TM Series Handheld Laser Cleaning Machine

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Preliminary Note

Before using the product, ensure you have thoroughly read and understood this manual, and are familiar with the operational and maintenance instructions. THEO strongly recommends that all operators review and pay close attention to the safety information provided in this document before using the product. This User Guide contains essential operational, safety, and other key information that should be regularly reviewed by operators, users, and owners.
For technical assistance, please contact our Customer Service team:
http://theo.inc/support

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This guide is intended for all owners and operators of THEO equipment, as well as individuals working near the product during operation. Usage of this product is restricted to fully trained professional and non-professional welding operators.

Preface

Thank you for choosing THEO's handheld laser welding products. This User Guide has been created to assist you in using and maintaining the laser effectively. While we have made every effort to ensure the accuracy of the information in this document, occasional oversights may occur. We appreciate your understanding and welcome any suggestions for improvement.

Before using the product, please take the time to read and understand this User Guide and familiarize yourself with the operating and maintenance instructions. We strongly recommend that operators review Section 2: Safety Information before operating the product.

Keep this User Guide with the product, as it contains important operational, safety, and maintenance information for you and future users or owners.

Throughout this document, we have highlighted sections that require special attention. Please be mindful of these to prevent unnecessary damage. Thank you once again for choosing THEO products.

Safety Precautions

I. High-Power Laser Hazards

High-power lasers pose potential risks, and improper operation of this equipment may cause serious harm to the human body. Before operating the equipment, relevant personnel (including but not limited to R&D, installation, and after-sales service staff) must carefully read this instruction manual and related operation manuals, strictly follow the operating procedures, and **non-professional personnel are prohibited from starting the machine**. For assistance, contact Eurasian Technical Support.

II. Class 4 Laser Safety (Intense Laser Radiation)

This equipment uses a Class 4 laser (intense laser radiation), which may cause the following hazards:

1. Ignition of surrounding flammable materials;
2. Generation of additional radiation and toxic/harmful gases during laser processing, depending on the material being processed;
3. Direct laser radiation can cause severe human injury. **Therefore**:
    1. Fire extinguishing equipment must be available in the equipment's working area.
    2. Flammable and explosive materials are strictly prohibited from being stored near the workbench or equipment.
    3. Ensure good ventilation in the workspace.
    4. Non-professional operators are forbidden to approach the equipment.

III. Regulatory Compliance

The materials being processed and any emissions must comply with local laws and regulations.

IV. Operational Risks and Equipment Handling

- Users must carefully assess whether the material to be processed is suitable for laser operation, as laser processing involves inherent risks.
- The equipment contains high-voltage components and other potential hazards. **Only factory-certified professionals are permitted to disassemble the equipment**.
- The machine and all associated equipment must be safely grounded before powering on.
- During operation, **do not open any covers or casings**.
- Operators must monitor the equipment's performance at all times. In case of abnormal conditions, **immediately cut off all power supply** and take appropriate measures.

- The equipment must be attended by a dedicated operator while powered on. **Do not leave the equipment unattended**.
- Always disconnect all power supplies before leaving the workspace.
- For detailed safety instructions, refer to the Safety Rules section of this manual and strictly adhere to them.

V. Pre-Use Instructions

1. **The galvanometer contains precision components and must be handled with care**.
2. **Working environment requirements**:
    - Temperature: 0°C to +45°C;
    - Humidity: ≤80% (non-condensing).
3. **Do not touch the lenses with bare hands** to prevent oil and dust contamination.
4. Regularly inspect the cleanliness of the lenses. If stains are found, clean them immediately with **alcohol and specialized lens cleaning wipes**.
5. Galvanometer lenses are fragile components and **not covered by the warranty**.
6. **Do not power off the galvanometer during operation**, as this may damage the lenses.
7. **Do not plug or unplug power cables or control signal cables while the galvanometer is powered on**, as this may damage the motor.
8. Unauthorized disassembly of the galvanometer casing will **void the warranty**.

Contents

1 Basic Information

1.1 Introduction to Laser Cleaning

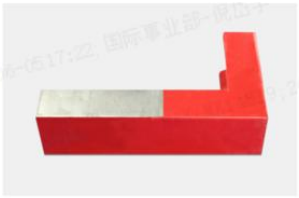
In traditional industrial cleaning, various methods are used, mostly relying on chemical agents and mechanical approaches. With China's increasingly strict environmental protection regulations and growing public awareness of environmental protection and safety, the types of chemical agents permissible for industrial cleaning are becoming fewer. Finding a cleaner and non-destructive cleaning method has become a critical consideration. Laser cleaning, characterized by being non-abrasive, non-contact, non-thermal, and suitable for various materials, is regarded as the most reliable and effective solution. It also addresses challenges that traditional cleaning methods cannot solve.

Laser cleaning offers technical advantages such as intelligent and controllable cleaning processes, precision and consistency, no substrate damage, and operational convenience. Additionally, it provides economic and social benefits like environmental friendliness, low maintenance, low operating costs, improved working conditions, and labor savings, making it the inevitable trend and preferred choice for future industrial cleaning!

