**SpeedLight PLI series**

Laser direct imaging platform for efficient production of printed circuit boards
**HISTORY OF THE DEVELOPMENT OF MANZ PLI SERIES**

Manz became leading supplier of wet chemical processing equipment by acquisition R6D and production sites of Intech Machines Co. Ltd in Taiwan and China. With more than 30 years, Manz has specialized in the development and manufacture of wet chemical equipment for the production of TFT LCDs, touch panels and printed circuit boards and is now the market leader in this sector. With the acquisition of KLEO Halbleiterechnik GmbH in 2015, the printed circuit board segment was expanded still further by the laser direct imaging process.

**MANZ AG**
- Founded by Dieter Manz
- Development of automation solutions for FPD and solar industries

**KLEO HALBLEITERTECHNIK GMBH**
- Founding of the development company KLEO Halbleiterechnik GmbH & Co. KG
- Delivery of first system for a fully automated crystalline solar cell production line
- Entry into the thin film market with systems for mechanical shadowing of solar modules
- IPO on the Frankfurt stock exchange
- Manz becomes leading provider of wet chemical processing equipment (PCB) through the acquisition of Intech of Taiwan
- Entry into the lithium-ion battery market
- Winner of the 2009 Industrial Excellence Award (PCB)
- Founding of the Manz Coating GmbH development center for vacuum coating technology
- Opening of the plant in Suzhou, China, for the manufacture of solar, display, and PCB equipment
- Manz becomes one of the world’s leading equipment providers for touch panel production
- First order from the AMOLED display industry
- Acquisition of KLEO Halbleiter GmbH, Tettnang, from ZEISS
- Integration into the PCB segment of Manz
- Delivery of PL500 LDI system to technology leaders for multilayer AP PCB and PL620 for a CGB leader respectively
- Delivery of the first Twinline PL880 LDI system for high-end PCBs as follow-up order

**FULLY INTEGRATED SOLUTIONS FOR PCB PRODUCTION**

**ADVANCED PCB SOLUTIONS**
- Preprocessor
- Horizontal/vertical imaging system
- LDI

**DEVELOPING PROCESSES**
- Laser drilling
- Laser, UV laser, or UV/NIR laser

**SURFACE TREATMENT PROCESSES**
- Solder pastes
- Flux pastes
- Immersion tin, copper, or silver plating
- Germination
- Pre/Post treatment
- Final rinsing
- Horizontal/vertical soldermask imaging system
- Horizontal/vertical stripper
- Roll to roll
- Horizontal/vertical loader
- Robotic arm
- SES/DES vacuum system
- Quick etching
- Horizontal/vertical stripper
- Horizontal/vertical imaging system
- Brown oxide

**METALLIZATION PROCESSES**
- Sapphire
- CVD/APEX
- Flash plating
- High speed automatic plating
- Glue
- Blank/hold
- RCA

**A wide field of possibilities**

MANZ LDI PLI SERIES WAS DEVELOPED TO LEAD THE PERFORMANCE AND COMPETE WITH THE MOST DEMANDING AND IMPORTANT ASPECTS OF INDUSTRIAL DIRECT IMAGING.

With more than 30 years of experience in developing high-tech equipment for manufacturing high-efficiency printed circuit boards, Manz AG has earned an outstanding reputation as a provider of wet chemical processing equipment. In 2015, through the acquisition of KLEO Halbleiterechnik GmbH from ZEISS, the printed circuit board technology portfolio has expanded further by combining dry process equipment – the Laser Direct Imaging, for PCB super fine-line applications.

The integration of this process into our existing production solutions for patterning enable PCB manufacturers to maximum precision and enormously increases flexibility through a significantly shortened production cycle and can be done more cost-effectively. In addition, to achieve the best imaging results with the highest throughput.

This gives our customers a significant competitive edge and allows them to meet the market’s increasing demand for ever lighter, thinner, better electronic devices.
Advantage of using Laser Direct Imaging (LDI)

INNOVATIVE PRODUCTION EQUIPMENT FOR THE MANUFACTURE OF HIGH-RESOLUTION PREMIUM AND XL PRINTED CIRCUIT BOARDS.

The market demands ever lighter, thinner and more powerful electronic devices. These demands can be applied equally to the components of such devices. Thus, this drives printed circuit boards, one of the basic components in almost every electronic device, constantly evolving and getting more complex, due to miniaturization trends in the electronics industry. These changes have caused the traditional imaging process for HDI PCBs to provide inadequate results.

In response to new electronics tendencies, only through the use of innovative production equipment can the rising demand be met. With a new imaging technique known as LDI, the PCB manufacturers can achieve the development of images that require more precision and higher resolution. In this way it is possible to increase the efficiency of production and the power of the printed circuit boards that are produced.

