为了在现片、车房树脂镜片、渐进多焦点和玻璃模具上留下不可擦写的隐形印记，都需要在镜片表面用机械或激光的方式进行隐形标志的刻写。机械雕刻由于雕刻效果差和速度慢已经激光打标替代。采用激光打标目前是大家的不二之选。

激光打标主要分热打标，冷打标和激光等离子体刻蚀三种。热激光和冷激光打标都要求镜片材料或膜层能吸收激光能量，激光等离子体刻蚀则不需要材料对激光吸收，但是要求有$10GW/cm^2$的激光功率密度。热激光通过激光热效应烧灼镜片材料使之汽化离开表面而形成不可擦写的标记；冷激光是利用激光高能光子打断材料的化学键使材料分子脱落表面而形成标记;而激光等离子体则通过等离子体刻蚀剥离镜片材料的方式达到刻写的目的。从打标效果来讲，三种方式打标效果依次提升，但伴随效果的提升，造价也是逐步非线性上涨。

To leave an inerasable and invisible mark on the surface of stock lens, RX and progressive lens and glass molds, lens surface is normally marked mechanically or by laser. Nobody in the industry likes mechanical engraving any more due to its low efficiency and bad quality, laser engraving is now the best choice.

There are three main approaches for laser engraving: hot engraving, cold engraving and laser plasma etching. Both hot and cold laser engraving require lens material or coatings to absorb the laser energy, while laser plasma etching does not. However, it does require $10GW/cm^2$ of laser power density. Hot laser burns lens surface by thermal effect so that the layer of material is vaporized and escapes from the surface to form an inerasable mark. Cold laser utilizes high energy photons to break off bond within the material and make material molecules escape from the surface to form a mark. In terms of engraving quality, laser plasma etching is the most effective with hot engraving as the least, but the better the quality is, the higher the cost gets.

性能逐步增加 Performance →

		CO₂	355nm	193nm excimer	266nm	266nm plasma
非加膜树脂镜片	Non-coated resin lens	***	*	****	*****	*****
加膜的树脂镜片	Coated resin Lens	*	**	****	*****	*****
玻璃模具或镜片	Mineral lens or mold	*	*	****	*****	*****
现片激光防伪	Stock lens	*	*	***	****	*****
生产效率(面/h)	Capacity (surf/hr)	600	500	120	500	500
维护间隔	Maintenance cycle	5years	3Years	1 Year	3 Years	3 Years

价格逐步增加 Cost price →

目前市面上大多数的激光打标机，由于技术的限制，通常采用基于PCI卡或通过USB控制激光或主轴的运动完成激光的打标，由于Windows是一个非实时的系统，USB则是消费 民用行业的串口协议，两者都无法满足7/24、无差错的工业级激光打标的应用。Toplens一直专注于专业高精度激光打标的技术引领，从2013年开始，首先应用EtherCAT总线协议，创造性地为业界提供了工业总线标准的激光打标解决方案，做到无数据误差的打标。
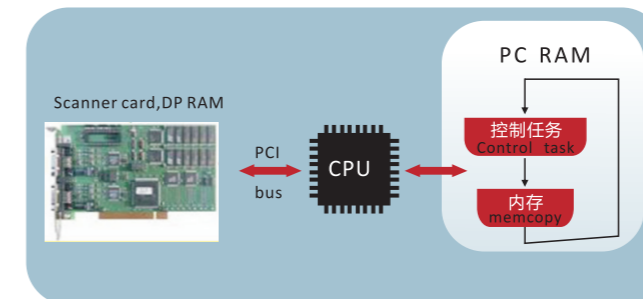
Most of the engraving machines currently on the market control laser beam or move axis via PCI card or USB. Because Windows OS is a non-real-time operating system, and USB is the serial protocol for consumer electronic, both of them are unable to meet the 7/24 hour, fault-free requirement of industrial laser engraving applications. Toplens has concentrated on its leading role in specialized high-precision laser engraving technology, being the first to apply EtherCAT BUS protocol in 2013 and creatively providing laser engraving solutions to achieve engraving with zero error.

