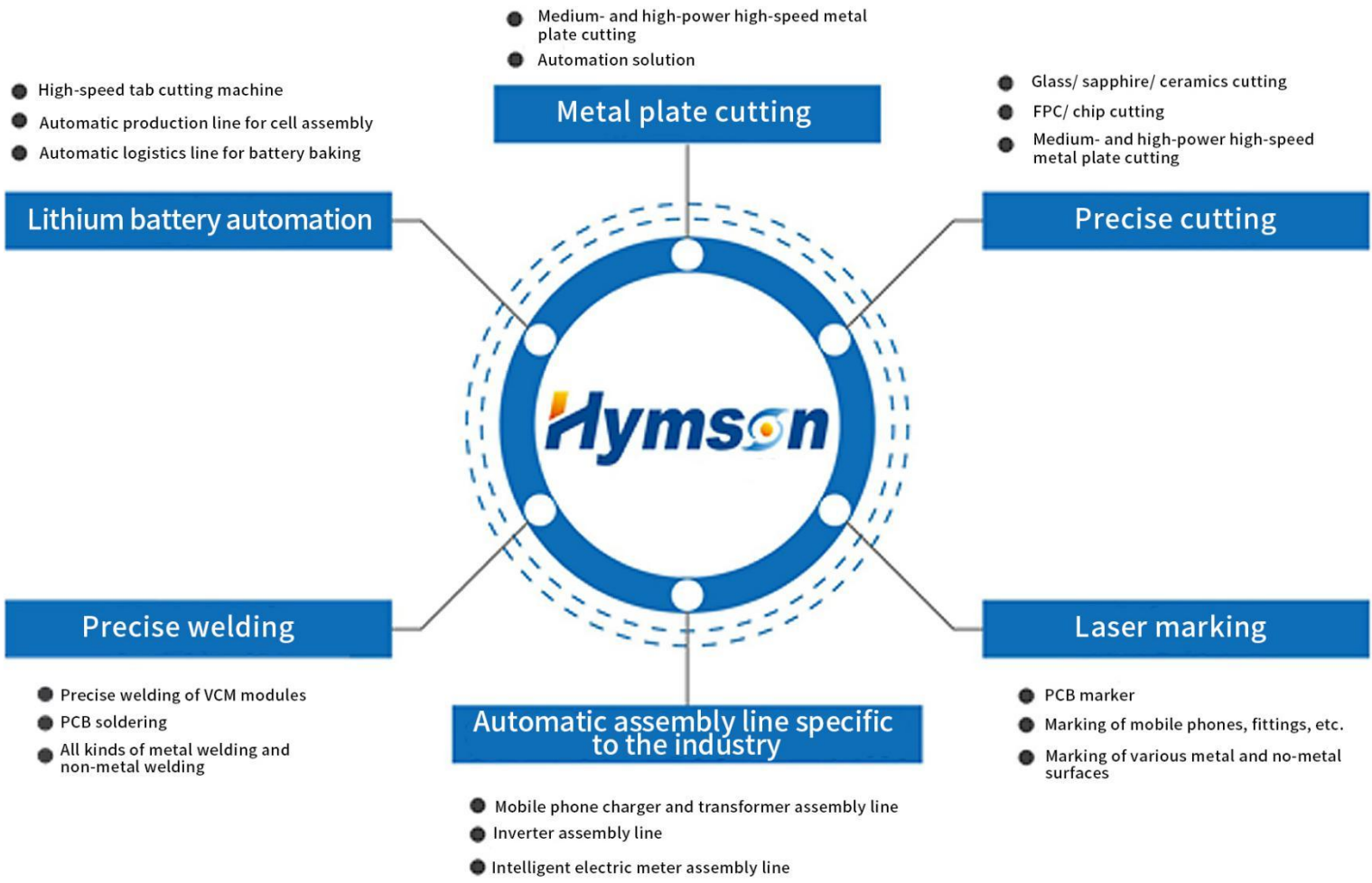




# Laser Cutting Machine Technology Document

## HF•B Series

Your Reliable Partner We Grow Together



## Company Profile

Hymson Laser, founded in 2008, has been making contributions to the fields of laser and automation. Now it has become the world's leading laser and automation equipment integrated solution provider and a national high-tech enterprise.

### The Carrier of Science and Technology

Through the continuous contributions and study in the industry for nearly 10 years, Hymson Laser maintains the proportion of R&D engineers of nearly 50% and has built a carrier of automation science and technology very fast. It has a senior research team for software development/process development with a complete organizational system, a laser application technology laboratory, an intelligent equipment R&D center and an application software development center. Hymson Laser has innovatively created a "triangle system of technology research and development" and always maintains thoughtful and quick services. The Company has achieved more balanced and diversified development in respect of domestic and overseas business. It has formulated a general, standard R&D production system and pursues the stability and high efficiency of equipment to steadily improve the share of high-power high-end customers.

### User Experience

Hymson Laser has accumulated extensive experience in the field of high-end application. By combining software control and hardware design and deep development of processes, it customizes man-machine interactive operation platforms leading in the industry to guarantee the technology leadership of Hymson laser cutting machines and at the same time to be able to provide even more amazing stable, efficient, intelligent user experience for entry-level and professional users.

### Manufacturing Field

Integrated laser automation solutions, such as intelligent laser sheet cutting equipment, intelligent laser tube cutting equipment, intelligent laser welding equipment, intelligent 3D laser processing equipment, and laser automation software, etc. Widely used in engineering machinery, construction machinery, light industrial machinery, agricultural machinery, petroleum machinery, electrical manufacturing, automobile making and aerospace industries.

