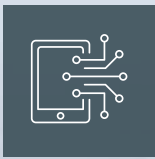


ENGINEERING
TOMORROW'S
PRODUCTION



Production Solutions for the Display Business

On-demand deployment for display applications

Navigating Innovative Equipment Matrix Boosting Productivity

Manz AG enables continuous improvement in the display market with high-performance equipment and superb system integration capability. It leads to a breaking through production standards to drive new innovative products for the display market

Manz AG is a globally active high-tech production engineering company, with a focus on automation, laser technology, inspection systems and wet chemistry process equipment. The production solutions improve manufacturing processes of display, IC substrate, semiconductor advanced packaging, lithium-ion battery, solar and medical industries. The product portfolio is ranging from customized single machines for laboratory production or pilot and small series production, to standardized modules and systems, to turnkey lines for mass production.



Working in close cooperation with customers and early participating in the project kick-off stages, that's Manz's strength to make customer success by providing high quality and demand drive solutions.

The advantage of display production solutions



Maximum capacity with stabilized output

Overall equipment and production process optimization in combination with an automation system, Manz delivers solutions with productivity and stability.



Process optimization for mass production

High-precision custom installation and on-site engineering services help customers to setup equipment with fine-tuning adjustment.



Fit varying generation glass and techniques

Accommodate varying substrate sizes and types of production processes ranging from G2 to G10.5 technologies carrying glass substrate sized up to 2,940 mm x 3,370 mm / 0.3 mm.



Over 30-year experience and 8,000-unit sales proof

Working together with our customers to develop innovative process, technology and production solutions that address the challenges of today's market.



High efficiency services

Provide 24-hour on call service to support customer needs.

Fuel Growth Through Market Development and Product Innovation

Manz built the largest manufacturing hub in China. With over 30 years of experience, we strive to move manufacturing closer to customers enhancing production and service quality. This helps us to achieve a market-leading position.

Milestone |

Display Production Solution

2009

Received the first order of copper etching equipment

2014

Launched slit coating equipment and received Gold Panel Award by TDUA

2017

Successfully delivered track line solution for display lithography process

2019

By linking with software integration and hardware expertise, Manz successfully delivered automatic glass substrate transporting & inspection systems

2008

Taiwan-based Intech joined the group, Manz becomes the leading production solution provider of wet chemistry

2013

Received the first order of copper etching equipment

2016

Received order of G8.6 wet process equipment

2018

G4.5 - G6 track line solution for display lithography process received Gold Panel Award by TDUA and the G10.5 wet chemistry equipment successfully delivered

2020

Deliver G10.5 automatic transporting systems and G8.6 Array Stripping & lithography process tools

Shipment over 8,000 units of display production equipment.



Manz Suzhou Fab extends its scale of production in manufacturing equipment, machinery and systems.

- Production site of 20,000 m²
- Class 10K clean room for production of precision machinery and electronic machinery
- Constant temperature workshop with our high "Germanız" standards of quality
- A separate high clean level area for semiconductor machine testing and inspection

Deliver Display Production Solutions Leveraging Manufacturing Expertise with Domain Knowledge

Our vast product portfolio of production solutions maintains the complete value chain from conceptual ideas to total fab solutions. Manz is the sole supplier to offer complete production solutions and equipment to boost innovation in the display industry.



As a globally recognized and trusted manufacturer, Manz collaborates with customers to develop high-efficiency production solutions for AMOLED, LTPS, IGZO and large-size TFT LCD panels. This model helps to increase the features of display products and contributes significantly to the success of customers. The high-quality and critical process production offerings include:

- Cover Glass
- Color Filter Glass
- TFT Array
- Cell
- Backlight substrate

The production solutions make display panels featuring high resolution, high color saturation and wide-viewing angle characteristics.

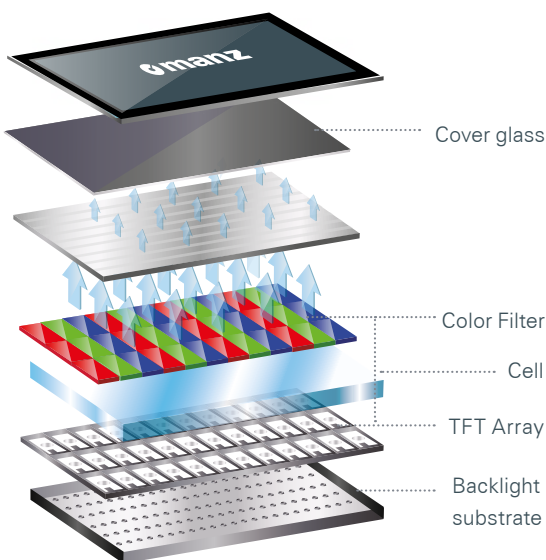
We offer easy-to-integrate automation systems through seamless software and hardware integration

Leveraging the modular design and flexible capability to extend the process technology contributing to other industries, Manz offerings provide outstanding profitability ratio, optimal cycle time and process reproducibility for ensuring higher product quality and driving revenue growth.

