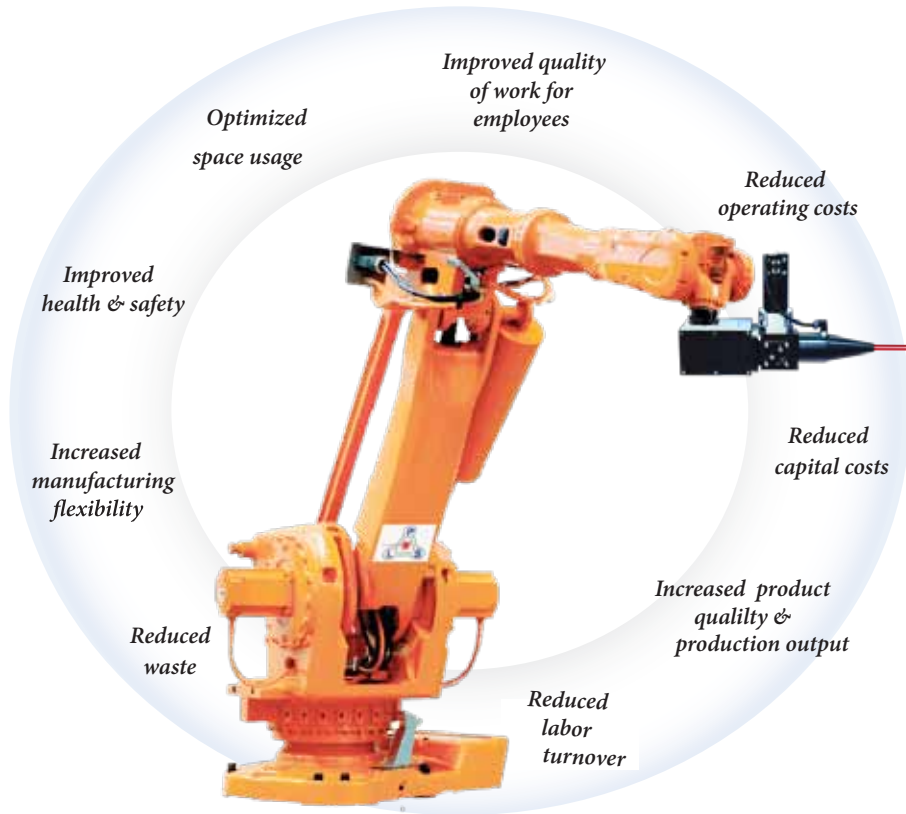


**Precision Laser
Solutions Pte Ltd**

Unrivalled expertise in system integration



INDUSTRIAL AUTOMATION SOLUTIONS



Precision Laser Solutions Pte Ltd

● CUSTOMIZED MACHINE ● AUTOMATION ● SOFTWARE ● VISION INSPECTION ●

ADD Block 1, #09-39/40 Harvest@Woodlands
280 Woodlands Ind. Park E5 S(757322)