As a green and environmentally friendly cleaning method, laser cleaning technology has emerged as a new frontier. Compared with traditional industrial cleaning, its advantages have attracted attention from industries such as automotive manufacturing, electronics processing, mold manufacturing, and petrochemicals:

- No consumables, chemical pollution, noise, and energy-efficient
- Non-contact, non-abrasive, and stress-free, causing minimal damage to the substrate
- Capable of removing contamination particles below the nanometer scale with high cleanliness
- Fiber-optic transmission enables mobile operation and cleaning of hard-to-reach areas
- Simultaneous cleaning and treatment achieve zero emissions during the process
- Enables rapid removal of heavy contaminants and high-speed cleaning of light contaminants

Rust removal

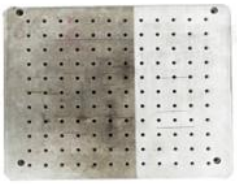


Paint layer removal

Paint layer removal

Rust removal

Surface cleaning



Surface cleaning

1.2 List

Name	Model	Qty
Handheld laser cleaning Machine	TM-300G	1
Pointed Cotton Swab	/	1
Round-head Cotton Swab	/	1
Power Cable	/	1
Network Cable	/	1
Field Lens	/	3
Key Switch	/	2
Gloves	/	1
Mask	/	2
Goggle	/	3
Clean Cloth(2*2)	/	6

2 Parameter Specification

2.1 Handheld Laser Cleaning Machine Parameter

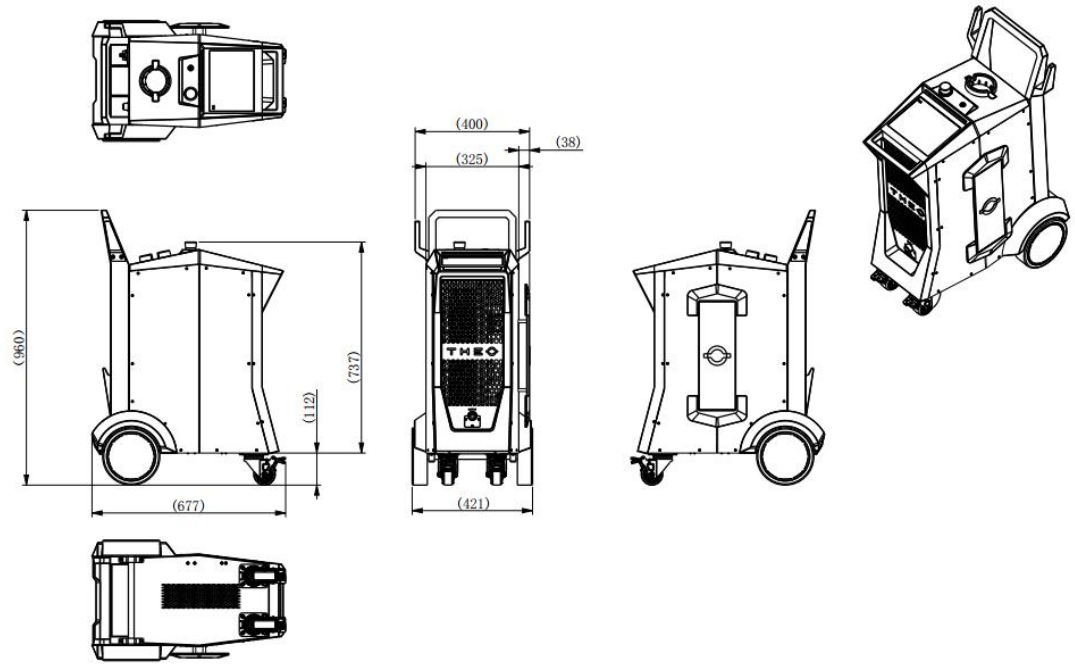
Laser Parameter	TM-300G	TM-300F	Unit
Norminal Output Power	305±3		W
Laser Wavelength	1060-1070		nm
Mode of Operation	Pulse		/
Repetition Frequency	1~8000	1-4000	kHz
Full Power Frequency Range	165-8000	20-4000	kHz
Pulse Width	10~500	20-500	ns

Pulse Energy	⩽1.8	⩽15	mJ
Fiber Cable Length	5		m
Power Stability (24h)	±2		%
Beam Quality,M2	⩽1.6	10-14	
Laser Beam Diameter	4-6		mm
Red Guide Laser (Class 2)	200-1000		μW
Fiber Diameter	30	100	μm
Cooling Method	Air Cooled		/
Operating Temperature Range	0~40		℃
Storage Temperature	~10℃ ~ +60		℃
Input Voltage	100-240		VAC
Dimension	960*677*477		mm
Weight	57±5		Kg