现场总线卡实现的PC控制
PC Control with Fieldbus cards

PC RAM

Scanner card,DP RAM

PCI bus

CPU

控制任务 Control task

内存 memcpy

现场总线卡:高达30%的CPU时间用于数据备用

Fieldbus Cards: up to 30% of CPU time for data copying

EtherCAT实现PC控制
PC Control with EtherCAT

NIC card,DMA transter

PCI bus

CPU

DMA

PC RAM

控制任务 Control task
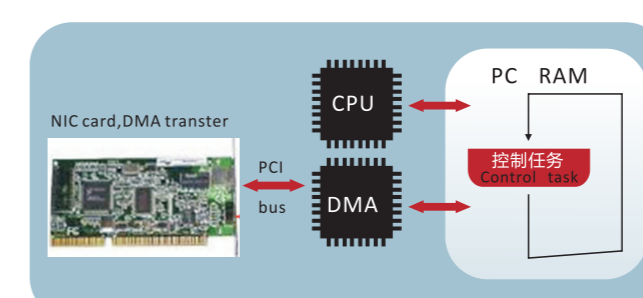
EtherCAT:NIC是 PCI总线主控设备，数据由DMA提供，直接传送到RAM：解放CPU更佳性能

EtherCAT:
MAC is PCI Bus master, data is provided by DMA directly to PC RAM: CPU relieved more performance

EtherCAT Motion Control Unit

Toplens的运动控制/激光单元是基于EtherCAT工业以太总线协议，分为MCU主模块、激光和振镜控制模块、Z-C轴控制模块、IO模块。这套系统不仅可以服务于打标机，更可以单独提供给其他运动控制或数控系统使用

Toplens motion/laser control unit is based on the EtherCAT Industrial Ethernet bus protocol, and consists of MCU main module, laser and galvanometer control module, Z-C axis control module, and IO module. This system can serve not only the engraving machine, but also other motion control systems or CNC alone.

运动控制单元 EtherCAT

LASER

MCU

Z-AXIS

I/O
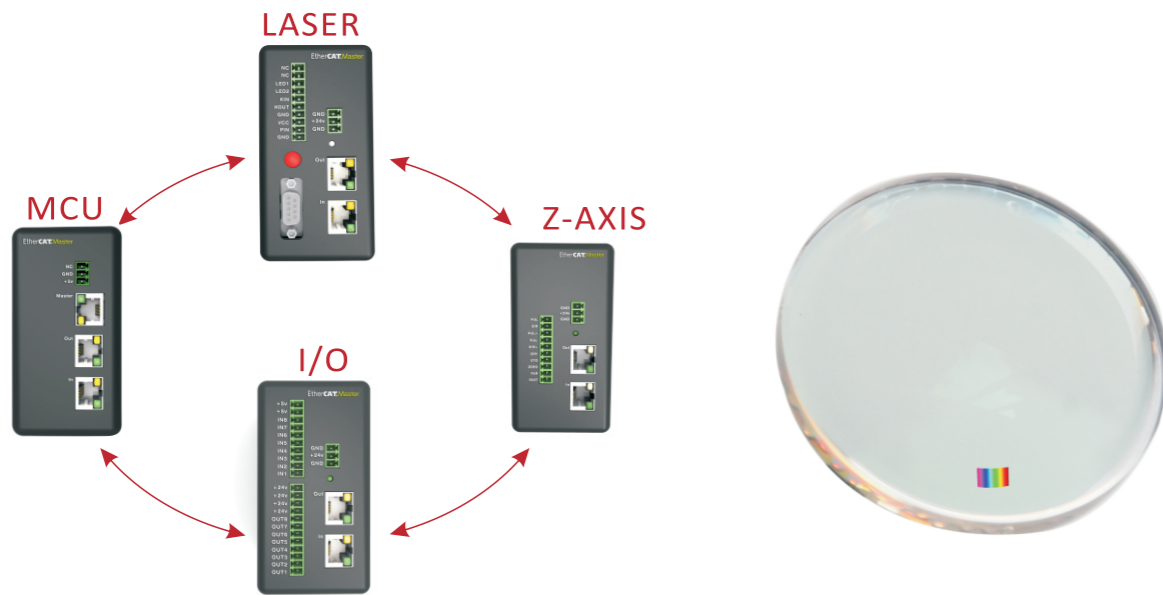
MCU 主模块 MCU main modul	IO模块 IO modules	激光和振镜控制模块 laser and galvanometer control module	Z-C 轴控制模块 Z-C axis control modules

产品图

型号Type	TEMO1-OLM	TESO1-IO	TESO1-PWM	TESO1-P/D

LSP Unit单元

常规的镜片轮廓或基弯仪通常都是接触式的，不小心操作时容易划伤软质镜片的表面，造成次品。Toplens将非球面刀口轮廓仪的检测方法经过革新，创造性地用于非接触面形测量。其原理是利用线光源上下移动，镜片从挡光到不挡光在望远镜像面上形成一系列的切面影像，再经过计算机图像重构后得到镜片的面轮廓或基弯，经过标定后的面轮廓测量精度为0.01mm。LSP单元的运用，使得现片的激光防伪打标成为可能。因为不管是193nm的准分子气体激光器还是263nm/266nm的全固体超快激光，一般聚焦f-θ透镜的焦深<2mm，而现片又没有现成的基弯数据。如果没有LSP在线测量系统，要精确地在加膜的镜片上既不破坏膜层又能进行激光防伪的光栅打标是不可能的。