EMAIL info@sg-pls.com **WEB** www.sg-pls.com

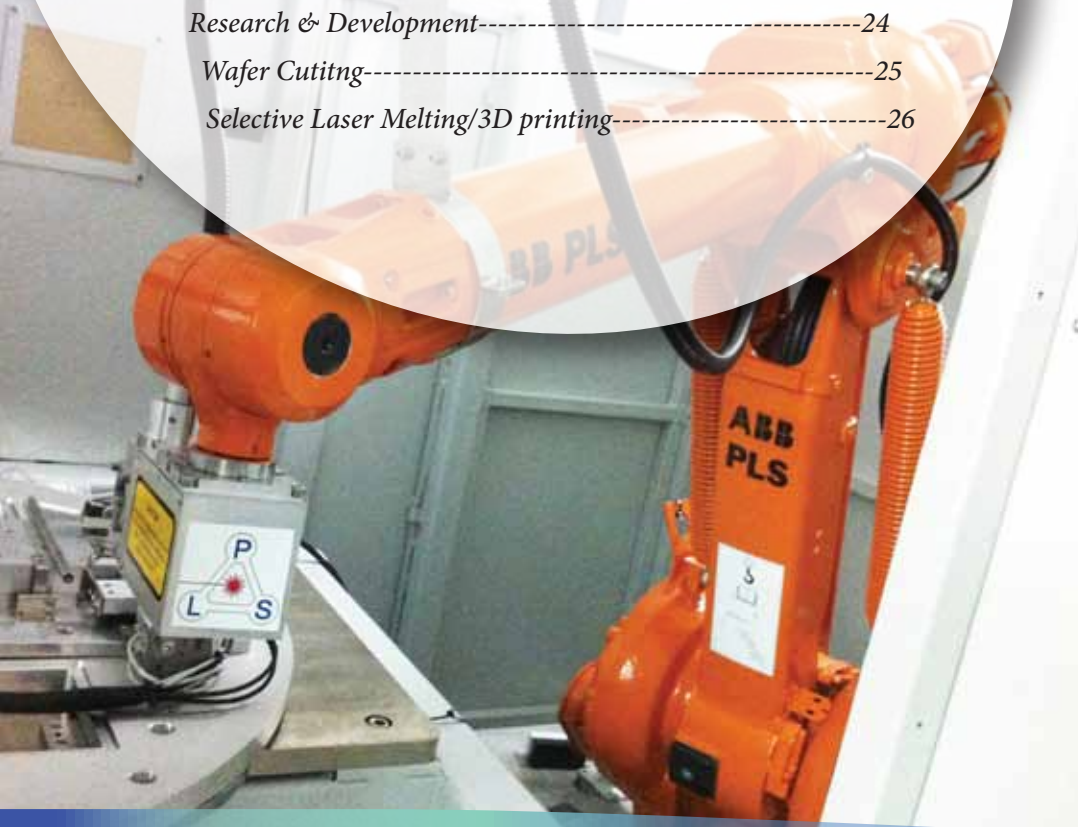
PHONE +65 67343105 **FAX** +65 67343185

HP +65 92992105; 91135308
+86 18520503308; 18896795260
+60 17 367 8661; +60 12 277 2507



**High precision capability and
quality for reasonable prices!**

<i>Laser Applications</i> -----	4
<i>SMARTLaser</i> -----	7
<i>Laser Integrated Machines</i> -----	8
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Main Office:
 280 Woodlands Industrial Park E5
 #09-39/40, Block 1, Harvest@Woodlands
 Singapore 757322

Suzhou Branch:
 新加坡精密激光系统有限公司苏州代表处
 中国江苏省苏州市工业园区
 苏虹东路188号
 方正科技园A栋

Laser generation of elliptical nanometre and sub-nanometre bump arrays on NiP/Al data storage disks and their effect on stiction performance

A A Pena¹, Z B Wang¹, J Zhang², N E Wu² and L Li¹

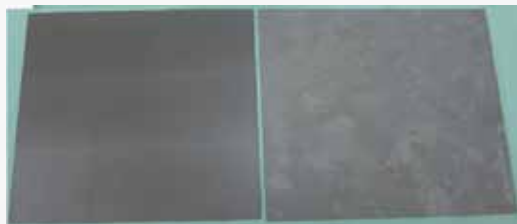
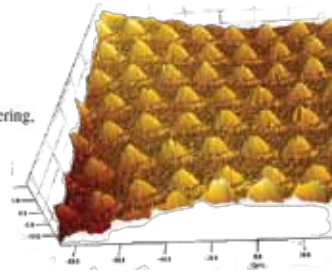
¹ Laser Processing Research Centre, School of Mechanical, Aerospace and Civil Engineering, University of Manchester, Sackville Street, Manchester M60 1QD, UK

² Precision Laser Solutions Pte Ltd, 29 Mandai Estate #03-11, 729932, Singapore

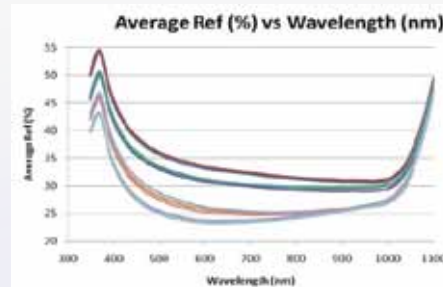
E-mail: Ana.Pena@postgrad.manchester.ac.uk

Received 23 March 2011, in final form 24 June 2011

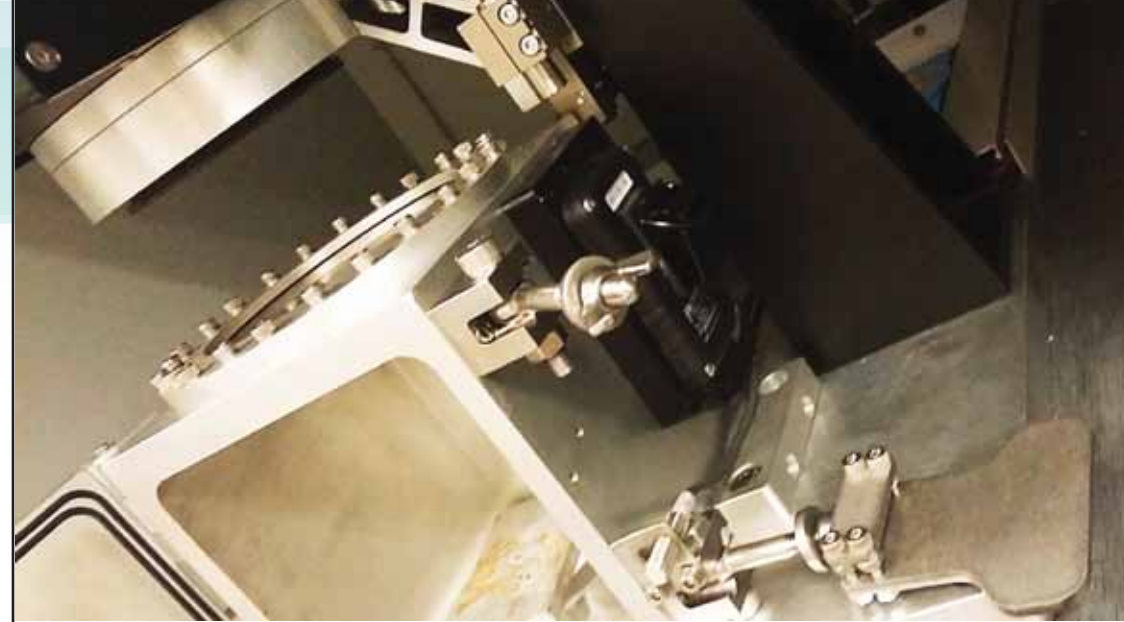
Published 11 August 2011



Solar Cell Efficiency Improvement



Lotus effect with PLS Laser for medical applications (super-hydrophobicity)



Why Laser?