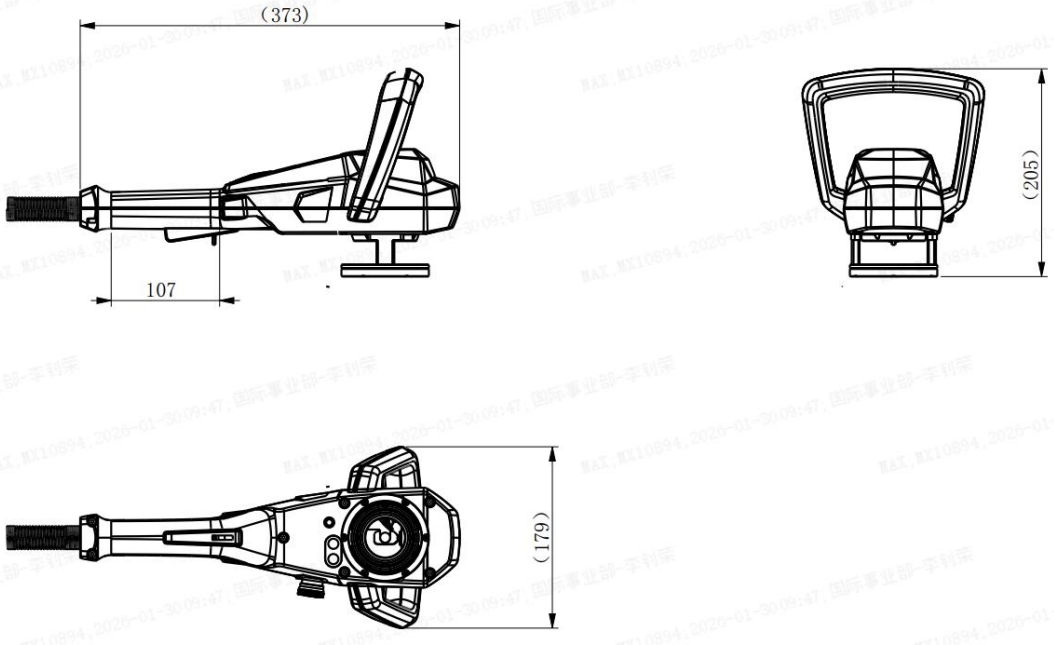
Parameter	Specification	Unit
Aperture	10	mm
Laser Wavelength	1064±5	nm
Standard Clean Area	100*30	mm
Scan Speed	30	mm/s
Air Flow	ON/OFF Control	
Cooling Method	Air Cooling	
Operating Temperature Range	0~40	℃
Storage Temperature	~10℃ ~ +60	℃
Dimension	373*179*205	mm
Cleaning Head Weight	⩽2	kg

2.2 Dimension Drawing

2.2.1 TM Series Machine Drawing



2.2.2 TM Series Cleaning Head Drawing



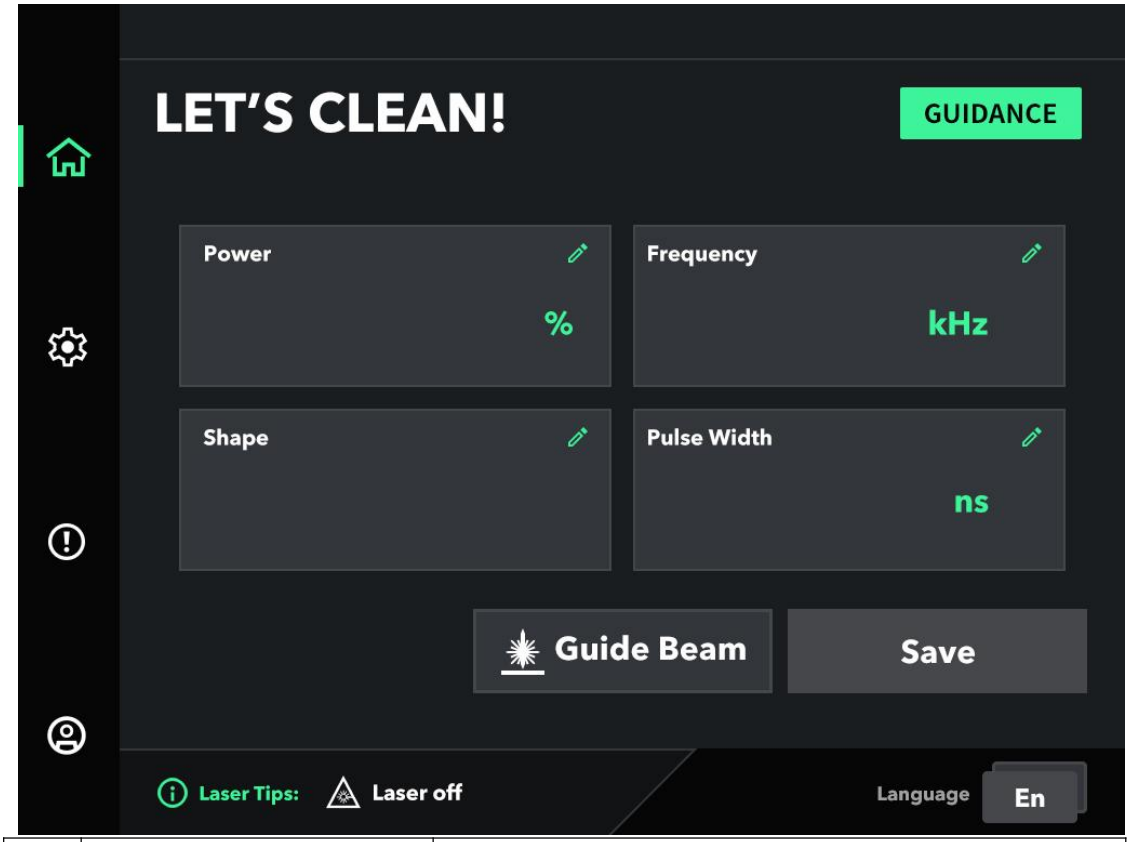
2.3 Interface Description of TM Series

No.	**Description**
1	Emergency Stop Button
2	HMI Screen
3	Fiber Output
4	Key Switch

