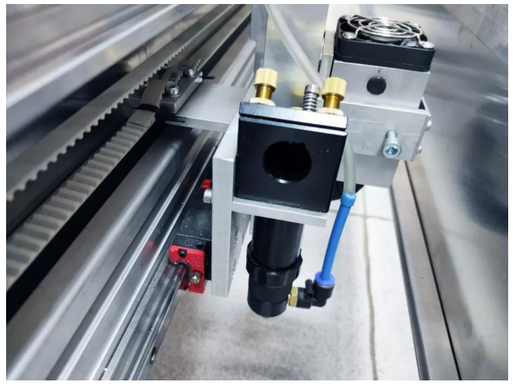
An Endurance 80 watt Custom Co2 Laser Machine with 6×5′ (2×1.7 m) working size area

Posted on 07.10.2019 (28.12.2021) by George Fomitchev

Endurance lasers present an industrial Co2 engraving and cutting machine with a huge working area (6×5′) [2×1.7 m]. High velocity + ultra-high precision.



Endurance Lasers LLC offers a custom Co2 engraving/cutting machine that can operate (suitable for) with various Co2 tubes. At the moment the CO2 laser is one of the cheapest options and has a low specific cost per watt of radiation. There are 40-600 watt Co2 tubes available on the market now. Common CO2 tubes have a power ranging from 40W to 100W. The laser is powered by a high-voltage source of approximately 10 … 40 kV, depending on the power. The size of the tube depends on the laser power: the more powerful, the longer the tube, and the diameter also increases.

The good thing about Co2 tubes is that the beam quality is quite high so that it is easy to focus it in a small laser beam spot.

Imagine. Create. Enjoy!

The machine itself has an aluminum frame with stainless steel guides and belts driven by stepper motors. In this type of frame, Nema23 stepper motors work fine. The work is carried out under the control of special controllers from the program (RdWorks) on the computer.

We use a high-quality stepper motor driver from Leadshine.

On an Endurance custom frame, we can install a spindle, a diode laser, and even a solid-state laser if needed.

Keep in mind that the laser radiation is potentially dangerous and it is necessary to operate the laser wearing special protective goggles (with at least OD>5) and it is better to have an enclosure as well.

Be careful when contacting the high-voltage part of the equipment. Be sure to connect the ground connection to the high-voltage part and to the machine body.

We also recommend using a fume extractor while laser cutting.

Keep in mind that to operate a Co2 laser you need a chiller – the device that cools down the laser tube itself. The temperature of the tube should be less than 30C.

That is why we recommend using 2 types of industrial chillers.

The wavelength of the Co2 laser is 10.6 uM while a diode laser has a wavelength of 445 nm which is 20 times less.

The laser cutting machine is a working area with a mechanism for moving mirrors and lenses.

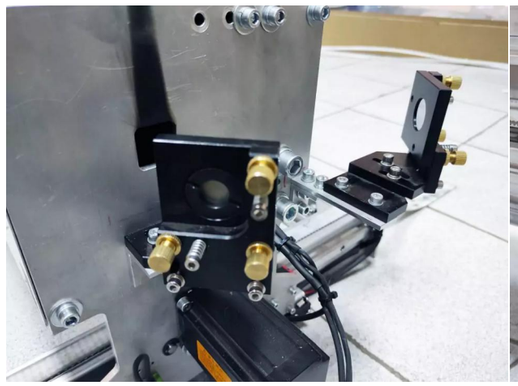
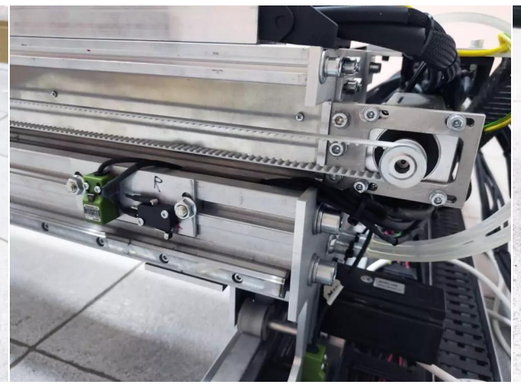
The laser radiation comes out of the tube, hits a mirror mounted at 45°, and turns the beam 90° into the working area. The next mirror is fixed to the profile of the X-axis and moves along with this axis. It also rotates the beam by 90°. On the axis itself, a carriage with a special head (laser barrel, laser focusing head) is installed, in which, in addition to another mirror that turns the beam from the horizontal plane vertically down, a focusing lens is installed that collects the laser beam to a point. Thus, the laser radiation moves in the XY plane.