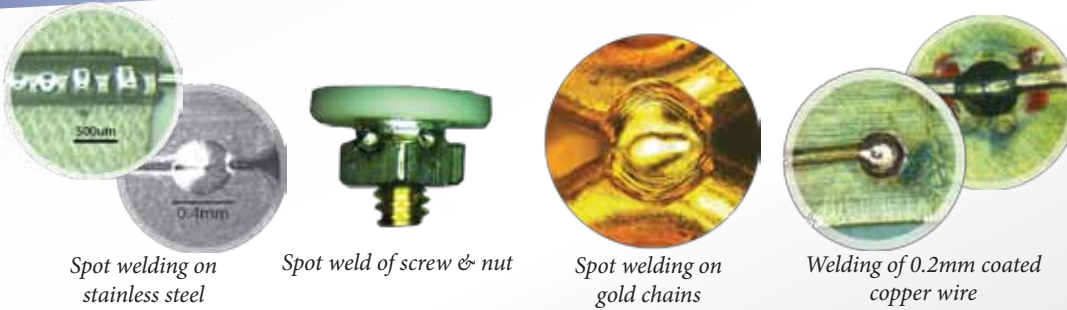
Laser integration is ideal for industries with extremely precise requirements for material processing and micro-material processing. The coherency, high monochromaticity, and ability to reach extremely high powers are all properties which allow for these specialized applications. Laser applications include welding, soldering, cutting, heat treating, marking, scribing etc.

Why Automation?

Higher output and increased productivity have been two of the major reasons in justifying the use of automation. Automated systems typically perform manufacturing processes with more stability than human workers, resulting in greater control and consistency of product quality. Speed is also increased without compromising quality. Also, increased process control makes more efficient use of materials, resulting in less scrap.

LASER APPLICATIONS

PATENTS GRANTED



Spot welding on stainless steel

Spot weld of screw & nut

Spot welding on gold chains

Welding of 0.2mm coated copper wire



Seam weld of plastics

Micro seam weld of stainless steel

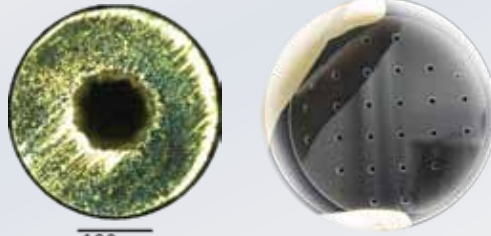
Seam weld of metal parts

Slot cutting on glass sheet



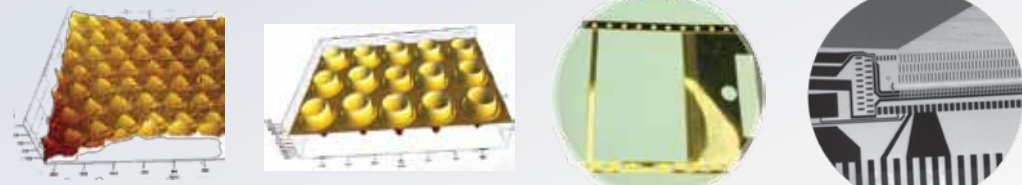
High contrast laser marking

Scribing of TCO on glass for solar panel or TFT



PS laser cutting on stainless steel

Drilling on sapphire glass



Nanometer bump creation on flat surface

Laser cutting on flex circuit film

TFT LCD test circuit trimming

(19) United States
(12) Patent Application Publication (16) Pub. No.: US 2013/0162810 A1
Wu (43) Pub. Date: Jun. 27, 2013

(54) APPARATUS FOR INSPECTING ROTARY PARTS AND THE METHOD OF THE INSPECTION
(76) Inventor: Nal Ea Wu, Singapore (SG)
(21) Appl. No.: 13826,290
(22) PCT Filed: Sep. 15, 2010
(86) PCT No.: PCT/SG10/00101
§ 371 (c)(1), (2), (4) Date: Mar. 1, 2011

(57) ABSTRACT
A computer vision inspection system disclosed for use in inspecting of rotary parts like pulley gear or bearing product with internal slots or ribs to determine the fabrication quality of the functional dimension of the slots or ribs with the help of inspection bulbs (11) and ball followers (40). The apparatus includes a vision system with camera (30), lens (32), lighting (35), control computer, the image capturing and bringing processing computer program, and the fixture (40) and eye system for the rotary parts and inspection bulbs (11) and ball followers (40).