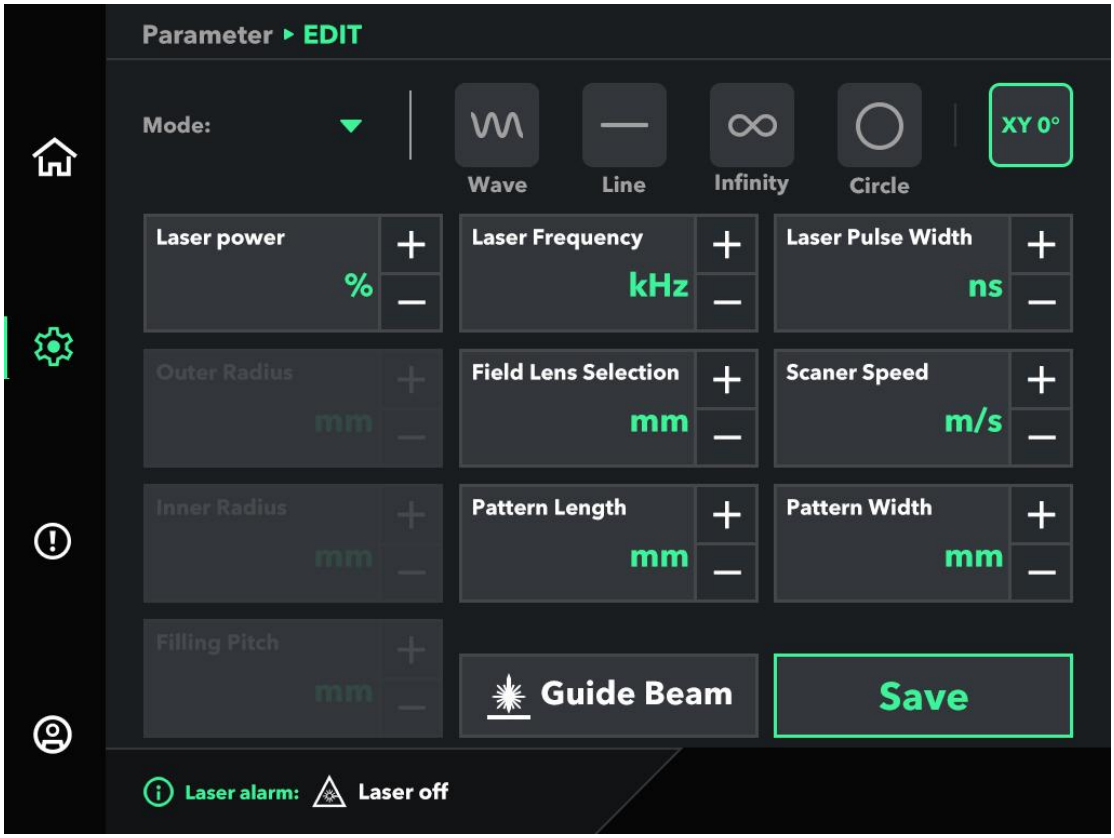
No.	**Description**
1	Cleaner Torch Holder
2	ON/OFF Switch
3	Power Cord Interface
4	GND
5	Ethernet Interface
6	External Control Interface
7	Safety Control Interface
8	Gas In

No.	**Description**
1	Laser Output
2	Distance/IR Sensor
3	Emergency Stop Button
4	ON/OFF Button
5	Hand Holder
6	HMI Screen
7	Screen Control Button
8	Laser Enable Button