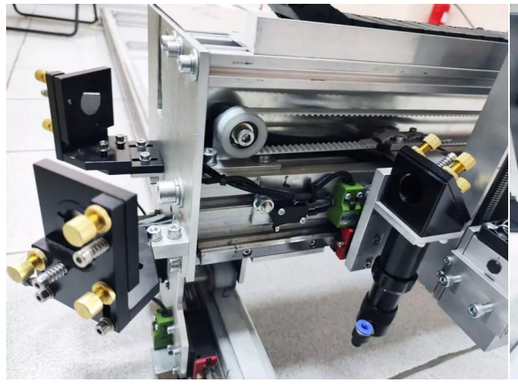
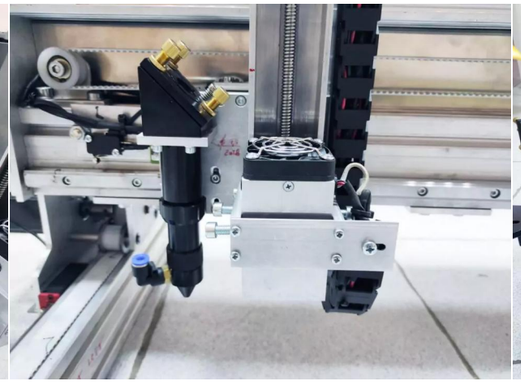
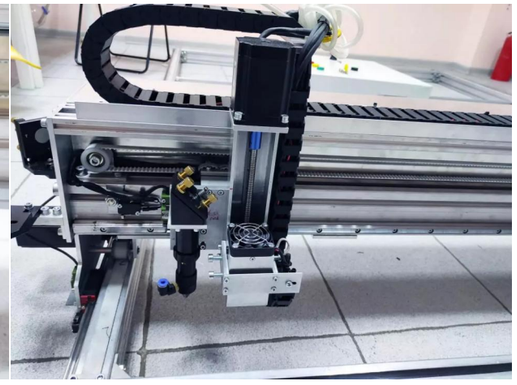
We also recommend using compressed air all the time when you do laser cutting. We used Hailea ACO-500 with 420 l / min and pressure of 0.05MPA, a higher pressure may be also used.

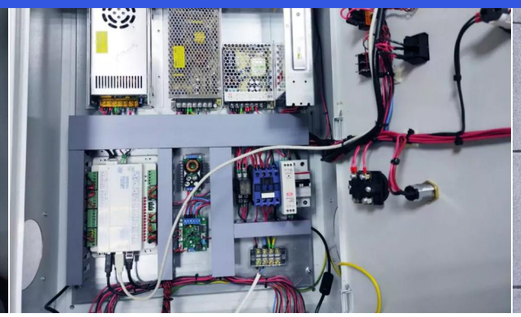
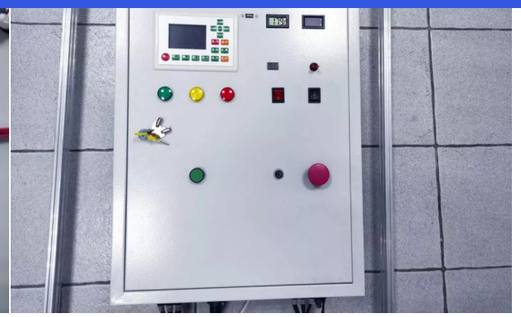
Keep in mind that most Co2 tubes have a lifetime of 3000-10000 hours so replace the Co2 tube once you see the power loss.

control our machine via USB or Wi-Fi.