### Industry Contribution

Hymson Laser is committed to making contributions to China's social development. Over the years, it has been participating with its partners in the response to the social problems faced by China's sustainable development and actively participating in the research and development in the fields of intelligent manufacturing, clean manufacturing, energy conservation and environment protection, etc. to help the promotion of the Made in China 2025 strategy and to drive the benign development of the industry.

Hymson Laser is technology-based and ensured by quality!

Our intimate services give you peace of mind when you are creating wealth!

# HYMSON LASER

METAL INTELLIGENT EQUIPMENT  
PRODUCT LINE SITES



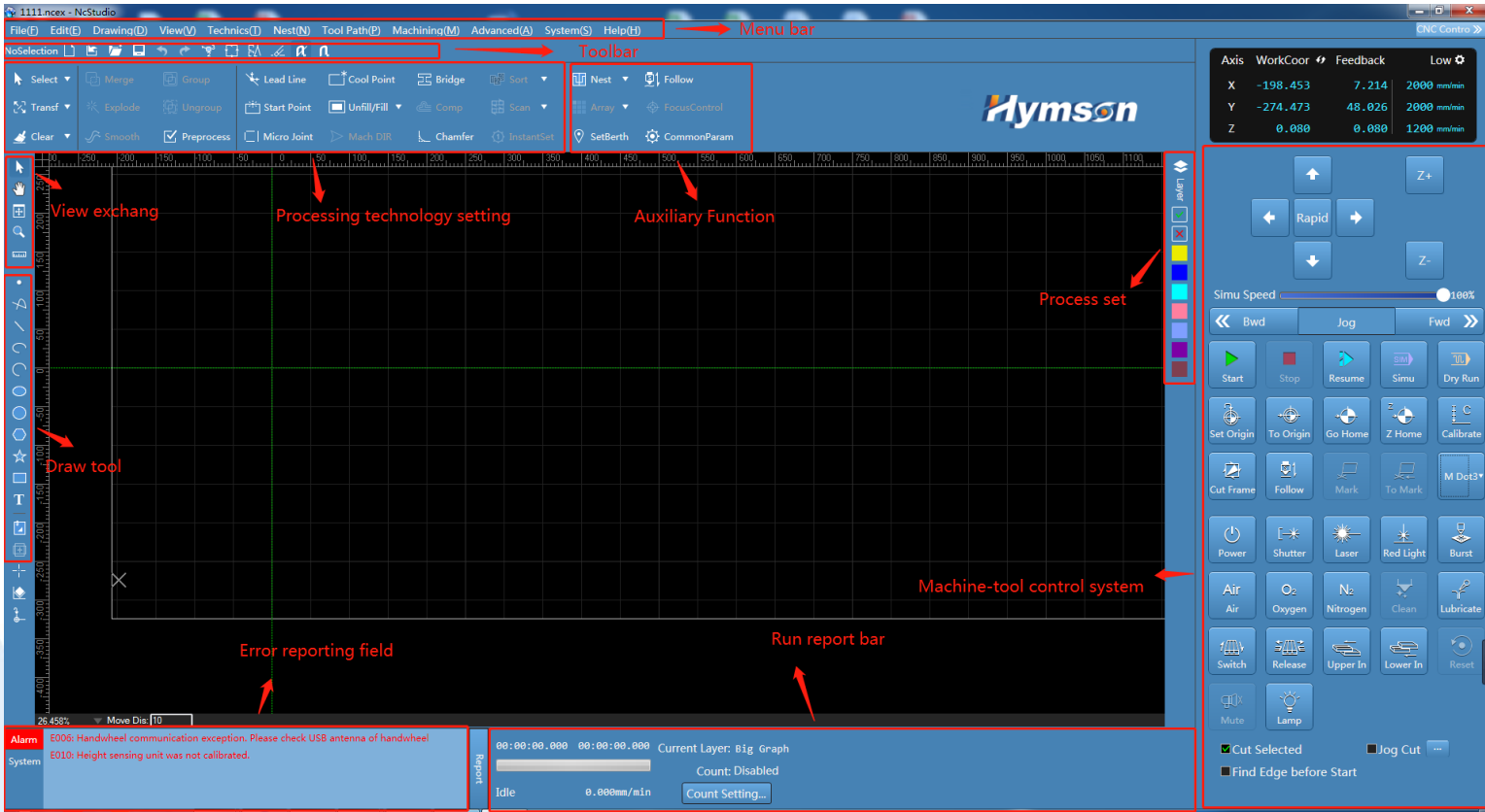