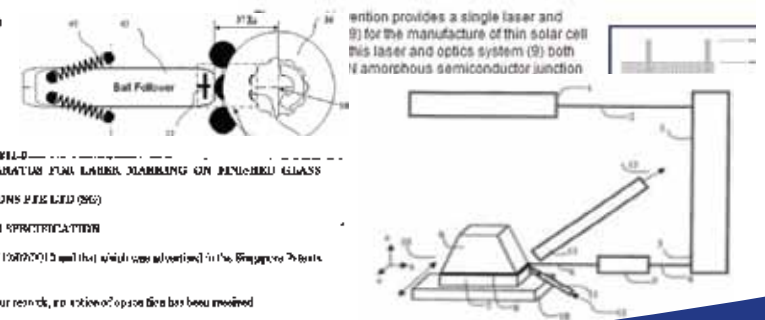


CERTIFICATE OF GRANT OF PATENT
In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 150278 (WO 2008/024076) has been granted in respect of an invention having the following particulars:
Title : PROCESS AND APPARATUS FOR LASER SELECTIVE SEPARATION
Application Number : 200901190-9
Date of Filing : 31 August 2007
IPC Class : B23K 09/00 (H) (L) (G) (S) (W)
Law : RFD/2010
Wales #1024100
Wales #1024100 : 6311 6556



WO/2009/035421 International Application No.: PCT/SG2008/00001
Date: 19.03.2009 International Filing Date: 15.09.2008
B23K 26/00 (2006.01), H01L 21/00 (2006.01), H01L 31/042 (2006.01), H01L 31/033 (2006.01)
PRECISION LASER SOLUTIONS PTE LTD, [SG/SG]; 29 Mandal Estate #03-11 Inne-3 Singapore 729932 (SG) (All Except US)
WU, Nalen [SG/SG]; (SG) (US Only)
CHEN, Tao [CN/SG]; (SG) (US Only)
TRAN, Duc Vi [VN/SG]; (SG) (US Only)
GOH, Jui Kiat, Ryan [SG/SG]; (SG) (US Only)
WU, Nalen; (SG)
CHEN, Tao; (SG)
TRAN, Duc Vi; (SG)
GOH, Jui Kiat, Ryan; (SG)
LAERENCE Y D HO & ASSOCIATES PTE LTD; 30 Bideford Road #02-02 Thompsons 229922 (SG)
60972,258 14.09.2007 US
SINGLE LASER SYSTEM FOR MANUFACTURE OF THIN FILM SOLAR CELL

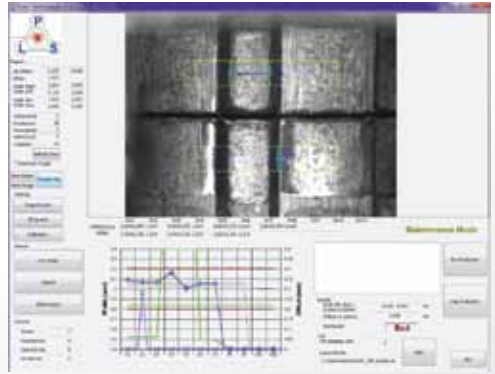
Dear Sir,
Singapore Patent P-No. 150278
Singapore Patent Application No. 200901190-9
Title of invention: PROCESS AND APPARATUS FOR LASER MARKING ON BENDED GLASS
DIXY NIKITA
Applicant: PRECISION LASER SOLUTIONS PTE LTD (SG)
NOTIFICATION OF GRANT OF PATENT SPECIFICATION



We refer to your Patent Form 19 of 1997/2013 and that which was advertised in the Singapore Patent Journal Issue 2010/14.
We are pleased to inform that from our records, no objection has been received.
From time to time with Rule 25(3) and (4) of the Patents Rules, please find a copy of the new and amended specifications.

AUTO INSPECTION SYSTEMS

designed just for you



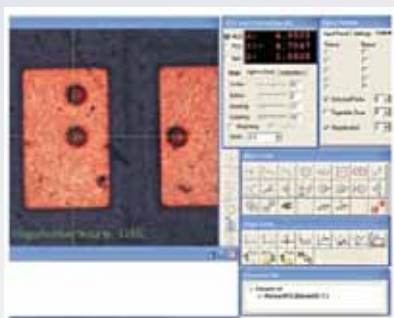
Real-time 9-parameters laser process quality inspection using pattern recognition & image processing/measurement vision software

Upload to Factory Information System for Statistical Process Control and SPC analysis

Fully in-house developed image processing software with flexible customization capability