IN FOCUS: LASER DIRECT IMAGING (LDI) IN PCB MANUFACTURING

When a circuit board is made, the imaging process is what defines the circuit traces. While the traditional imaging process requires a photo-tool and UV-light to transfer images, LDI only uses a computer-controlled, highly focused, laser beam to directly define the circuit pattern onto the board.

The throughput time for LDI lithography is several times shorter than for the conventional photolithographic method. Thus, adjustments, changes and eliminations of errors can be implemented more quickly and at significantly lower costs.

In comparison with the conventional photolithographic process, PCB manufacturers make the following benefits possible:
- Increase in the efficiency and flexibility of the product and the production process
- Significant cost savings of up to 75%

Conventional photolithography work process

(Exemplary presentation)

- Pre-Condition: 30 Min.
- Scale Factor: 10 Min.
- Plot: 25 Min. + 2
- Measure & Inspect: 5 Min.
- Diazo Film: 10 Min.
- Retouch: 5 Min.
- Print: 10 Min.

LDI lithography with SpeedLight series work process

- Scale Factor: 2 Min.
- Print: 10 Sek.

Your best choice in every configuration

THE USE OF INNOVATIVE MANUFACTURING EQUIPMENT FROM MANZ SIGNIFICANTLY INCREASES THE EFFICIENCY OF PCB PRODUCTION.

By using Manz LDI technology, you can fulfill the most demanding customer requests for printed circuit board production.

The LDI platform PLI series offers you powerful graphics processors to compensate for material distortions in real time as well as the best possible flexibility when imaging rigid or flexible PCBs of all common sizes, and is also well-suited for a variety of specialized applications, such as oversized panels or ceramic substrates. It is the flexible solution for efficiently producing high-resolution premium printed circuit boards.

Compared with conventional photolithography, not only production costs are lowered by up to 75%, but also the job setup time is shortened several times. This allows manufacturers to make adjustments and changes and correct errors more quickly and at significantly lower costs.

In addition, the PLI series is available as an individual tool or as a combined solution for integration into a PCB production line with other Manz high-tech machines, such as loading and unloading, buffer, pre-cleaning, dry film laminator, mylar peeler, and developer.

Using Manz LDI in high performance PCB manufacturing

Cost efficiency
- Omitted 6 steps compared with conventional photolithographic method
- Reduced material cost
- Saved production time

Quality
- High accuracy exposures
- Various position marks
- Higher registration precision

Flexibility
- Cater for highly variable market
- Flexible to adjust production layout and process
- Compatible with different manufacturing technologies and production

Traceability
- Enables panel tracking by marking
- Flexible serialization
- Comprehensive production information database
**PLI SERIES—APPLICABLE TO VARIOUS APPLICATIONS**

**Manz LDI system**

**PLI 800**
- Fully automated
- Stand alone, in-line or robotic system
- Seamlessly integrated automation

**PLI 700**
- Fully automated
- Stand alone, in-line or robotic system
- Seamlessly integrated automation

**PLI 500**
- Semi-automated
- Stand alone, in-line
- Seamlessly integrated automation

**PLI 200**
- Manually operated
- Stand alone, in-line

**Features**
- **PLI 800**: Two LDIs inline for double throughput
- **PLI 700**: Fully automated for a single LDI
- **PLI 500**: Entry-level automation for a single LDI
- **PLI 200**: Available as a standalone equipment or as a solution for integration into a production line

**A wide field of possibilities**

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*● Solder Mask (Only one Wavelength: 405 nm)

**Optional worktables**
- PLI X10 for flexible PCB/
- PLI X20 for ceramic PCB/
- PLI X50 for oversized PCB/Backplane DCB

- Special worktable / vacuum design
- Available in all Manz automation configurations
- 2- or 4-camera solutions for faster registration
- Patented corner registration
Using Manz LDI in high performance PCB manufacturing

MANZ OFFERS WIDEST RANGE OF LDI SYSTEM - PLI SERIES TO BEST SERVE MORE TO FULFILL THE NEEDS OF CUSTOMERS.

Registration of a large variety of position marks
Registration for image-to-panel alignment and image-to-panel scaling is performed by a highly sophisticated vision system, using all available illumination and registration techniques (including patented corner registration).

Alignment and scaling is calculated in real time by a grid of high-performance graphic processors running on several high-end servers.

Depending on the quality of registration marks, the front-to-back registration accuracy peaks in ±10 µm @ 3 sigma, the highest degree among the industry.

• Registration accuracy* ± 5 µm @ 3 Sigma** with laser drilled through holes or vias.