# Partners



# CNC Control System

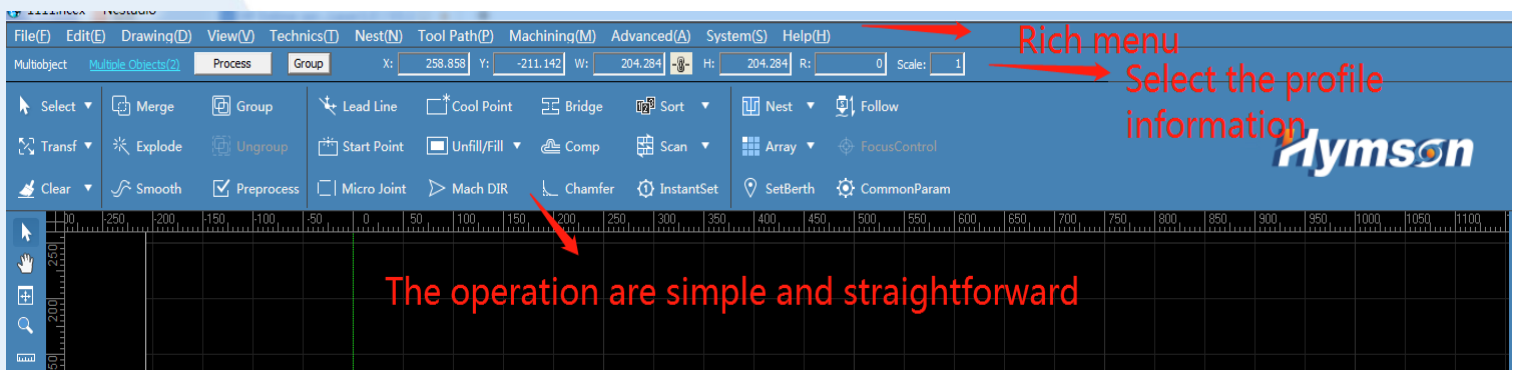
## Master 6000 Control System

- The equipment applies Master 6000 laser cutting control system, with simple and elegant interfaces, strong and practical functions and a large-screen display. It is a professional laser cutting system developed based on the Windows operating system and integrating many laser cutting modules with dedicated functions. Equipped with a wireless keyboard and a wireless mouse, the equipment is easy to operate.



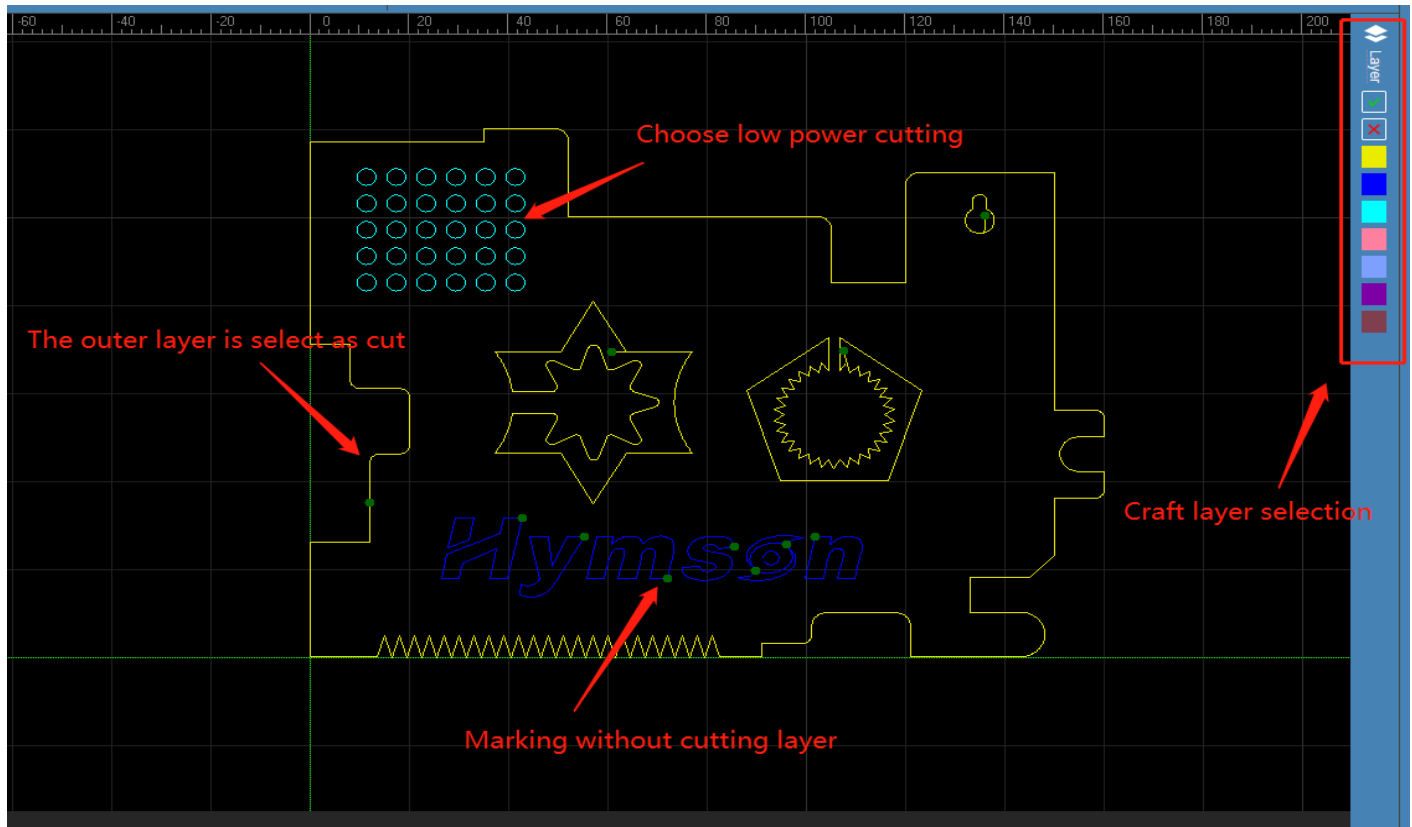
## Simple and Practical Cutting Software

- We provide Master 6000 cutting software with complete functions. With rich functions, the software highly simplifies and optimizes the cutting process to significantly improve the operator's work efficiency and production efficiency.



