titan fixed blade knife is a high quality option with replaceable blades that are fixed rather than retractable.

Rep-Rap style 3D printer

The stage has been designed to be printed on low-cost entry-level fused filament fabrication 3D printers. Many of these printers are Open-Hardware and originate from the Rep-Rap project.

A popular example is the Prusa i3 MK3S.

Laser cutting machine

High-precision tool that uses a focused laser beam to cut through or engrave various materials.

It offers versatility in cutting intricate shapes, patterns, and designs in materials like wood, acrylic, metal and fabric.

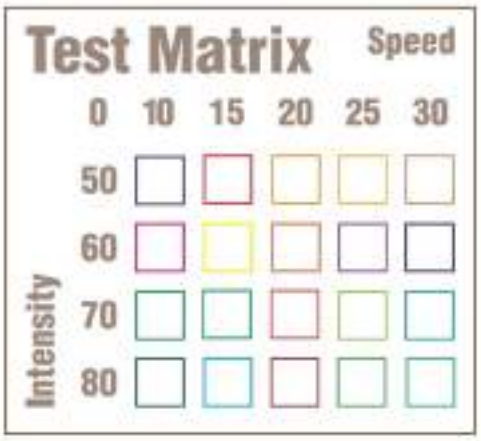
Laser cutting machines are used in industries like manufacturing, crafting, signage, and engineering for precise and efficient material processing.

PLA filament

Supplier: Esun

Test Matrix

Download test-matrix.pdf



Acrylic sheet

5mm thick plates.

Supplier: Novoacril

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