First launch of the laser machine

Endurance custom 2x2m (6x6') Co2 machine. 80 watt laser power. First l

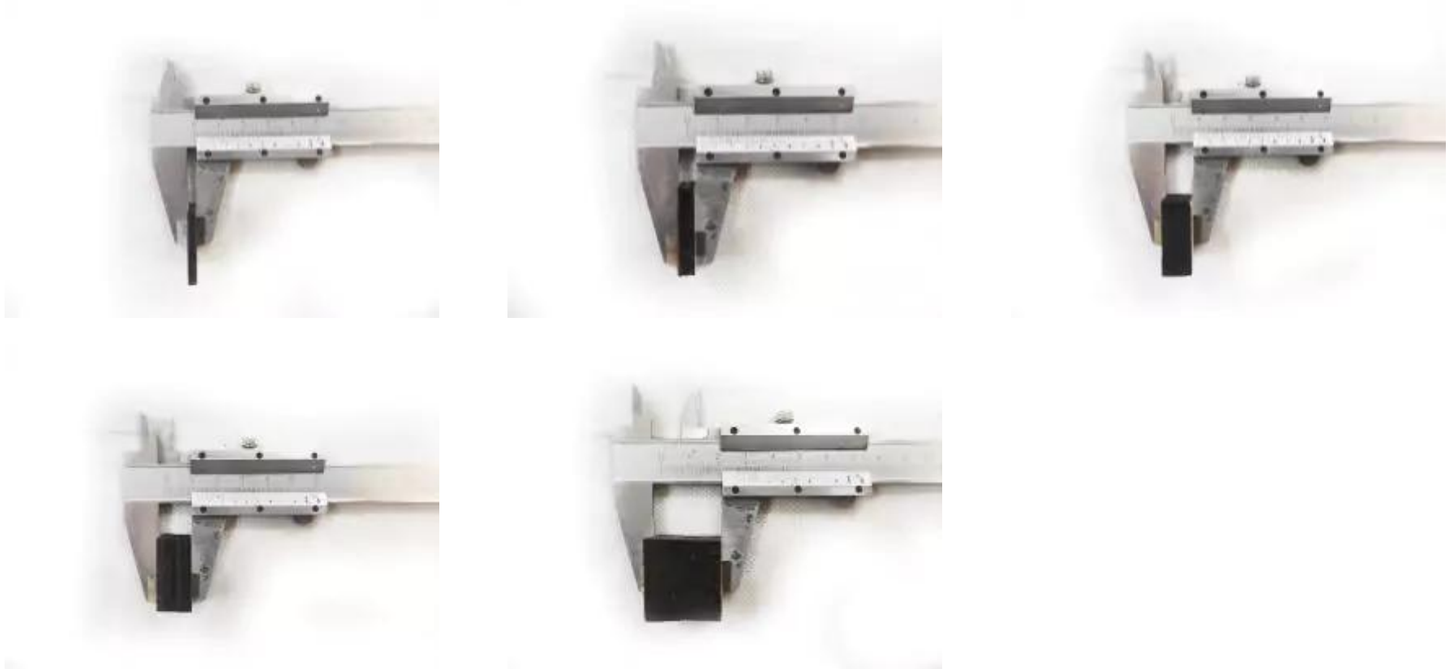
Wood / plywood C02 Co2 laser cutting

We cut:

- 3 mm (1/8”) MDF
- 5 mm (3/8”) plywood
- 10 mm (5/12”) plywood
- 12 mm (1/2”) plywood
- 24 mm (1”) piece of wood

Running on RdWorks software

- Using the same power: 95%
- Laser cutting speed: 15 mm / sec
- 80 watt Co2 tube
- Hailea 500 watt ACO-500 420 l / min air compressor



Metal engraving/etching with 80 watt Co2 laser: steel, stainless steel,...

Plywood cutting speed can vary: 50-75 mm / sec, power 95%
Acrylic cutting speed can vary: 25-40mm / sec, power 95%

MDF cutting speed can vary: 100 mm / sec, power 25%
MDF engraving speed can vary: 200 mm / sec, power 15%

Stainless steel engraving speed can vary: 200 mm / sec, power 90%
Titanium engraving speed can vary: 200 mm / sec, power 50%

More cutting abilities with a Co2 laser

Cutting different materials with a Co2 laser: bread board, kevlar, gasket s

Tech specs of an Endurance 80 watt Co2 laser machine

Name	**Endurance Custom 80 watt Co2 machine**	
Total size X x Y x Z	2550 x 2370 x 500	mm
Material	Aluminum Alloy	
g size X x Y	2035 x 1655 (6 x 5')	mm