Optimized vision system best fit to specific requirements

Patent Granted in Singapore, China, Taiwan and Japan



CUSTOMIZED MACHINES

designed just for you



Fast Speed Auto Loader



Robotic Arm Auto-Packer
10 operators saved

From simple laser processing stages to complex industrial production systems

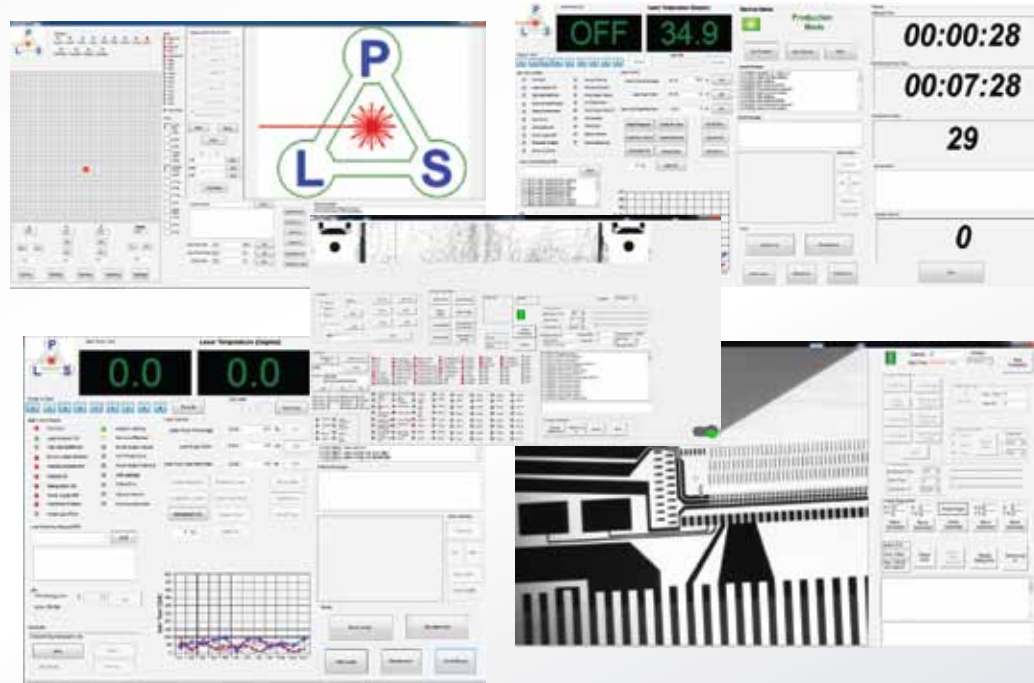


Unmanned Fully Automatic Robot Transfer Line
30 operators saved

CUSTOMIZED SOFTWARE

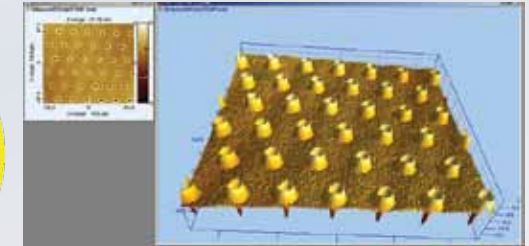
designed just for you

HIGH-END NM BUMP LASER TEXTURING MACHINE

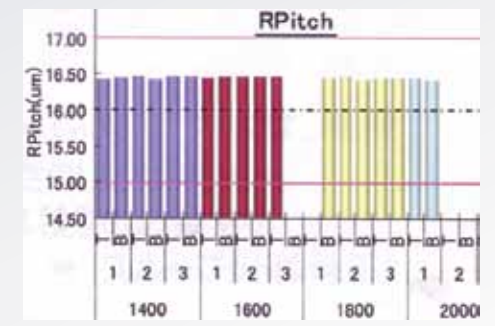
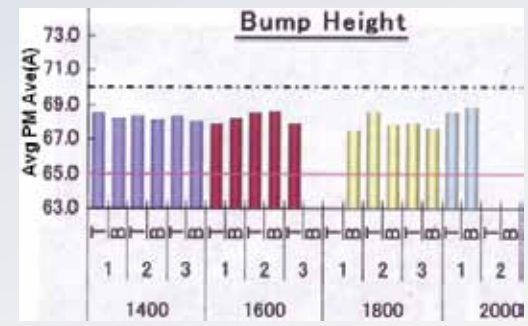


KEY SPECIFICATIONS:

- Bump Height (BH): 6, 6.5, 7, 7.5, 8.5nm
- Ultra stable bumps: $< \pm 0.4$ nm variance
- Bump pitch = $16 \mu\text{m}$
- Pitch Stability: $\pm 1 \mu\text{m}$
- Dual spindle independent operation
- In-line conveyor for loading/unloading
- Clean-room class 10 standard



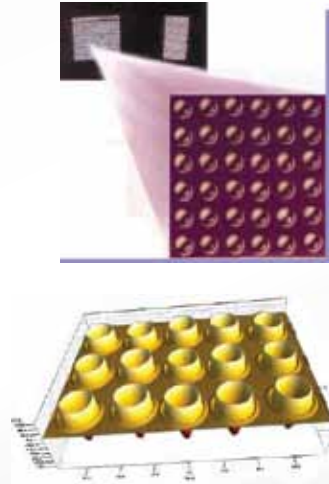
Customized automatic control software to suit your production needs accordingly
Flexible to changes and feature upgrades
Fast remote online support capability



NANO SCALE LASER INDEX MARKING ON HDD MEDIA



100+ machine installations!