Scaling/orientation of multiple samples
All available registration techniques, with their respective accuracies, are available for registering several (up to 64) distinct regions, PCBs or panels (e.g. DCBs).

• „Partial registration“ of up to 64 individual rectangular regions on one panel.
  Each region can be registered, corrected and fix or automatic scaling applied independently.

Powerful image processing allows the registration, by way of example, of inner layers without position marks or special color-change resists, using patented corner registration. This simplifies and accelerates the process and contributes to the high precision of the process.

High resolution
• Feature size down to 1 mil/25 µm L/S.
• Cpk ~ 2 at a feature size of 1.5 mil/38.1 µm L/S.
• Roughness < 2.5 µm.

Highest stability of registration
• Highest stability of registration and accuracy proven in mass production.
• Long alignment and calibration intervals for easy use and highest reliability.

Dual-table system/advanced optical technology
The double table system provides the highest possible throughput, which is determined solely by the exposure time.

288 laser beams are formed on the panel by 9 polygon modules, significantly increasing throughput in comparison with other technologies.

• Polygon mirrors: highly precise manufacturing technologies in the processing of the polygon mirror surfaces as well as in placement and balancing guarantee the required precision of the deflection in the micrometer range. The polygon mirrors rotating at more than 50,000 rpm are equipped with air bearings. Thus they are wear-free with uniformly high precision.

• Multiscan technology: conductive pattern determined in real time for each exposure registration/alignment and scaling in real time.

• Smart service: simple laser diode exchange can be performed by customer upon early automatic warning. No need to wait for service, thus reducing machine downtime.

* Offers a wide range of customization options.
** Depending on method and registration mark quality and accuracy.
Systems for traceability and flexible manufacturing

MANZ IS CAPABLE OF OFFERING TOOLS FROM PCB SAMPLING, LOW VOLUME MANUFACTURING UP TO FULLY AUTOMATED MASS PRODUCTION. ALSO, MANZ PROVIDES THE BEST POSSIBLE FLEXIBILITY TO WELL-SUITED FOR A VARIETY OF SPECIALIZED APPLICATIONS.

One of the steps for agile manufacturing implementation
Rapidly and easily in response to changing production needs and requirements of customer demand while maintaining high standards of quality. Because we know of different levels of flexibility and/or determine the amount of flexibility required to achieve a certain level of performance.

• Flexibility in production layout and process enable to implement optional work tables to enlarge the portfolio of PCB manufacturing.
• Available as a standalone piece of equipment or as a solution for integration into a production line. In-line solution and fully-integrated automation for seamless production.

Enables high degree of traceability
Logging/monitoring of all production data (incl. registration images) in customer accessible database to ensure product quality & traceability.

• Flexible serialization: free placement of customized labels, barcode/DMC, serialization, for full traceability of the final products.
• “Pilot Panel” measurement: scaling is linked to the history of each panel.
• Production Order statistics are logged: number of produced panels, average exposure time per panel, number of qualified and unqualified panels and m²/hour and m²/day.

Process development & optimization
Analyze current and future production challenges and develop custom solutions. Also, perform complex process data evaluations and visualize clearly.

On-site testing
At the customer’s production plant, our expertise allow for quick adjustment/response in case of changes in the process design.

Customer training
High-tech equipment places high demands on personnel. The customer training not only during start-up, but also during the production phase.

After-sales Service
Manz sends service technicians to the production site. In addition, our round-the-clock customer service and quick delivery of replacement parts and accessories are just two important aspects of our customer support.

Manufacturing
At our worldwide development sites, we can perform feasibility studies and develop prototypes to manufacture small unit runs semi-automatically and under realistic production conditions to actively support customer’s product development process.

Why MANZ PLI SERIES?
Manz LDI is the ideal system for future growth & caters to a highly variable market. We are capable of offering tools from low volume manufacturing up to fully automated mass production and even capable of PCB sampling that due to product variations may not be designed yet. The widest range of PLI series to best serve, and fulfill the needs of customers.

• Super fine lines/space PCB for producing miniaturization/lower weight consumer electronic device.
• High quality PCB for producing high level security products, serving medical, aerospace and automotive related industries.

Traceability
Manz LDI PLI series is the best and most sophisticated mechanisms to write serialization and process/production parameters onto each PCB. The data includes serial numbers stamp, production data, environmental data, free text to print without limitations. This is the way to grant for consistent traceability of the PCBs, thus serving documentation of product quality and in case of damage, product recall, and liability.
Founded in 1987, Manz AG is a global high-tech equipment manufacturing company. In addition to the CIGSfab turnkey production line in the Solar segment, the company focuses specifically on the automotive industry in the Electronics and Energy Storage segments. The company, listed on the stock exchange in Germany since 2006, currently employs 1,600 people in eight countries.