General profiler or torometer usually involves contact, thus, it is easy to scratch the surface if operation on a soft lens is not careful enough, resulting in defective products. Toplens innovates the profiler detection method through aspheric edge detection for non-contact measurement of surface profile in a creative way. Its principle is to use collimated parallel light to project on linear CCD through or through not the lens, move lens up and down to have a series of slice images on telescope image plane, and then reconstruct the surface contours of the lenses with computer's aid in calculation, which eventually obtains a measurement accuracy of 0.01mm after calibration of surface profile. This application of LSP has made it possible to achieve laser grating engraving. Because no matter whether it is 193nm excimer laser or all-solid-263/266nm ultrafast laser, focal depth of f-theta lens generally is less than 2mm, and in the meantime stock lens has no base curve available. If Lens Scan Profiler wasn't introduced, it would be impossible to accurately make laser grating engraving on coated lenses without any damage to film.

线形光源 Line Light Emitting

线形传感器 Linear CCD

轮廓拟合
profiler fitting
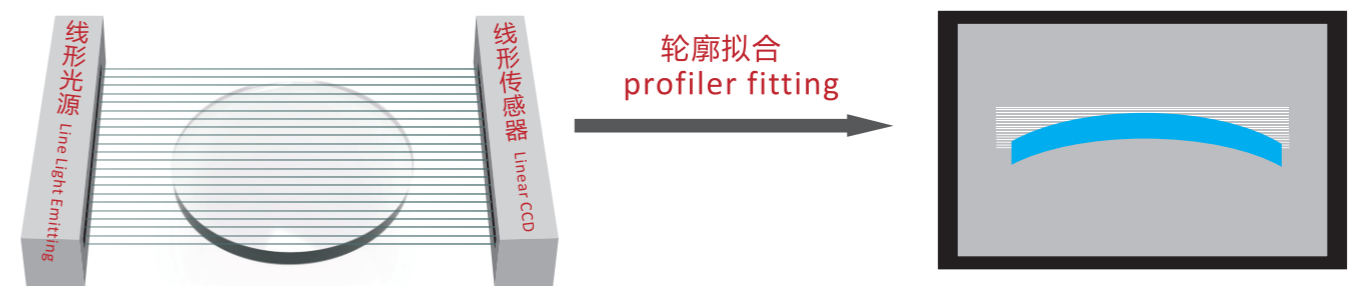
独特的非接触式透镜轮廓自动探测系统LSP单元
Unique Non-Contact Linear Scan Profiler

TLE 80 —CO2

FEATURES

技术特性

用于树脂渐进多焦点和车房镜片的打标	Design for Freeform and RX lens engraving
打标周期<6秒/片	Cycle time: < 6 seconds per mark
能够与OptoCalc,VCA以及其他设计兼容	Compatible with OptoCalc, VCA or other Design format
X/Y/Z三轴设计，激光随镜片表面面形自动聚焦	X/Y/Z 3-Axis, possible automatic laser tracing on lens surface
能够通过输入基弯和厚度打标现片	Engraving stock lens with parameter inputs
能够同时标刻隐形标记和明显可读标记	Engraving invisible and visible mark in one cycle
使用双手安全模块和连锁安全模块	Double-hand button and inter-lock function safety design
激光功率波动补偿，保证连续打标质量	output fluctuation to keep the consistent engraving quality
支持DXF、TIF、JPEG等各种图片格式	corporate logo input in different formats: DXF, TIF, JPEG, and etc
Windows XPE sp3嵌入式操作系统	Embedded Windows XPE sp3
嵌入式12.1寸工业显示触摸屏	12.1 LCD embedded Industrial PC with touch screen
EtherCAT高速工业总线构架	Reliable motion control units based upon EtherCAT protocol
根据CE标准设计	Standard design in compliance with CE regulations
激光安全等级	Safety: laser class IV
软件	Software: SmartEdit 5.0

TECHNICAL DATA

技术参数

打标范围	<φ80mm	Working Range
压缩空气	>5bar	Air Pressure
冷却水	20℃, about 5 l/minutes	Cooling Water
输入电源	80-230V AC 50/60Hz	Voltage
功率	1.2kW	Power
外形尺寸	850x600x600mm	Dimensions
重量	about 120 kg	Weight