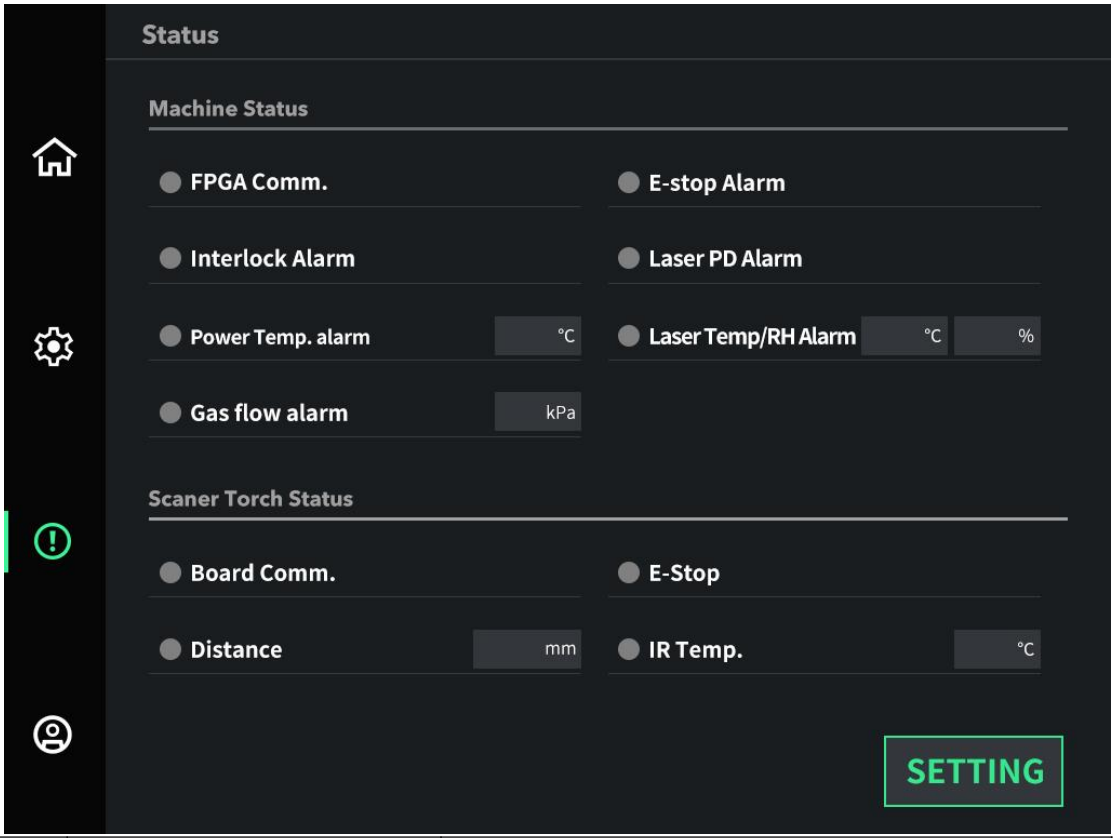
3 HMI Instruction



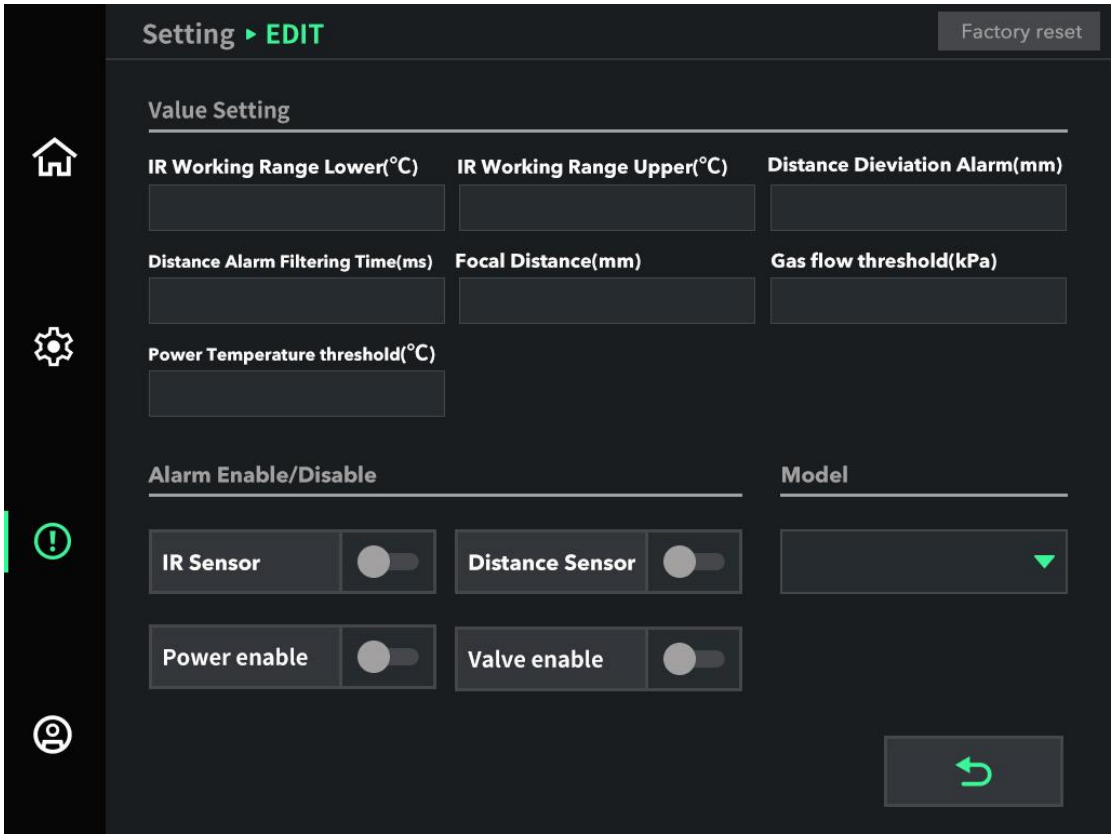
No.	**HOME Interface**	**Description**
1	Power	Laser Power 0-100% adjustable
2	Frequency	Pulse Repetition Frequency, 165-8000kHz adjustable, associated with pulse width
3	Shape	Pattern Selection, there are 4 shapes: Wave, Line, Infinity, Circle
4	Pulse Width	Laser Pulse Width: 10-500ns adjustable
5	GUIDANCE	Add some info to guide users how to adjust the parameters
6	Guide Beam	Redlight ON/OFF
7	Save	Save the parameters
8	Laser tips	The status of Laser: ON/OFF
9	Language	Language Switch