max		
Max Travel Speed (X / Y / Z) Optimal Travel Speed (X / Y / Z)	50 15	meters / min
Accuracy	0.1	mm
Motor Drivers (X / Y / Z)	Leadshine 552	
Steps / mm (X / Y / Z)		
Communication Interface	USB	
Control Board	Ruida 6442G	
Firmware		
Software Support	RdWorks / Lightburn (optional) Autocad / CorelDraw can be used with RdWorks plugin	
Supported OS	Windows 7/8/10	
Laser	Endurance 10 watt (wavelength 445 nm) 80 watt Co2 (wavelength 10.6 um)	
Total power supply		watt
Air assist	Air compressor Hailea ACO-500 1 x air nozzle for a Co2	420 L / min
OS	Win	
Warranty	1 year	
Maintenance	Keep the frame and the laser clean	
Laser Box Size XYZ	650 x 500 x 220	mm

working area		
Supply Voltage	240	V AC
Co2 laser-beam focus	2-3 mm	
Co2 laser lens	20 mm diameter / 100 mm focus	
Laser beam divergence	3.1	mRad
Laser beam spot	0.3	mm
Laser focal depth	7.5	mm

- Laser lens package (optional)

Focus range in inch	Focus range in mm	Laser beam spot in mm	Laser focal depth mm
2	50	0.155	3.75
2,5	60	0.186	4.5
3	75	0.2325	5
4	100	0.31	7.5

- Cooling chiller for Co2 tube is required (CW3000 / CW5200)

Model	CW-3000AG	CW-3000DG
Voltage	AC 1P 220V	AC 1P 110V
Frequency	50/60Hz	50/60Hz
Current	0.45A	0.9A
Machine power	0.10KW	0.10KW
Radiating capacity	50W/°C	
Max.lift	10M	
Max.flow	10L/min	
N.W.	9.5Kgs	
G.W.	12Kgs	
Protection	Flow alarm	
Tank capacity	9L	
Inlet and outlet	OD 10mm Barbed Connector	
Dimension	49 X27X38 cm (L X W X H)	
Package dimension	59 X39X48 cm (L X W X H)	

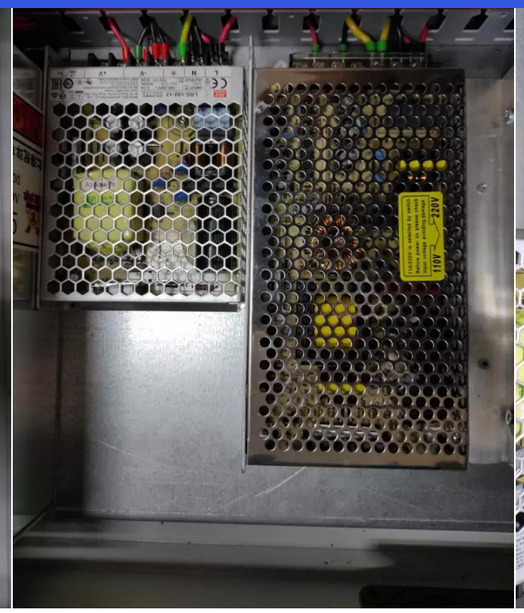
CW3000	CW5200

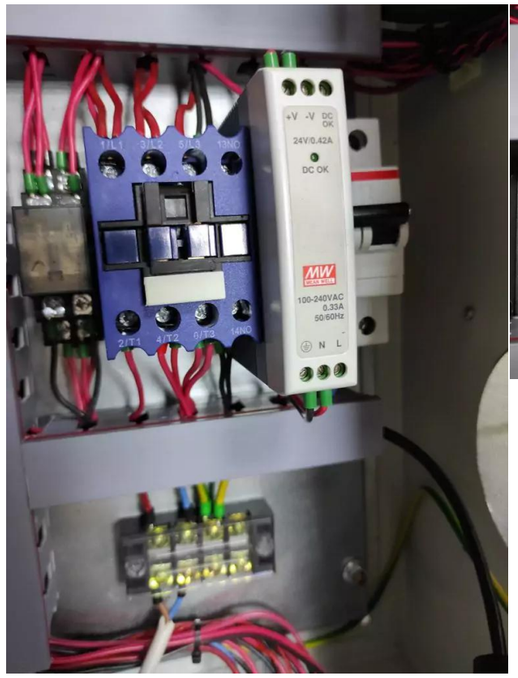
Warranty :	2 years
Weight :	23KG
Model :	S&A CW3000
Country/Region of Manufacture :	China
MPN :	0298000192503
Brand :	S&A
MPN :	0298000192503
Brand :	S&A