Options

选件

C-轴模块	C-axis
自动装载系统	Auto Loading System

Accessories

附件

品名 Items	规格 Description	部件号P/N
校准平台 Calibration Platform	φ80 DIN58766	020-05-12
热敏纸 ThermoPaper	52*70 340	607001000009

三视图
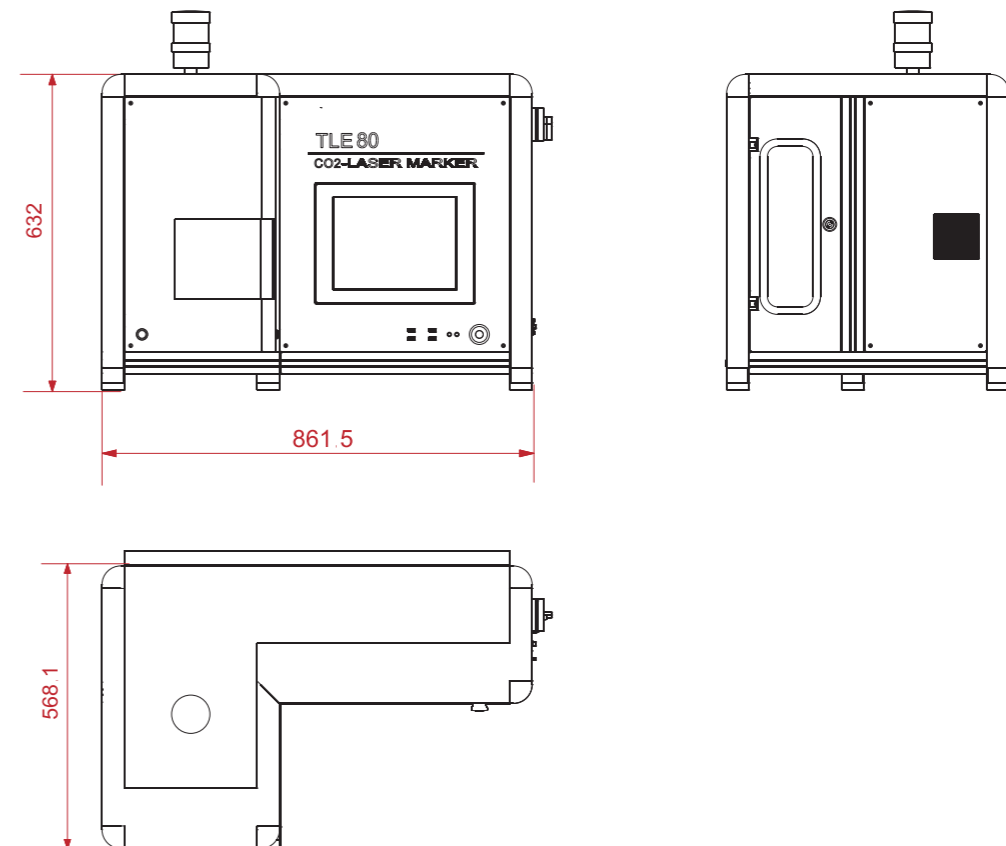
TLE 80－DUV

FEATURES

技术特性

用于任何镜片和任何模具的打标	Enable to mark for any plastic and mineral glass
打标周期<6秒/片	Cycle time: <6 arc second
能够与OptoCalc,VCA以及其他设计兼容	Compatible with OptoCalc, VCA and others
Z轴采用高速直线电机控制	Z-axis driven by linear and AC servo motor
采用远心光学聚焦系统	Telecentric F-theta focusing system
集成LSP单元，无需读取镜片面型	Integrated LSP unit
也能对任意镜片进行打标	Any lens marking without form data
使用深紫外 266nm全固体超快激光器	DPSS, Pico-Second ultrafast 266nm laser
特别可用于镀膜后的现片防伪打标	Extreme marking for coated stock lens
光栅防伪打标	Possible grating marking
集成条码和电子条码扫描模块	Integrated Linear Scan Profiler for stock lens
EtherCAT高速工业总线构架	Industrial EtherCAT Bus, reliable with easy maintenance
嵌入式12.1寸工业显示触摸屏	12.1 LCD embedded Industrial PC with touch screen
Windows XPE sp3嵌入式操作系统	Embedded Windows XPE sp3
激光安全等级：IV	Safety: laser class IV
根据CE标准设计	Standard design in compliance with CE regulations