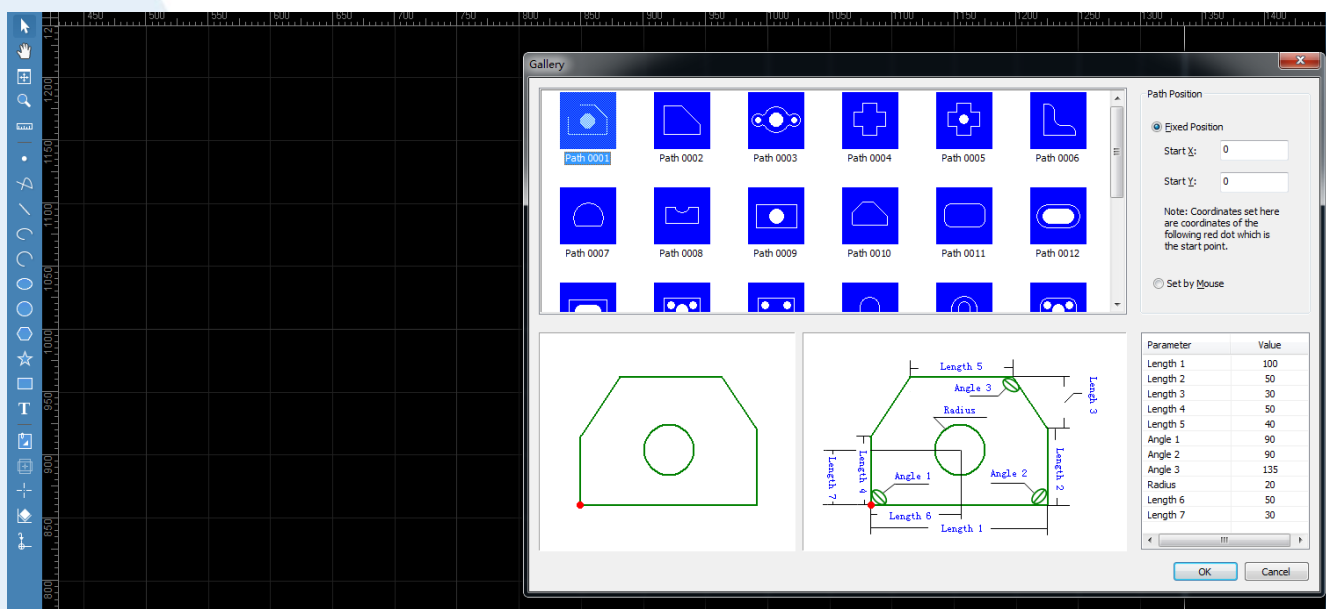
## Automatic Switching between Marking and Cutting Modes

- The marking and cutting modes are separately set by the operator before the commencement of cutting. The operator may reconfigure the machine and input new settings without stopping the material handling process. The switching between modes is automatic, which improves the productivity of compound cutting.
- The operator conducts setup before starting the processing without stopping the material handling.



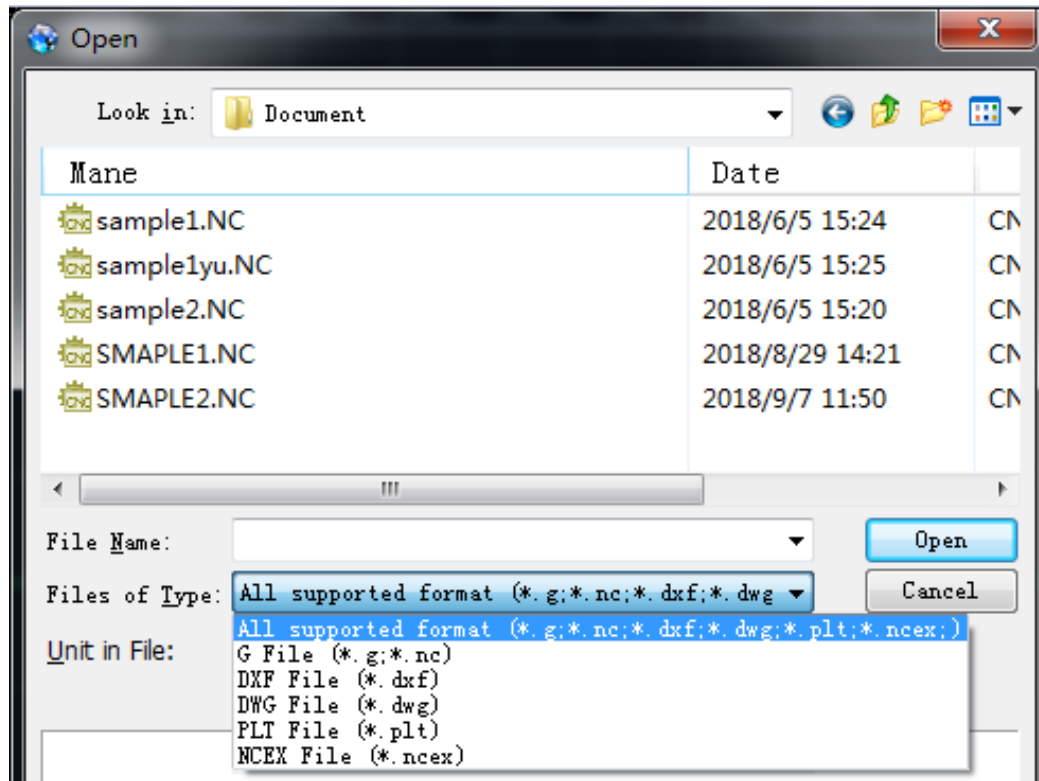
## Graphic Operation Function

- Master 6000 provides common drawing functions, which can be easily used from the drawing toolbar on the left side. The use of these drawing functions is mostly similar with AutoCAD and is very intuitionistic. The software has a number of humanized graphic operation functions and has a common graphics library, such as five-pointed star call, etc., so it is easy and quick to get started.