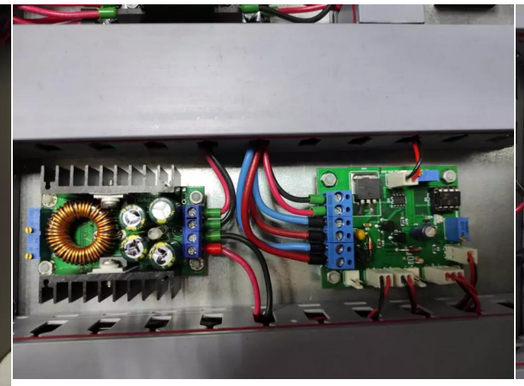
1. 1400W cooling capacity; optional environmental refrigerant;
2. Compact size, long working life and simple operation;
3. ±0.3°C precisely temperature control;
4. The intelligent temperature controller has 2 control modes, applicable to different applied occasions; with various setting and display functions;
5. Multiple alarm functions: compressor time-delay protection, compressor overcurrent protection, water flow alarm and over high / low temperature alarm;
6. Multiple power specifications; CE approval;RoHS approval;
7. Optional heater and water filter.

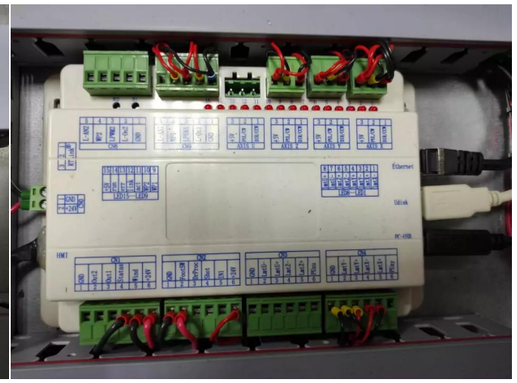
- A fume extractor can be added upon request
  - Example 1: Orion Motor Tech XF-250 Fume Extractor with 2 Intake Tubes and 3 Stage Air Filter, Wheeled Smoke Absorber & Purifier, 130W Air Purifier for Laser Cutters Engravers Soldering Stations CNC Machines More
  - Example 2: SW Shunwei “High-quality double welding fume arms dust extractor industrial”

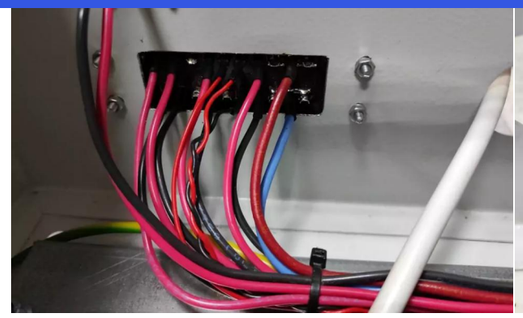
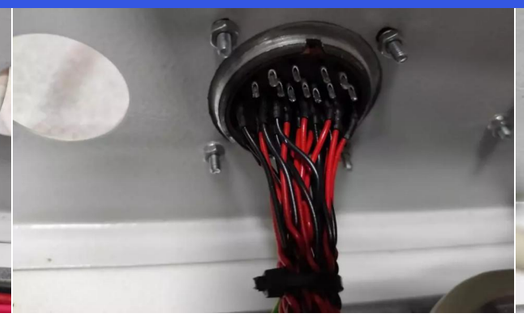
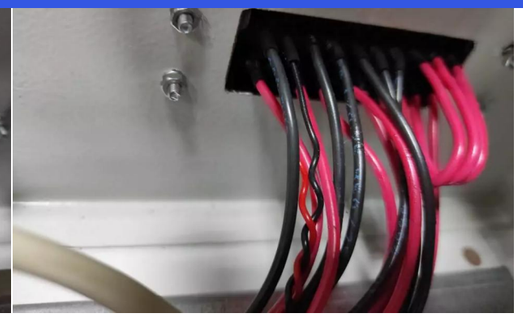
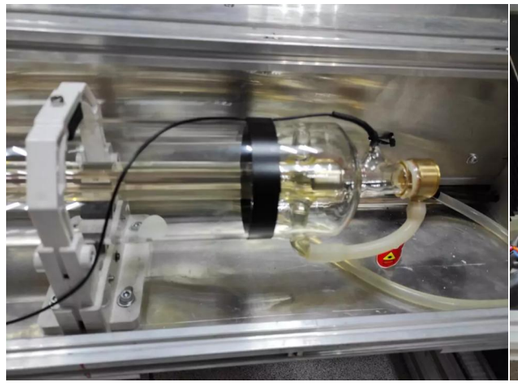
Components list