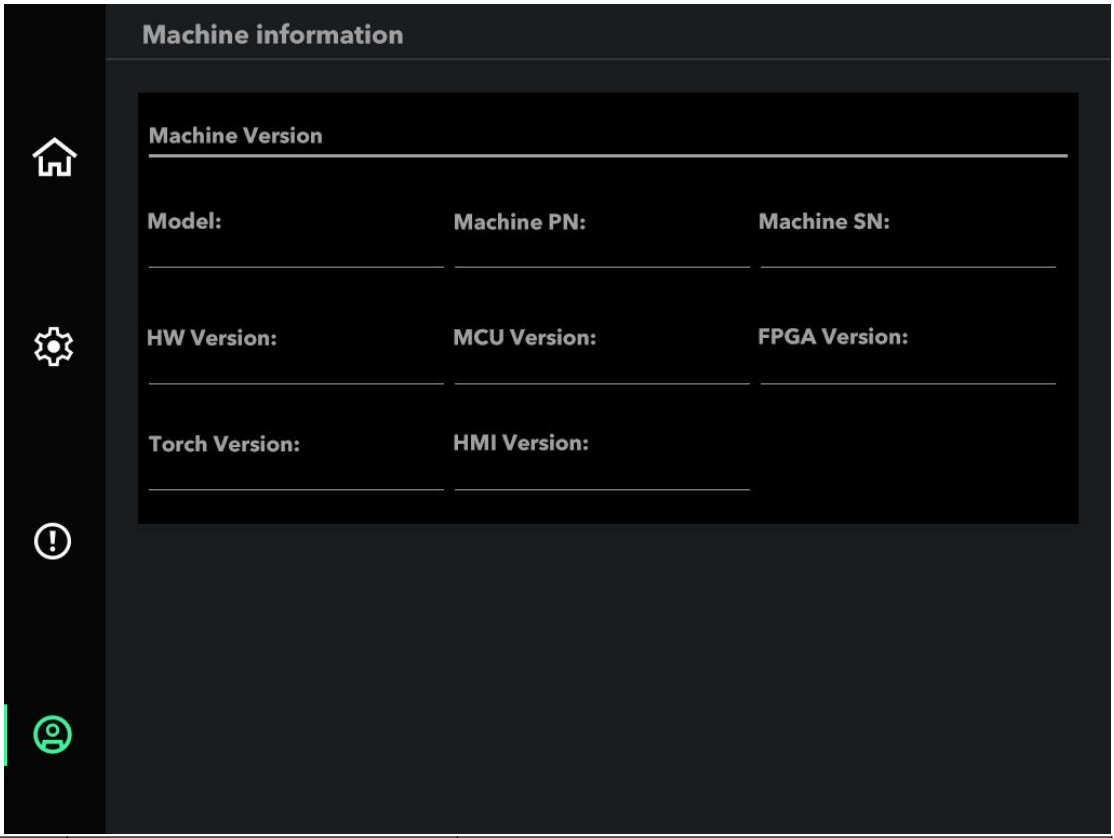
No.	**Parameter Interface**	**Description**
1	Mode	Mode Selection, the range is 0 to 9, Users can save 9 parameters in Mode
2	Wave	Wave Pattern
3	Line	Line Pattern
4	Infinity	Infinity Pattern
5	Circle	Circle Pattern
6	Laser Power	0-100% adjustable
7	Laser Frequency	165-8000kHz Adjustable
8	Laser Pulse Width	10-500ns Adjustable
9	Field Lens Selection	Field Lens Selection(160,254,330 optional), when users change the field lens, please update lens focus length.
10	Scaner Speed	The speed of galvanometer, the faster the speed, the quicker the pattern fomation: 0-30mm/s adjustable
11	Pattern Length	0-100mm adjustable
12	Pattern Width	0-30mm adjustable
13	Outer Radius	For Circle pattern: 0-100 adjustable
14	Inner Radius	For Circle pattern: 0-100 adjustable
15	Filling Pitch	0 to 50 adjustable, the smaller the value, the denser the filling
16	Save	To save parameters for users' applications into 9items mode



No.	**Status Interface**	**Description**
	Machine Status	Includes machine status&safety signal status
1	FPGA Comm.	FPGA Communication Abnormal
2	Interlock Alarm	Interlock status
3	Power Temp. Alarm	Power Temperature Alarm
4	Gas Flow Alarm	Gas Flow Alarm
5	E-Stop Alarm	Machine Emergency Stop Alarm
6	Laser Temp. Alarm	Laser Temperature Alarm
7	Laser PD Alarm	Laser PD Alarm
	Scaner Torch Status	Includes Torch status&safety signal status
8	Board Comm.	Torch Control board comminication
9	Distance	To detect the distance between torch and workpiece, if the distance variation exceeds the range, it alarms
10	E-Stop	Torch Emergency Stop Alarm
11	IR Temp.	If IR sensor detect the temperature higher/lower than threshold, it alarm
12	SETTING	Click to enter the setting interface