TECHNICAL DATA

技术参数

打标范围	<φ80mm	Working Range
压缩空气	>5bar	Air Pressure
输入电源	80-230V AC 50/60Hz	Voltage
功率	1.0kW	Power
外形尺寸	850x600x600mm	Dimensions
重量	about 200 kgs	Weight

Options

选件

C-轴模块		C-axis
自动装载系统		Auto Loading System

Accessories

附件

品名 Items	规格 Description	部件号P/N
校准平台Calibration Platform	φ80 DIN58766	020-05-12
荧光纸Fluorescent Paper	52*70 340	607003000006
激光防护镜 Laser Shield	ThorLabs	607003000005

三视图

618

870.5

565
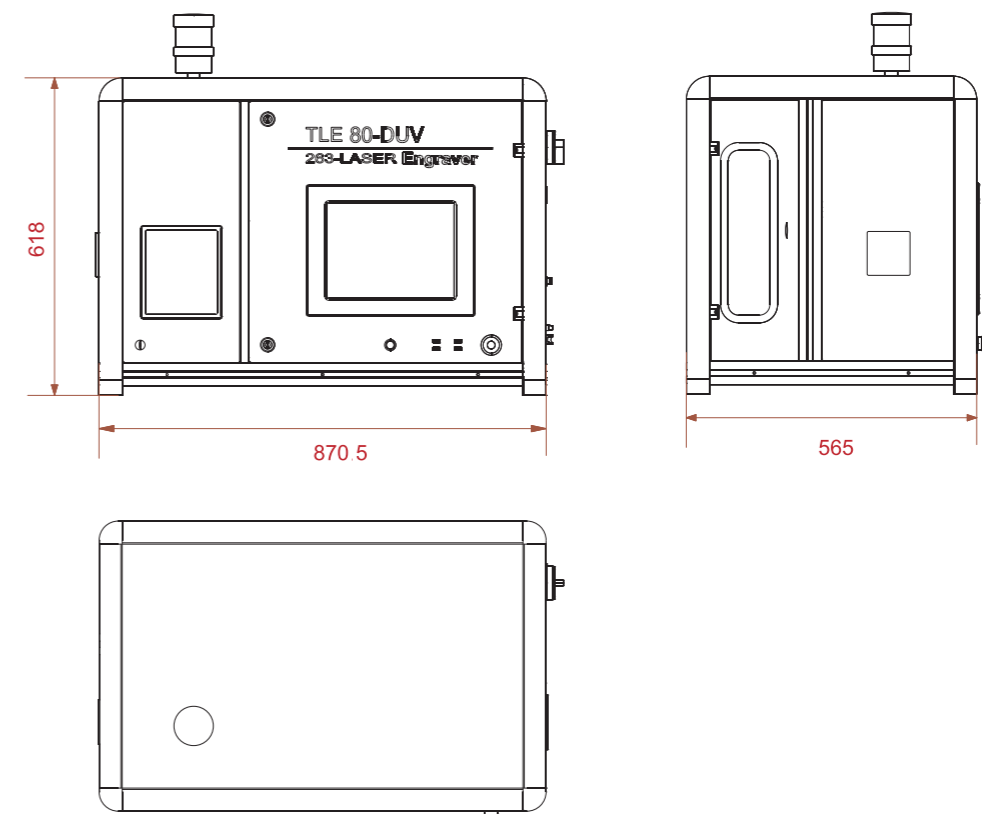
TSL-80

TSL 80 是一款专用于库存片防伪打标的深紫外打标机。具有基弯和轴位测量，直径测量，镜片位置检测和防伪打标四个功能。特别是对任意放置的散光镜片，可自动根据轴位方向在确定的位置打标。

TSL80 is designed for anti-fake DUV engraving for stock lens with automatic check lens base curve and axis, lens diameter & position and engraving. Axis of Cylinder also can be detected even lens with random position so that engraving in defined area is possible

技术参数

TECHNICAL DATA

非接触式直径测量精度	0.05mm	Non Contact Position check
基弯和轴位测量精度	0.01D	Base and axis check accuracy
打标时间	<5秒/片	Cycle time
打标范围	60mm x 60mm	Working area

三视图

1170 / 778 / 815 / 450

FEATURES

技术特性

用于现片的防伪打标	Anti-fake Engraving for stock lens
使用深紫外266nm全固体超快激光器	all solid state DUV laser
EtherCAT高速工业总线构架	Reliable EtherCAT industrial BUS
嵌入式12.1寸工业显示触摸屏	12.1"industrial PC
Windows7 嵌入式操作系统	Windows7 OS
激光安全等级：IV	Laser Class IV
根据CE标准设计	Design according to CE mark
自动机械手设计	Automatic loading and unloading design