Laser components

High voltage Co2 laser power supply

Holder for laser tubes with a diameter of 80mm x 2PCS

Mirrors d = 25mm x 3 PCS

80 Laser tube PURI PRR-1200

Focusing lens: Lens d = 20 mm, f = 63 mm

Electronics components

Power supply AC/DC 48V 12.5A x 2PCS (power for X1, X2, Y, Z axes)

Power supply AC/DC 24V 10A x 1PCS (Ruida power)

Power supply AC/DC 24V 0.42A x 1PCS (emergency end-stops)

Electric opening switch 6A

DC/DC+ Mo2 (power + controller of a diode laser)

curity switch (on/off the machine)

Control box (transportable)

Active fan cooling

Mechanical components

X axes:

Aluminum profile 40×80 – 2 x 2.5 meters

Profile guide 15 mm – 2x 2.5 meters

Belt 20 mm XL 5.08- 2×3 meters

Motors: Nema23 ST57-100x 2PCS

Y-axes:

Aluminum profile 40×80 – 2 x 2 meters

Profile guide 15 mm – 2x 2 meter

Belt 10 mm XL 5.08 – 4.5 meters

Motors: Nema23 ST57-100x 1PCS

Z axes:

Motors: Nema23 ST57-75 x 11PCS

Connector X with Y Aluminum profile 40×80 – 2 x 1.92 meters

Extra X with Y connectors 20×40 – 2 x 1.92 meters

Cutting abilities (material / thickness / speed / amount of repeats / laser power)

RIAL (3mm)	SPEED (mm/sec)	POWER (%)

Card	30-100	30-70
Laser Plywood	15-20	70
MDF	16-25	70

80W CO2 laser

Co2 laser cutting speed for different laser power tubes (thickness | speed in mm per second)

	Thickness in mm	Thickness in inch	40 watt	60 watt	80 watt	100 watt	130 watt	150 watt	180 watt
			mm/s						

Acrylic	5	1/5	5	15	16	20	21	25	30
	8	1/3	4	5	10	12	12	15	20
	10	2/5	1	3	6	7	10	11	16
	15	3/5	_	1	3	4	5	7	9
	20	4/5	_	_	1	1,5	2	3	5
	30	1 1/6	_	_	_	_	_	1	1,5
MDF	3	1/8	9	15	20	23	25	30	33
	5	1/5	5	10	13	15	18	21	25
	10	2/5	_	3	5	7	9	12	14
	15	3/5	_	_	2	3	5	7	10
	20	4/5	_	_	_	1	1,5	2	3
Plywood	2	1/12	15	25	35	40	45	55	65
Wood	3	1/8	10	15	20	25	30	35	40
	5	1/5	5	10	15	20	25	30	35
	10	2/5	_	4	8	12	15	20	25
	15	3/5	_	_	4	8	11	15	18
	20	4/5	_	_	_	1	2	2,5	3
[illegible]	1 layer		40	60	100	200	300	400	500

Paper	1 layer		80	120	20	–	–	–	–
Rubber	4	1/6	15	25	30	35	40	45	50

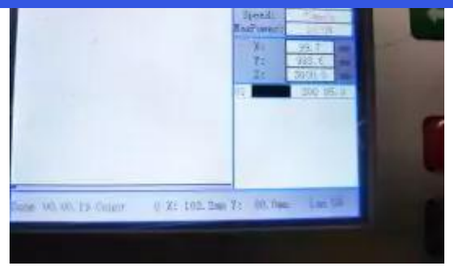
Engraving abilities

A starting point for the power setting when engraving is 30-35%.

A higher percentage will increase the power and produce a deeper engraving, while a lower percentage will decrease the power and produce a shallower engraving.

The depth of the engraving will also depend on the material which is being processed (softer materials can be etched away more easily than harder materials).