No.	**Setting Interface**	**Description**
	Value Setting	Set the alarm threshold
1	IR Working Range Lower	IR alarm threshold, if higher or lower the range, it alarms
2	IR Working Range Upper	
3	Distance Dieviation Alarm	If the change of distance in a filtering Time is higher than dieviation threshold, it alarms
4	Distance Alarm Filtering Time	
5	Focal Distance	Select the focal distance according to the spec, of field lens
7	Gas Flow Threshold	If the gas preasure is higher than threshold, it alarms
8	Power Temperature Threshold	If the power supply tem[p. is higher than threshold, it alarms
	Alarm Enable/Disable	Set the alarm OM/OFF
9	IR Sensor	ON/OFF the IR Temp. alarm
10	Distance Sensor	ON/OFF the distance alarm
11	Value Enable	ON/OFF the gas valve alarm
12	Power Enable	ON/OFF the power supply temp. alarm
13	Model	Select the laser model: 300-1.8/15



No.	**Machine Information**	**Description**
	Machine Version	
1	Model	Machine Model Name
2	Machine PN	Part Number of Machine
3	Machine SN	Series Number of Machine
4	HW Version	Record Hardware Version
5	MCU Version	Record Machine MCU version
6	FPGA Version	Record FPGA version
7	Torch Version	Record Torch Software version
8	HMI Version	Record HMI version

4 Maintenance and Repair

4.1 Repair

All maintenance and repair of components in this scanning head must be performed by our company. The company shall not be liable for any product damage caused by unauthorized disassembly or repair by users.

4.2 Maintenance

- **Field Lens Parameters**: When using different field lenses, corresponding parameters (e.g., F160, F254) must be selected. Laser power, frequency, galvanometer speed, and pattern dimensions should be configured according to specific products. After setting parameters, use the red alignment light for calibration. Click "Save" to store settings for future use if calibration is successful.
- **Mirror Cleaning**: Regularly clean the reflectors, as dirty surfaces can absorb laser energy and interfere with reflection. Inspect mirrors periodically.
- **Environmental Requirements**: Ensure the following conditions for storage, operation, and maintenance:
    - Storage Temperature: -35°C to +60°C
    - Operating Temperature: 0-40°C
    - Avoid humidity and corrosive environments.

4.3 Fault Maintenance

If problems occur during equipment operation, first check whether the operation instructions are strictly followed, and then refer to common faults for troubleshooting.
Common faults are as follows:

1. No indication on the galvanometer or smoke from the driver board at first startup; Cause: Power not connected or power polarity reversed. Solution: Check whether the power connection is correct.
2. Motor humming and heating up after startup; Cause: Whether the lens is secure. Solution: If the lens is loose, return it to our company.
3. Long - lasting red light and clicking noise after startup; Cause: Limit protection activated. Solution: Check the input signal to see if its amplitude is too large. If the input signal is normal, please contact our company.
4. Marking pattern becomes a straight line; Cause: One axis of the galvanometer is not working. Solution: Return to our company for repair.
5. Wavy lines in marking segments; Cause: Poor grounding or strong surrounding interference sources. Solution: Check if the ground wire is well connected and if there are strong interference sources around.

6. Square marking appears as a diamond; Cause: Misaligned optical path. Solution: Adjust the optical path. If it still doesn't work, replace the galvanometer.
7. Marking range does not meet requirements; Cause: Incorrect position signal ratio. Solution: First adjust the scale factor in the software.
8. Reduced laser energy or no laser output; Cause: Damaged lens coating or broken lens. Solution: Check the lens condition.

If the problem still cannot be solved, or if you have any unclear issues, please contact our company's customer service.

5 Warranty Statement

1. General Provisions

THEO Lasers Inc and Maxphotonics Co., Ltd. provides a warranty for any defects in its products resulting from materials and manufacturing processes during the warranty period agreed upon in the contract. We ensure that our products meet the relevant quality and specification requirements outlined in the documentation under normal usage conditions.
During the warranty period, THEO Lasers Inc and Maxphotonics Co., Ltd. shall, at its sole discretion, repair or replace products with faults caused by material or manufacturing processes. Repairs or replacements of products within the warranty coverage will be performed according to the remaining warranty period of the original products.

2. Warranty Limitations

The following circumstances will render products, parts (including fiber connectors), or equipment not covered by the warranty:
(1) Tampering, opening, disassembling, or modification by unauthorized personnel.
(2) Damage resulting from misuse, neglect, or accidents.
(3) Usage beyond the product specifications and technical requirements.
(4) Indirect damage caused by the user's software or interfaces.
(5) Accessories and fiber connectors are not included in the warranty coverage.
Customers are responsible for understanding and following the User Guide and product specifications; any faults resulting from non-compliance are not covered by the warranty.