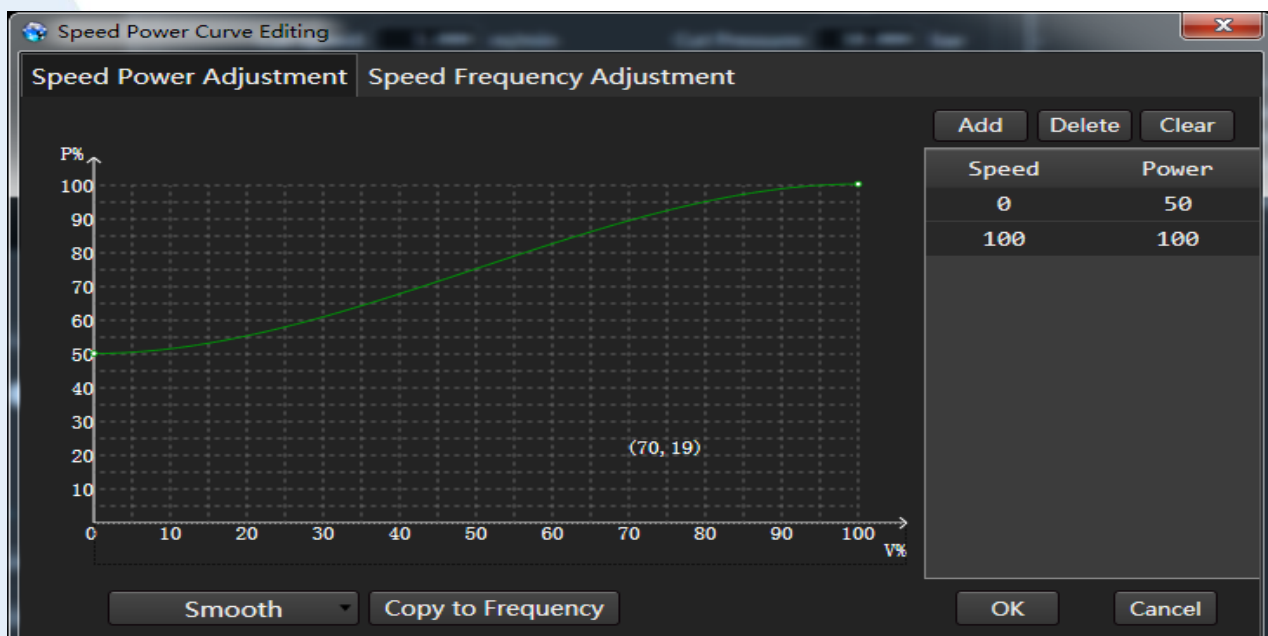
## Supporting Multiple Files

Master 6000 software supports such graphic and data formats as .G, DXF, DWG, PLT, ENG, etc. and accepts international standard G codes generated by Master Cam, Type3, etc. The opening/import of external files, such as DXF, etc. are optimized automatically, which saves times and is efficient.



## Real-time Frequency and Power Curves

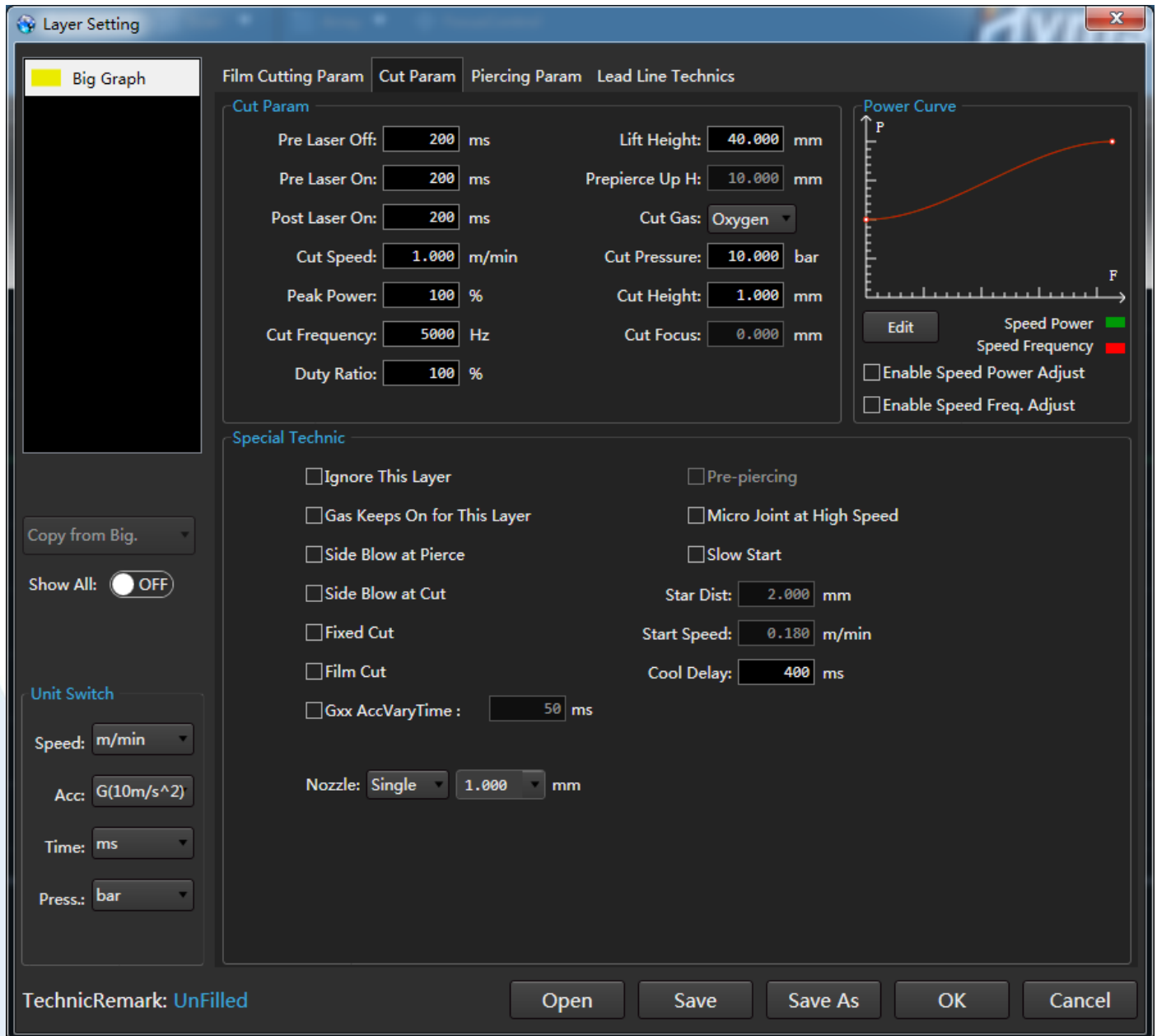
- In order to obtain high quality acute angles and right angles, the software is equipped with real-time frequency and power curves and regulates the power of laser radiation automatically according to the movement speed of the cutting head. When the movement speed of the cutting head is zero (when it stops at a corner), the power of output radiation equals to the minimum power set in Setup to prevent burning the corner.