Laser power test stability



Final CNC frame tests

CNC test check report	Electronics
Final test	Control board stability
Working size	Laser temperature
RdWorks	PWM
Max cutting speed	Focusing
Max engraving speed	Laser beam spot
Z-axis length	Motors test
[illegible]ops	Drivers test

Home position	Resonance test
100 repeats test	
MAX / MIN travel speed	**Mechanical**
Laser engraving parameters	Backlashes
X-axis travel speed	XY vibrations
Y-axis travel speed	Z-axis vibrations
The maximum workpiece height	Z-axis power
The maximum workpiece height	Stepper motors temperature
	Machine weight

Total costs and time consumption:

Costs for components	Costs
Co2 laser + all accessories	700 USD
Diode laser + driver + DC/DC	600 USD
All Mechanical parts	1300 USD
All Electronics parts	1400 USD

Total costs for components: 4000 USD

Time consumption	Hours
Metalwork	160
Electronics	160
laser installation and aligning	10
Total testing	20

Total hours spend on the project: 350 hours

(without the shipping costs)

Full components list (PDF)

Co2 laser a full components list

RdWorks user manual

Users manual for software RDWorksV80.325318474

RDC644XG Controller User Manual

Changing modes in Ruida from Co2 into diode laser mode

For CO2 laser and diode laser to work, you need to change the profile in the memory of your Ruida controller.
I'll attach it to my email.
If you are using a diode laser, load into memory
If you are using a Co2 laser, load into memory
To download a profile

1. Run the rdworks8 program (pic1)
2. File -> Vendor settings (pic2)
3. Enter the password RD8888
4. Open – select the desired profile (pic3)
5. Write -> Exit
6. Reset the Ruida controller with the reset button

Files >>> co2 vs diode on ruida

What material does this machine engrave / cut?

Material	Engraving	Cutting	Maximum cutting thickness (mm)					
			60W	80W	100W	130W	150W	180W
Acrylic	√	√	8	10	15	20	25	25
Wood	√	√	6	9	12	15	18	18
MDF	√	√	5	8	10	12	15	15
Plywood	√	√	6	9	12	15	18	18
Textiles	√	√						
Leather	√	√						
Paper	√	√						
PVC	√	√						
Glass	√	×	×	×	×	×	×	×
Stone	√	×	×	×	×	×	×	×
Steel	×	×	×	×	×	×	×	×

30W / 40W / w60W CO2 Laser Tube
30W/40W/60W CO2 Laser is suitable for fine surface engraving. Design for hobbyists, crafters to cut thin materials (<3mm) and engrave fine quality pictures on a smooth surface.

80W/90W CO2 Laser Tube
90W CO2 Laser is suitable for laser marking, laser cutting, and laser engraving which is the ideal choice of a laser cut on thin plates include perspex, softwood, etc laser cloth cutting, and marble marking.

100W CO2 Laser Tube
100W CO2 Laser is suitable for leather carving and hollowing-out or embossing, cloth cutting, lampshade making, signs, marks and artwork processing and truly boasts excellent engraving and cutting performances.

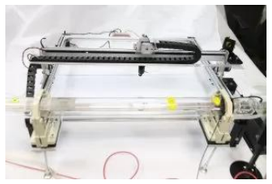
120W/130W CO2 Laser Tube
120W/130W CO2 Laser is suitable for the cutting of die-cutting plates, thick acrylic plates, and so on. It is widely used in the packaging industry which uses large quantities of medium-density fiberboard and plywood cut by die-cutting machines. In addition to the packaging industry, this Laser is also popular in the signage industry with the prominent usage of perspex, light guiding plates and display screens.

150W/160W/180W CO2 High-Power Laser Tube
W – 180W CO2 Laser is capable of cutting thin metal plates.

Learn more about our custom frames >>>

Read more about lasers on All3DP >>>

How to upgrade your CNC or engraving machine for the work with a Co2 laser tube.



In this article, we'll tell you how to upgrade your CNC machine for work with a CO2 laser tube. ... Continue reading [...]
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Comparison of a different types of lasers and different wavelength

Differences between Endurance lasers and different laser wavelengths. ChatGPT is helping you to learn more about lasers. I'd like ... Continue reading [...]
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- Engraving Mirrors with the diode laser
- Firmware using Arduino

‹ Metal marking with Endurance diode lasers 445 nm wavelength

Are laser pointers safe to use? ›

Show discussion

How to connect the laser to your CNC machine or 3D printer

Laser beam focusing. All you need to know how to make the best laser beam focus!

Running Endurance laser