Our leading technologies will continue to drive high efficiency, high quality and cost reduction to give the best benefits to end consumers around the world.

High Level Integrated Production Solutions to Drive High Quality Manufacturing

Applying wet chemistry, automation, laser, and inspection techniques makes Manz offer high-efficiency production equipment and systems to accommodate the industrial requirements of stiff or flexible substrates to gain the benefits of the optimal process and improved OEE.



With the rapidly changing landscape of the display industry, Manz production solutions and equipment satisfy customer requirements of ever changing innovation and ensure excellent consistent product results.

Fast integration of equipment maximizes the productivity

We provide our customers with the photolithography process tools they need on display production solutions— to mass produce patterns on substrates, allowing them to increase the value and lower the cost of panels.

Cover Glass

- **Automation** | loader, unloader & transport system
- **Wet chemistry** | cleaning systems of pre/post coating process
- **Laser** | laser cutting

Cell

- **Automation** | loader, unloader & transport system
- **Wet chemistry** | Pre-or-post treatment cleaning | Cleaning after cutting | Cleaning before lamination
- **Inkjet system** | photo-sensitive material

TFT Array

- **Automation** | loader, unloader & transport system
- **Wet chemistry** | Unpack cleaner | Cleaner of pre-coating process | Photoresist developer | ITO, Al, Cu etching and stripping
- **Coating** | Photoresist coating | Organic photoresist coating
- **Laser** | PI film laser lift-off

Backlight Substrate

- **Automation** | loader, unloader & transport system
- **Wet chemistry** | Pre-or-post treatment cleaning | Cleaning after cutting | Cleaning before lamination
- **Inkjet system** | Quantum Dot spray
- **Plating** | Jig free vertical & horizontal plating

Color Filter

- **Automation** | loader, unloader & transport system
- **Wet chemistry** | Unpack Cleaner | Pre-or-post coating cleaning | Photoresist developer | Photo mask cleaning
- **Coating** | Photoresist coating
- **Inkjet system** | Color filter film

Our industrial inkjet printing technologies enable high efficiency, eco-friendly and customized solutions to print circuitry or materials of OLED/QD/Micro LED

The application of inkjet printing is a highly growing market with high potential. Manz collaborates with customers in this field to directly print the various functional inks to the 2D or 3D surfaces of different products.



Innovative display production solutions make a new vision for real-world applications

Manz develops production equipment for use in different processes to increase efficiency and quality, as well as cost reduction to gain the growth of scale-up economics. The strength include,

- High self-supply rate of parts and components
- Rigorous quality management to lead the best quality assurance
- Ensures high equipment utilization rate
- Stable substrate transportation capability
- Lower cost of ownership
- High material utilization rate



Automation Leads a Clever Shortcut to High Efficiency Manufacturing Innovations

Automation is a significant factor in production success. Manz's solutions achieve consistent high quality, high throughput, and low production cost thus enabling significant competitive advantages in end product retail pricing.



Manz's core competencies are to be found in various types of robots with fast, precise handling and minimal breakage rates. Through our outstanding capabilities in production planning, the customers deeply rely on our leading product portfolio and Total Fab Solutions with conveyor segments, robots, inclusive development, software and final assembly.

Easy integrated automation systems from hardware to software

The outstanding features guarantee

- High quality, high reliability and ease of integration into existing processes
- Customers gain benefits from high efficiency, lower costs and competitive products
- Integrate a light carbon-fiber gripper system with maximum stability, low vibration and reduced breakage rates to carry up to G10.5 glass substrates sized 2940 x 3370 mm and ultra-thin at 0.3 mm
- The maximum throughput is 15 seconds per glass substrate by carrier design requirements
- The precision of substrate placement positioning within 0.3 mm
- Deliver 3,000 units of automation systems to transport various sized glass substrates

Wet Chemistry Process Becomes Key Success Factors of Circuit Patterning

The precision and stability of wet chemistry equipment will decide the final production yields. Manz develops wet chemistry equipment for fine-tuning chemicals, parameters, substrate dimensions and thickness.