## Rich Process Layer Interfaces

- Master 6000 provides a number of layers, each of which can be independently set, including such process parameters as cutting speed, laser frequency, air pressure, cutting height, etc. The color of each layer is unique for easy browsing and configuration of parameters such as cutting graphics.



# Cutting Technology



## Leapfrog Cutting

- The new leapfrog function based on CNC eliminates the disadvantage of “rectangular” motion or false leapfrog of the cutting head.
- Adopting the motion of a parabola, with jumping and falling based on CNC to achieve real-time control and with accurate and rapid positioning, thus significantly improves the efficiency of processing.

## Automatic Obstacle Avoidance

- When a workpiece cocks, the cutting head can identify it automatically and rise rapidly to avoid the obstacle and locate the position of the next workpiece intelligently
- ① To reduce the probability of collision between the cutting head and the workpiece; ② to guarantee the consistency of cutting during processing, thus improves the efficiency of processing; ③ to locate the position of the next workpiece intelligently, thus reduces the probability of integral transfer of a sheet and reduces the waste of sheets; ④ to reduce the workload of the operator and editor through the simple and intelligent operation.

## Lightning Cutting

- Hymson’s characteristic new technology, which improves the laser cutting production in three aspects, i.e. cutting precision, cutting speed and energy consumption in cutting
- High Efficiency: Lightning cutting has more efficient capability of perforation and faster cutting speed.
- Low Energy Consumption: The energy consumption of gas for cutting purposes is reduced by over 50%
- Good Quality: Higher quality of cutting section, smooth and even cut edge, fewer burrs.

## Rapid Perforation

- Hymson's characteristic new technology, which reduces the time of perforation and optimizes the whole process of perforation to achieve stable, fast, high quality perforation
- High Speed: To penetrate various sheets of medium thickness consistently and quickly within 200ms
- High Efficiency: To save time by over 80% as compared to the time of general perforation of 1-2 seconds
- High Quality: The perforation process is stable, without blasting. The technology is safe and efficient.
- Easy to Operate: Simple and intelligent, reducing the workload of the operator and editor.

## Breakpoint Resume

- In case of program interruption, sudden power failure, etc. during cutting, when you restart the machine, the "Breakpoint Resume" function can memorize the path previously set and resume the processing.
- Avoid going through the process again from the original start point which is time-consuming and affects the efficiency
- When cutting a thick sheet or a workpiece with a broad outline, the "Breakpoint Resume" function can well solve a series of problems, such as time-consuming, consumption of a lot of materials, high cost, etc.

## Arbitrary Point Cut-in

- During the real production, when a part of the sheet is not cut thoroughly due to dust on a certain node on the sheet, insufficient gas, etc., the solution for general laser cutting machine manufacturers is resetting the system interface, that is, going through the process again from the start to the end of the procedure operation which is time-consuming, consuming a lot of materials, and high-cost.
- With Hymson's "Arbitrary Point Cut-in" function, the cutting head can cut in at arbitrary point, without cutting from the start to the end, thus solves the problems of time-consuming, consumption of a lot of materials, high cost, etc.



## Gradual Speed Regulation in Tool Start

- A thick sheet is not cut thoroughly; lines on the section are uneven; the section has serious dross, etc. If the tool start is poor, high quality cutting effect of thick sheets cannot be obtained and a series of problems that impact the workpiece quality, such as reflection of blue light, fault, etc., may appear. In serious cases, the cutting head and optical devices may be damaged.
- With Hymson's "Gradual Speed Regulation in Tool Start" (for thick sheets) process, after perforation, the speed regulation is gradual intelligently, thus achieves better cutting effect. This process is mainly used in cutting of thick stainless steel and aluminum alloy sheets, and is stable and provides high quality workpieces.

## Aluminum Alloy Burr-free Cutting (Optional)

- Burrs are easy to appear in aluminum alloy cutting, so additional manual or mechanical polishing is needed, which increases product production processes, thus reduces the productivity, extends the shipment cycle, and increases the production cost.
- Hymson's "Aluminum Alloy Burr-free Cutting" process realizes no burrs, no wrinkles, high precision, no mold consumption, no need for repairing molds, saving of time of mold replacement, saving of processing fee, reduction of product cost, etc.

## Fly-cutting

- The "Fly-cutting" process can put the start point of cutting of the outline on the tangent line of the motion trail of the laser head, without adopting leads. It does not independently cut every detail, instead, it cut all outlines into a straight line.
- It reduces the changes in the cutting direction of the laser during cutting, reduces the duration and the number of times of perforation, and ensures that the laser head is always in the high-velocity motion status during cutting, so it is very suitable for high speed cutting processing of thin steel sheets.
- It reduces the processing time of sheets and improves the cutting efficiency of the lathe.