IMPORTANT NOTICES:

- *Purchasers must report any product defects to THEO within 31 days of discovery to be eligible for warranty coverage.*
- *THEO does not authorize any third party to repair or replace parts, equipment, or other THEO products.*

Company Profile

Introduction

About THEO

Theo Inc. is at the forefront of transforming the welding industry with cutting-edge laser technology, built on a foundation of innovation, quality, and safety. We are committed to empowering professionals by enhancing their craftsmanship and productivity, while minimizing the barriers to entry in advanced welding techniques.
At Theo, our mission extends beyond providing tools—we're building a future where professionals can work smarter and faster without compromising precision or safety. Our advanced handheld laser products are designed to deliver unmatched performance in speed, quality, and ease of use, ensuring that every operator, from seasoned experts to beginners, can experience high-quality results with minimal training.
As a subsidiary of Maxphotonics, a global leader in laser manufacturing, we leverage nearly two decades of expertise in laser technology and precision engineering. This partnership allows us to integrate advanced fiber laser innovations with the agility needed to respond to the evolving needs of modern professionals.
Our philosophy is simple: we aim to be the sidekick for smart professionals, offering tools that streamline workflows, increase productivity, and redefine the standards of efficiency in welding. Whether tackling labor shortages or minimizing energy consumption, Theo is committed to providing solutions that help businesses Say No to Slow and achieve excellence at the speed of light.
Backed by Maxphotonics' industry-leading manufacturing and research capabilities, Theo remains committed to delivering the highest levels of reliability, affordability, and safety in every product we develop. With a focus on creating user-friendly solutions, we aim to simplify even the most complex welding tasks, enabling professionals to unlock their full potential with confidence.
We are driven by a vision where every professional has access to the best tools for the job, designed to boost productivity and reduce operational costs without sacrificing quality. Theo products are crafted with precision, empowering professionals to make an impact in their field by combining innovation with craftsmanship.

About Maxphotonics

A Legacy of Innovation in Fiber Laser Technology
Founded in 2004, Maxphotonics has established itself as a global leader in fiber laser manufacturing. With nearly two decades of experience, Maxphotonics has been at the forefront of research and development in core optical technologies, providing high-performance fiber laser sources, systems, and solutions across various industries.

- Global Leadership: A top brand in the fiber laser market with global influence.
- Deep Expertise: Nearly 20 years of experience in R&D and manufacturing fiber lasers and optical components.
- In-House Development: Vertically integrated, producing key optical components in-house to ensure unmatched quality.
- Quality Assurance: ISO 9001:2015 certified, adhering to globally recognized quality standards.
- Production Scalability: With an annual capacity exceeding 200,000 units, Maxphotonics is equipped to meet growing market demands.

Maxphotonics provides Theo with a robust foundation for manufacturing, development, and service excellence. Headquartered in Shenzhen, China, Maxphotonics maintains a strong global presence, enabling rapid responses to customer needs and close collaboration with industrial partners.

Products and Services

Maxphotonics specializes in a wide range of high-quality products and services:
Fiber Lasers: Offering a comprehensive portfolio of fiber lasers, including continuous wave (CW), pulsed, ultrafast, and high-power fiber lasers. These cater to a variety of applications, from material processing to healthcare, optical transmission, sensing, and research.
Optical Components: Designing and manufacturing high-performance components such as fiber Bragg gratings, optical isolators, optical circulators, couplers, and other passive photonic system components.
Laser Solutions: Delivering turnkey laser solutions and customized systems for industries like automotive, aerospace, electronics, and semiconductors, enhancing efficiency, productivity, and cost-effectiveness.
Engineering Services: Offering technical consulting, system integration, and customer training through a skilled team of engineers to ensure optimal performance from laser systems.

Quality and Certifications

Maxphotonics is committed to delivering world-class quality products and services. With stringent quality control procedures, the company has achieved certifications such as ISO 9001, CE, and RoHS, reflecting its dedication to international quality

standards.

Research and Development (R&D)

Maxphotonics continuously invests in R&D to drive technological advancements and product innovation. The in-house R&D team collaborates with leading research institutions and universities to explore new technologies and materials, aiming to create breakthroughs in photonics.

Customers and Partners

Maxphotonics serves a global customer base, ranging from small businesses to Fortune 500 companies, across industries such as automotive, aerospace, electronics, telecommunications, and semiconductors. The company has forged strategic partnerships with industry leaders, leveraging combined expertise to deliver premium solutions.

Core Values and Vision

Maxphotonics' core values center around innovation, customer focus, and excellence. The company is committed to advancing photonic technology and delivering reliable, cutting-edge solutions that exceed customer expectations.
Maxphotonics envisions becoming a global industry leader in advanced fiber lasers, expanding its product portfolio, and providing solutions that empower businesses to revolutionize their operations, contributing to a better world.

Conclusion

With over a decade of experience in optics and photonics, Maxphotonics has become a trusted leader in the global photonics industry. As it continues to drive innovation and deliver world-class products and solutions, Maxphotonics remains dedicated to its core values, ensuring sustainable growth and success for its customers and partners.
For more information, visit our website: http://maxlasers.com