Manz wet Chemistry equipment reduces the customer's total cost of ownership:

- **Special chamber design**
To prevent internal cross-contamination or corrosion, reduce downtime and increase production throughput
- **Compact modular design**
Use modular design to raise the self-made rate, lower inventory and save time for maintenance works, as well as take up a minimum of factory space for reducing ownership costs
- **Advanced process design**
To save consumption of chemicals, lower operating cost and fast response to green energy policy
- **Strong production experience**
To provide outstanding product assurance and after-sales services

To reach optimal conditions for panel production processes, the cleaning systems reliably remove the smallest particles and contaminants. Then, using neutral detergent mixed with purified water, the systems use rotating brushes to remove organic contaminants for cleaning glass surfaces.

With customized air knives, this unique system design removes over 99 % of small dust particles and organic contaminants

Cleaning systems & solutions

- Effectively remove organic contaminants, reduce contact angles and improve film deposition features
- Customized air knives including vertical knife body, double inlets and excellent uniformity to increase drying effects and improve production yields with the transportation velocity up to 9,000 mm/min
- Equipped with AP Plasma / EUV systems and the raw glass substrate contact angles below 5°
- Applying double nozzle knives and high pressure water-air mixture to remove contaminants effectively



Maximized Productivity Through Optimal Process Design, Simulation & Fab Construction

The modular assembly systems make it possible to optimally tailor to the customer needs and continue to use for multiple generations of products. Through standardizing the machine components, we achieve an excellent cost-benefit ratio with short delivery times.

With reliably removing the exposed photoresist on glass substrate leveraging the superb system uniformity and stability, the systems drive to achieve desired circuit patterns on multiple layers.

Ensure excellent uniformity and stability in the developing process

Developing solutions

- A special chemical knife is designed for coating on the substrate to meet the requirements of high thickness film layers deposition
- Apply servo motors with timing belt adjustment control to deliver instantly maximum torque, precise positioning, and smooth transportation to avoid mura effects
- Photoresist development with low-flux, low-pressure chemical knife to maintain high uniformity over 90 %
- Outstanding developing uniformity reaching $3\sigma \leq 0.5 \mu\text{m}$
- Unique buffering area design to avoid defects while the downstream process in abnormal conditions
- Ensure outstanding isolation with air-fluid control systems to prevent chemical leakage and increase process safety



Providing outstanding etching stability and uniformity, the systems remove partial metal thin film layers to form excellent circuit patterns with acid chemicals.

Our etching processes can be applied to various substrates with excellent uniformity

Etching solutions

- Apply fluid knife with medium-pressure nozzles to remove multiple chemical residues through horizontal or tilted surface transportation
- Support etching processes including metal, transparent ITO and SiO₂ layers
- By offering both spray and dip features to give customers more process options
- The uniformity of etching < 10 %



100 % photoresist removal and no remaining photoresist on the substrate after stripping processes

Satisfy the requirements of removing photoresist on glass substrates through organic solvents

Stripping solutions

- Exclude scratches, watermarks, wheel marks, and chemical residues
- Provide fitting chemistry supply cabinet to carefully manage multiple chemicals for satisfying customer's flexible demands

Digital Printing Opens Up Access to The Growing Market of Customized Production

Digital printing offers the advantages of high efficiency, environmental-friendly customization, as well as mass production capability. It can direct print components on surfaces to achieve special functions including optics, haptics and 2D, 2.5D, 3D structures.

With decades of industrialization expertise, Manz engages the partnership with CADIS, the leading suppliers and service providers in the field of industrial inkjet solutions for markets. This combination is able to provide customers with innovative and smart production solutions.