## High Speed Cutting

- General rapid acceleration and deceleration, such as violent impact vibration, toothed rack break-off, etc., may damage the hardware of the lathe.
- Hymson's "High Speed Cutting" function plans the cutting path in advance and optimizes the turning and the addition and subtraction process as well as the interpolation.
- Efficient: Significantly improving the acceleration and deceleration and reducing the time of acceleration and deceleration; increasing the efficiency of complicated workpiece processing by 30%
- Safe: Absorbing the shocks from acceleration and deceleration in cutting on the lathe to guarantee high speed processing of the machine and to protect the lathe against shocks.

**Hymson**

**Master6000**

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# Core Configuration

Core Configuration			
Unit	Name	Model / Specification	Remarks
<b>I. Control Programming</b>	Control System	Master 6000	China
<b>II. Mechanical Drive</b>	Honeycomb Heavy Duty Lathe	HF3015B	China
	Patented Honeycomb Aluminum Beam	HF3015B	China
	Servo Motor and Drive	INOVANCE	China
	Precision Reducer	DESBOER	Japan
	Precision Toothed Rack	JT/YYC	Taiwan
	Precision Guide Rail	T-WIN / ROUST	Taiwan /Germany
	Pallet Changer	shuttle table	China
<b>III. Pneumatic Control</b>	Intelligent Pneumatic System	SMC.PARKER.AIRTAC.etc.	Japan / USA / Taiwan
	Proportional Valve	SMC/ AVENTICS/LANY	Japan / Germany
<b>IV. Optical System</b>	Fiber Laser	MAX/IPG ≤8000W	China / USA
	Auto Zoom Cutting Head	HYMSON	China
<b>V. Electrical System</b>	Standard Electrical Element	SCHNEIDER	France
<b>VI. Dedusting System</b>	Intelligent Zoned Exhausting System	HYMSON	China
	Dedusting Fan	HYMSON	China
<b>VII. TEMPERATURE CONTROL SYSTEM</b>	Double Temperature and Double Control Cooling	HYMSON	China
	Constant Temperature Air Conditioner with Independent Electric Cabinet	HYMSON	China

## Performance Indexes

Major Performance Indexes	
Equipment Model	HF3015B
Effective Cutting Range	3000mmX1500mm
Effective Z-axis Stroke	300mm
X/Y-axis Positioning Accuracy	$\pm 0.03\text{mm/m}$
X/Y-axis Repositioning Accuracy	$\pm 0.02\text{mm}$
Maximum Speed of X/Y-axis Linkage Positioning	140m/min
Maximum X/Y-axis Acceleration	1.2 g
Maximum Z-axis Positioning Speed	30m/min
Maximum Z-axis Acceleration	1.2g
Main Power Protection Grade	IP54
Total Weight of Equipment	$\approx 8\text{t}$
Maximum Load of Workbench	0.9 t
Floor Space of Whole Machine	8330mmX5700mm

## User's Machine Installation Site Condition Preparation

S/N	Content
1	Power Supply Capacity: $\geq 60\text{KVA}$
2	Power Supply Requirements: (1) Three-phase voltage stability $< \pm 5\%$ ; (2) Unbalancedness of three-phase power supply $< 2.5\%$ (Note: Abrupt changes in supply voltage and sudden power failure are not allowed, otherwise, the laser may be damaged easily. Good grounding is required (ground resistance $< 3\ \text{Ohm}$ ).
3	Compressed Air Supply Requirements: (1) Air supply capacity: $\geq 0.8\text{m}^3/\text{min}$ (2) Air supply pressure: $\geq 7\text{bar}$ (3) Dewpoint $\leq 5^\circ\text{C}$ (4) Oil content $\leq 0.01\text{ppm}$ Solid particle $\leq 0.01\mu\text{m}$
4	Auxiliary gas for cutting: Oxygen ( $\text{O}_2$ )/ Nitrogen ( $\text{N}_2$ ): Purity $\geq 99.99\%$
5	Sheet (Tube) Cutting: Black skin, smooth, level, rustless, evenly rolled, reaching the ISO standard or the standard of Bao Iron and Steel Company.
6	Installation Site Requirements: 1. The foundation for equipment installation does not settle and should be constructed according to the foundation drawing provided by Party B; 2. Temperature Requirement: $[5-30]^\circ\text{C}$ ; 3. Humidity Requirement: $< 70\%$ ; 4. After the equipment is installed and commissioned, separate the laser and install an air conditioner.
7	The equipment operator should have been graduated from a secondary specialized school or above and have the experience in operation of computers and general numerically-controlled lathes. The equipment should be equipped with a programming computer.

### Installation and Commissioning

- All the equipment provided under the contract should be installed and commissioned by us. After the contract is signed, we will determine the specific installation location of the equipment in the shortest time and provide the equipment foundation drawing within 5 working days after the contract goes into effect. Prior to the installation and commissioning, you should prepare the equipment foundation strictly according to the requirements specified in the equipment foundation drawing provided by us. After the installation site is ensured, the engineers will install and commission the equipment with the tools they carry and, within 10 days, complete the installation, commissioning, technical index tests, training, acceptance and delivery for use;
- The expenses related to the installation and commissioning and the staff assigned should be borne by us.

### Transportation and Logistics

- The place of delivery should be your installation site.
- Standard packaging suitable for long-distance transportation by truck, being dampproof, rust-proof and shockproof; suitable for integral hoisting and indicating the centre of gravity for lifting and the hoisting position;
- Mode of Transport: Motor transport. We should bear the freight and insurance.
- Each packaging box should be accompanied by a detailed packing list and a quality certification as well as the instructions on the equipment and other documents and materials. The packing list should be outside the packaging box and the quality certification should be inside the packaging box.