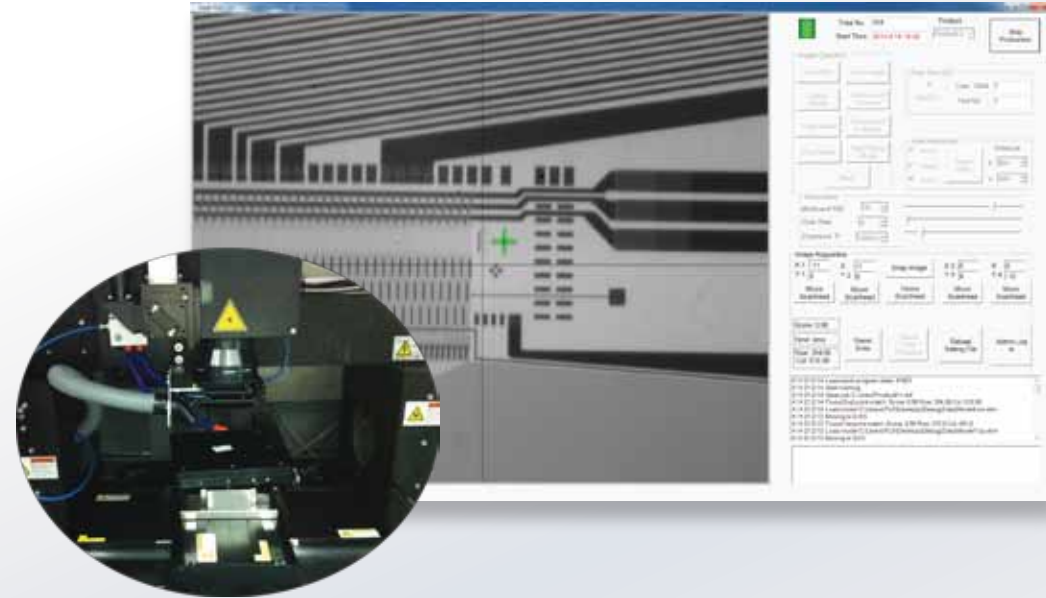


KEY SPECIFICATIONS:

- Bump height: 100 ~ 200nm;
- Bump height stability: +/- 10nm
- Bump diameter: 10 ~ 30um;
- UPH 950
- Cleanroom class 10/100 standard

FEATURES:

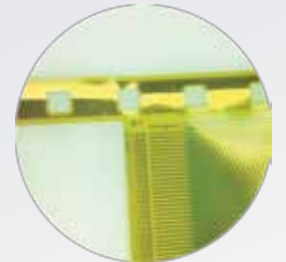
- Fully integrated machine/laser/vision control software
- Versatile 3-axis optical alignment system
- Independent top and bottom side optical adjustment
- Independent bump height control and setting
- High Precision Laser Marking Capability
- Real-time Vision Inspecting for Closed loop process quality control
- Proven technology with 100+ installation in Singapore, Malaysia, Japan and America.



FEATURES:

- XY Scanner Cutting system Integrated with Precision Vision Alignment System
- Win7 Operation System Control Software; User-friendly
- Tailored **High resolution** Vision Alignment System
- Integrated with **powerful marking software**
- Motion; laser; and Vision auto Alignment
- Seamless Large Area Laser Marking & Stitching
- Through-the-Scanner in-Line Vision System
- Fast and precise** recognition of preset guide markers
- High repeatability accuracy
- Highly customizable** for industrial/research use

APPLICATIONS:



LASER INTEGRATED MACHINES

LASER INDEX MARKING ON HDD GLASS MEDIA DISKS

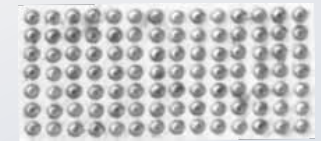
PLS UV Laser Micro-processing Machine

FEATURES:

- XY Scanner Integrated into XYT-Z 4-axis Granite Motion Stage:
- Windows 7 Operation GUI
- Integrated software for Motion; laser; and Vision auto Alignment system
- Seamless Large Area Laser Marking & Stitching
- Through-the-Scanner in-line vision system
- Latest high-precision laser scanner from Germany



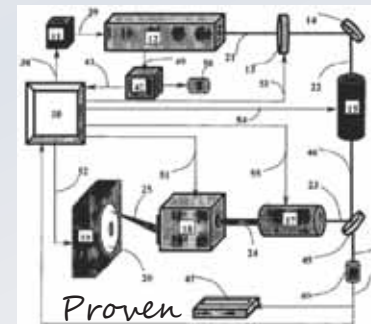
50+ machine installations!



3D Laser Welding Machine

FEATURES:

- Customized workstation for Trumpf 2D/3D PFO Welder
- Manual/Auto welding process control
- Manual/Auto Z-stage movement
- Upto 6KW TruDisk Laser
- Fast 2D/3D Galvo scanner laser welding



*Proven
Patented
Technology!*

FEATURES:

- Single-Laser, Dual-Scanner & Optical system
- Independent bump height setting
- Close-loop Laser Pulse Counting technology
- Close-loop in-line bump-height monitoring
- Real-time In-line Vision Inspection Technology
- Cleanroom class 10/100 standard

KEY SPECIFICATIONS:

- Bump height: 100- 400nm +/- 15nm
- Bump diameter: 20 ~ 50um;
- Compact size: 1300(L) x 1040(W) x1870mm(H)

PLS-ABB ROBOT TRANSFER LINES

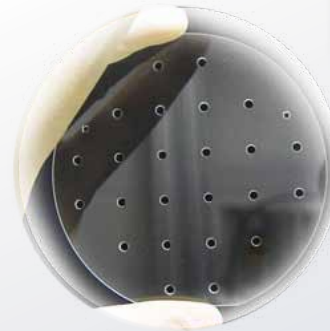
PLS PS LASER MICRO-PROCESSING MACHINE



9X Small Robot Line
20 operators saved

FEATURES:

- **Flexible** production
- **Consistent** product quality
- Safety fence mechanism
- Doubled production, doubled **efficiency**
- **Low maintenance**