The seamless integration of printing technologies and the associated ink supply systems achieve fast manufacturing, sustainability and customization

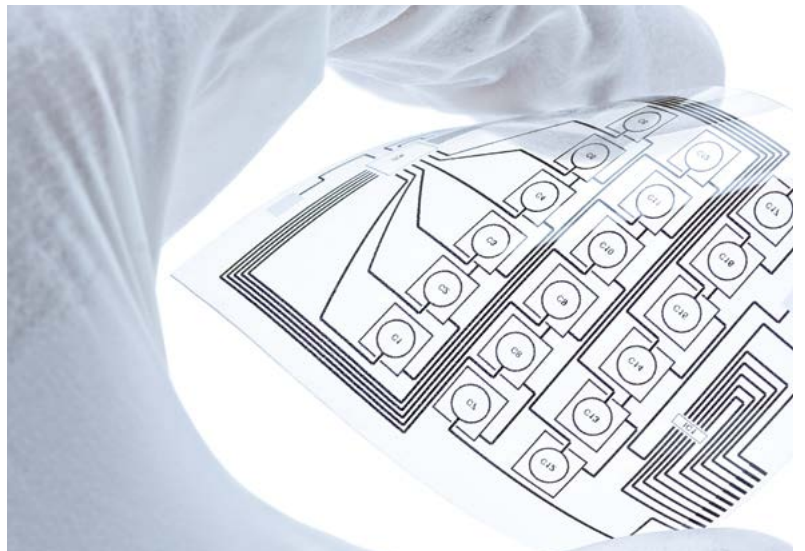
“Functional Printing” is introducing to display industry

The major categories and applications of Functional Printing materials

- Conductive Circuits, Touch Sensor
- OLED, QD, Micro LED
- ePaper color filter
- Photoresist material
- Anti-etching material

Manz Functional Printing ensures minimum ink droplet size ranging from 1pl to 100pl. Leveraging precise positioning control combined with automation, Manz inkjet systems enable immense potentials in promising industries.

Continuing to provide outstanding quality, durability and reliability, the inkjet systems put the company in an excellent position to meet the demands and requirements of various industries.

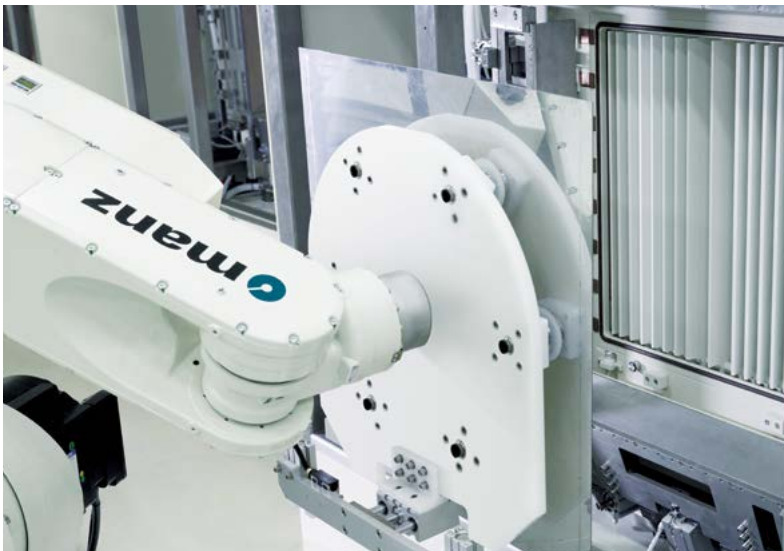


A core competence of multiple system integration of Manz AG enables customers to find innovative and flexible solutions for rapidly responding to the demands of constantly evolving fast-paced process.

- Modular technology
- Maximum flexibility in the system
- Customized handling and material handling systems
- Simulation of planned production processes
- Innovative solutions for transport and material handling

Plating Equipment with Modular Design Gives the Freedom of Fab Production & Layouts

The continuous substrate transportation systems reduce process time and surface damage during handling. And the adjustable-height upper cathode and modular design gain further strength of maintenance friendly and shortening the lead-time.



Starting to have a galvanic copper bath to form negative conductivity through connecting cathodes, the electroplating process uses soluble or insoluble anodes to form a closed-loop path and makes the copper ions migrate to the anodes and recover it in metallic form.

Performing excellent uniformity of Cu-plating and via-filling capability, the systems improve yields and provide optimal conditions for further processing stages

Manz modular designed plating systems he benefits of lower maintenance costs, easier production adjustment and further production expansion.

The first industrial jig free vertical plating production lines improve product yields and maintain optimal conditions for further processes after plating.

- Excellent plating uniformity <10 %
- Via filling <25 μm
- Warpage allowance 3~5 mm (SUS)
- Patterning uniformity <15 %
- Apply to stainless, epoxy, glass & CCL (FR-4) carrier substrates
- Jig free design



Unique jig free design combined with high integration of automation for seamlessly linking the process tools to reduce the chemical consumption and save the maintenance cost to achieve flash plating results

Our Locations



Manz AG 07/2022

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