## Equipment Acceptance

- a. Acceptance Standard: The acceptance should be according to the technical agreement between you and us.
- b. Final Acceptance
  - After we complete the installation, commissioning and self-check of the equipment, the acceptance should be conducted at the demander's site, including the acceptance inspection of the quantity, model/specification, functions, technical indexes, etc. all goods; the typical sample pieces recognized by both parties should be cut with laser.
  - The parties should record the situation of acceptance and evaluate the acceptance results. Only after both parties sign the acceptance results can a performance test be conducted.
- c. Other Notes to Final Acceptance
  - If the acceptance is interrupted due to the failure of the auxiliary facilities (power supply, surroundings, etc.) at the site or the environment not complying with the normal operation requirements of the equipment, the demander should immediately conduct repair to ensure the conditions necessary for the normal work of the equipment.
  - If the equipment is found to lack parts or be damaged or not complying with the contract terms and quality standards during the acceptance, we will be responsible for supplement and replacement at our expense.

## Technical Training

- We provide free technical training. After the installation and commissioning, we will provide technical guidance and training for your operators for no less than 5 days till the operators are perfect themselves in the structure and technical principle of the equipment as well the correct programming, operation, check, repair and maintenance of the equipment.
- The main contents of training are as follows: Structure and technical principle of the equipment; programming, operation, repair and maintenance and general fault diagnosis of the equipment; laser processing technology; common faults and troubleshooting of the equipment (including the mechanical, electrical and pneumatic sections); laser processing safety education, etc.

## After-sale Services

1. After the equipment passes the strict final acceptance inspection and the final acceptance results are signed, the warranty period of the whole machine is one year.
2. In case of quality problems in the system parts within the warranty period, our well-trained service engineer will provide phone or onsite services at any time. For any injury or damage caused by the quality of the equipment, we will be responsible for part replacement and services for free, except for conventional consumables (such as externally operated optical fibers, optical lenses, and cutting nozzles) and accidents due to the user's operation in violation of regulations;
3. During the warranty period, after receiving the repair notice from the demander, we will designate a specially-assigned person to follow up the matter and reply within 2 hours. If the fault still cannot be removed via phone, WeChat or fax, our technical services staff will arrive within 24 hours (excluding the travel time);
4. Beyond the warranty period, we will still provide wide and preferential technical support and services, regular maintenance of the whole machine and auxiliary machinery and spare parts for the demander, provide whole-process maintenance services for the products supplied, and provide daily consulting and guidance related to the equipment as well as the information and materials in respect of equipment improvement and repair technology at any time.
5. We have sufficient reserve and spare parts and can timely provide technical and spare parts services for the demander to meet the needs in operation and repair.

6. We regularly arrange project engineers to go to the user's site to provide free technical visit services;
7. During our development of new kinds of products and utilization of new technology, we provide related technical services and technical support for free, such as software upgrade services.

## Precautions for Starting the Laser Cutting Machine

As a laser cutting machine uses electronic and optical devices, excessive temperature difference between inside and outside may cause dew formation on the surfaces of optical lenses and elements, thus reduces the performance of and even damage the laser and cutting head. Dew formation inside a fiber laser is closely connected with the bad operating habits of the fiber laser operators of the customer. In order to reduce the fault rate of the fiber laser and decrease the losses caused by the downtime of the fiber laser machine of the customer, the operators of the customer are asked to pay attention to the following when using the fiber laser machine:

Switching sequence of the fiber laser machine (By switching on/off the machine strictly according to the switching sequence, the risk of dew formation inside the fiber laser may be reduced, thus decreases the faults of the laser!)

### 1、 Switching-on sequence of the fiber laser machine

( 1 ) Turn on the main power switch of the laser and allow the air conditioner or dehumidifier of the cabinet to run for over 30 minutes.

( 2 ) 30 minutes after the laser has been switched on, turn on the power switch of the cooling-water machine.

### 2、 Switching-off sequence of the fiber laser machine

( 1 ) Turn off the power switch of the cooling-water machine.

( 2 ) Turn off the power switch of the laser.

### Precautions for Pause

If the duration of pause during the switching-on by the customer exceeds one hour, we suggest that the high voltage of the laser be turned off, the power switch of the fiber laser not be turned off, and the cooling-water machine be turned off. If you need to cut products again, turn on the cooling-water machine and allow it to run till the actual temperature of the high temperature water and low temperature water of the cooling-water machine reaches the set temperature

±1℃. Then turn on the high voltage of the laser, and enable the beam emission for cutting.

Note: The cooling-water machine must not be still running after the power switch of the fiber laser has been turned off!

### Environment Requirements of the Fiber Laser:

1、 Prepare an independent air-conditioned room for the laser, improve the external work environment for the laser, and allow the laser to work in a dry, constant temperature environment.

2、 We suggest that you purchase a hygrothermograph and put it in the air-conditioned room for the fiber laser to monitor the temperature and humidity of the air-conditioned room.

3、 According to the ambient temperature, adjust the temperature of the cooling-water machine. Set the high temperature to 28-32℃ and set the low temperature to 23-27℃.

In summer, we suggest that you set the high temperature water in the water tank to 30-32℃ and set the low temperature water to 25-27℃ to prevent dew formation in the laser.

In addition, there are many thunderstorms in summer. In order to guarantee the normal use of the machine, we suggest that you disconnect all power supplies of the laser cutting machine when it thunders and do not power on the machine until after the thunder and lightning. Damages by thunders and lightning are not within the scope of warranty.