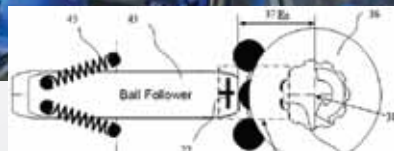
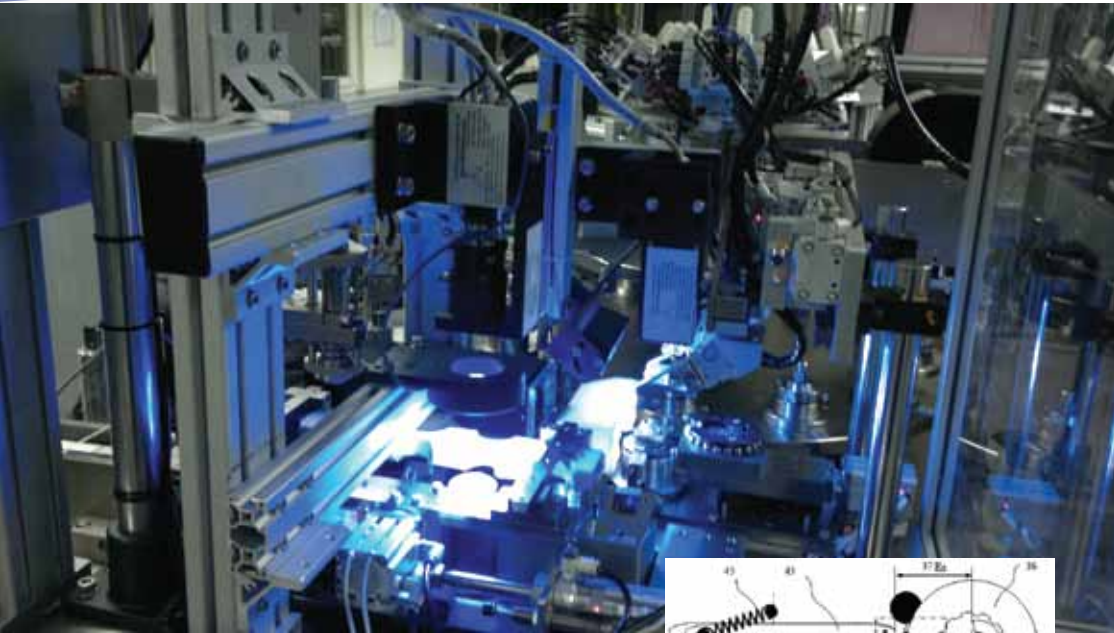
FEATURES:

- **XYT-ZZ 5 Axis Motion Stage**
- CCD vision for easy focus & position adjustments
- Seamless Large Area Laser Stitching
- 600x400x200mm x 350D
- **1 um repetitive accuracy**
- Windows 7 Operation GUI
- **Motion, laser and Vision Alignment system integration**
- IR + Green + UV ps-laser
- Dual scanner head auto shuttle



7X Big Robot Line
30 operators saved

PLS MARK-WELD-INSPECTION FULL SOLUTION MACHINE

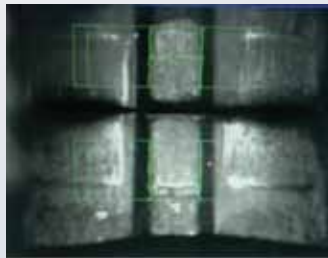


Proven Patented Technology

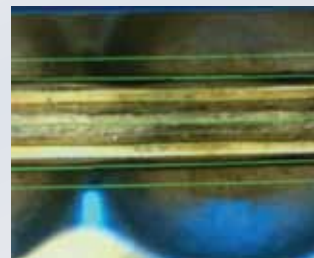
Laser Welding-Marking-QC Vision
Inspection all in ONE machine



Pitch Diameter Auto Inspection



Gear Teeth Auto Inspection

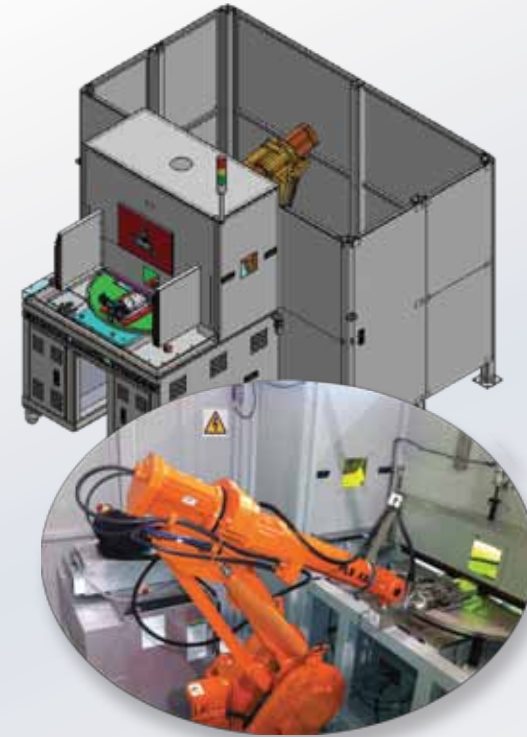


Weld Seam Auto Inspection
(Full 360D QC)

PLS ROBOT LASER WELDING/CUTTING PROCESSING CENTER

FEATURES:

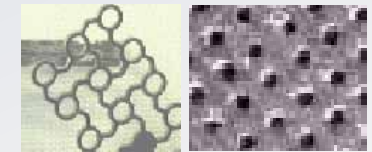
- Compact **Fiber Laser**
- Auto Laser Welding with ABB Robot
- Auto **Turn-Table** for fast processing
- In-line Vision for alignment & Inspection
- Full Safety Protection & enclosure
- Windows Control Software; User Friendly
- Customized full-system control **software**
- 9-points **precise spot welding** machine
- 2-port auto-shuffle rotary table with automatic jig & fixture clamping
- Flexible fiber laser interface



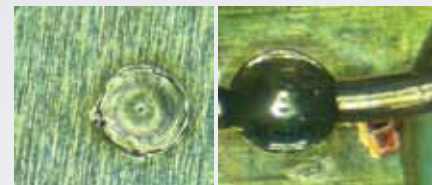
APPLICATIONS: Multi-functional incl. Laser welding, Cutting, Marking, Cleaning



Laser Seam welding



Precision Drilling / Cutting



Spot welding ss304 & Copper



welding fine wire to PCB

PLS DUAL TRACK FAST SPEED TAPE & REEL PACKING MACHINE



FEATURES:

- Dual track vibratory bowl
- Speed at 0.3s/pc
- 4 port rotary table for continuous pick&place
- User-friendly PLC touchscreen
- Full Safety Protection & enclosure
- Full Inspection before sealing
- Suitable for small 3D electronic components packing
-



PLS DUAL TRACK TAPE & REEL PACKING MACHINE (CCD VISION)

FEATURES:

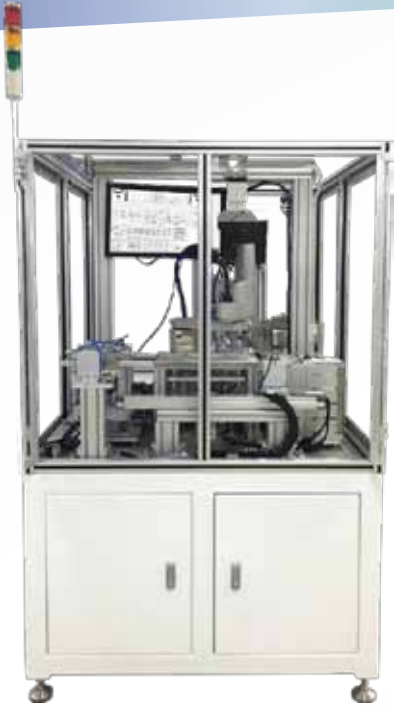
- Dual track vibratory bowl
- Speed at 1.2s/pc
- Able to pack parts ranging from 8-13mm
- User-friendly PLC touchscreen
- Full Safety Protection & enclosure
- Full Inspection before sealing
- CCD Vision able to identify and process 90°, 180°, 270° & 360° orientation
- Designed to run more than type of component (using same vibratory bowl)



**CCD vision allows
packing of orientation
specific parts**



PLS DUAL TRACK TRAY PACKING MACHINE



FEATURES:

- Dual track vibratory bowl
- Speed at 0.8s/pc
- CCD Vision System to identify part orientation before picking (Optional)
- User-friendly Customized Windows Software
- Full Safety Protection & enclosure
- Loads 15 trays for one cycle
- Robot Arm PnP enables easy modification for different tray pocket design
- Designed to cater for different tray sizes



PLS HIGH-POWER LASER WELDING MACHINE



FEATURES:

- Motorized rotary table with 4 different stations
- Speed?
- Removable Jig Fixtures for easy modification
- User-friendly Customized Windows Software
- Full Safety Protection & enclosure
- Loads 15 trays for one cycle
- Robot Arm PnP enables easy modification for different tray pocket design
- Designed to cater for different tray sizes
-



PLS PORTABLE LASER CLEANING MACHINE

PLS 3-AXIS WAFER LASER CUTTING MACHINE



Benefits:

Easy use handheld **all-in-one** system

Upgradable to integrate with robot

Ideal for many coatings & metal surfaces

Green technology:

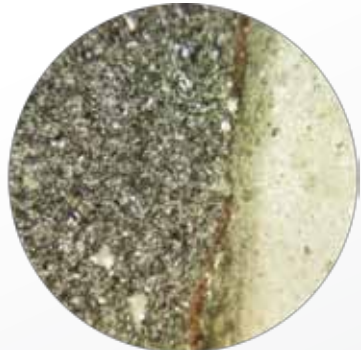
No chemicals, no residues, no consumables

Totally dry process – no water or liquids that can cause moisture damage & corrosion

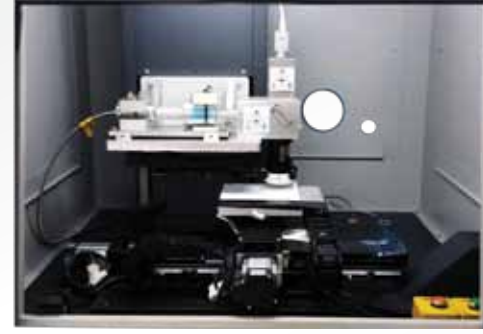
Unmatched cleaning quality:

Laser cleaning produces surfaces with excellent bond strength quality for coating durability and corrosion resistance.

Non-contact/non-kinetic, No abrasion to delicate surfaces



1.2mm thick paint layer



FEATURES:

- Dual track vibratory bowl
- Speed at 0.8s/pc
- CCD Vision System to identify part orientation before picking (Optional)
- User-friendly Customized Windows Software
- Full Safety Protection & enclosure
- Loads 15 trays for one cycle
- Robot Arm PnP enables easy modification for different tray pocket design
- Designed to cater for different tray sizes



