TFS Production Solutions
For thin-film solar modules
As a high-tech equipment manufacturer, Manz develops and produces highly efficient systems for the production of thin-film solar modules.

Founded in 1987, Manz AG is a global high-tech equipment manufacturing company. Its business activities focus on the Solar, Electronics, Energy Storage, Contract Manufacturing, and Service segments.

With many years of expertise in automation, laser processing, vision and metrology, wet chemistry, and roll-to-roll processes, the company offers manufacturers and their suppliers innovative production solutions in the areas of photovoltaics, electronics and lithium-ion battery technology.

The company’s product portfolio includes both customer-specific developments and standardized machines and modules that can be linked together to form individual system solutions. Manz AG is involved in customer projects from a very early stage, and is thus contributing significantly to the success of its customers with high-quality, needs-oriented solutions.

Process machines and automation systems by Manz offer many advantages for customers in the photovoltaic industry. We offer customers globally the latest production equipment for manufacturing thin-film solar modules. Our goal in the area of thin-film technology is to cover all relevant processes along the value creation chain with technology we develop in-house.

Our product portfolio sets international standards in terms of efficiency increase while reducing production costs. As a pioneer in designing and building photovoltaic machines, we have 30 years’ experience in taking photovoltaics from the laboratory to the factory floor. Our solutions have helped solar companies offer their products at a fraction of their original cost and bring them to market faster and faster.

We accompany you from the initial idea to the final production process and are at your side during planning, projecting, construction and installation of your production line.

In addition, we support you with our comprehensive know-how through the setup and commissioning of the system, with user training, remote maintenance and after-sales service.
WE AREN’T SCARED OF CHANGE. BECAUSE EVERY DAY, WE MAKE THE WORLD A LITTLE BETTER WITH OUR IDEAS AND PATENTS.
MANZ – PASSION FOR EFFICIENCY
MANZ OFFERS THE LATEST PRODUCTION EQUIPMENT FOR MANUFACTURING THIN-FILM SOLAR MODULES. OUR GOAL IN THE AREA OF THIN-FILM TECHNOLOGY IS TO COVER ALL RELEVANT PROCESSES ALONG THE VALUE CREATION CHAIN WITH TECHNOLOGY WE DEVELOP IN HOUSE.

**THIN-FILM SOLAR MODULE PRODUCTION**

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**Fab Automation**

FOR HANDLING OF ALL MAJOR SUBSTRATES FOR THIN-FILM SOLAR MODULES WITH 6-AXIS ROBOTS, BUFFER SYSTEMS, CONVEYOR SYSTEMS AS WELL AS LOADING AND UNLOADING OF TROLLEYS.

**FAB AUTOMATION/ TOTAL FAB SOLUTIONS**

The concept of a central automation corridor for Fab automation provides many advantages for our customers:

- **30 years of experience in automation systems for the FPD and solar industry**
- **Low operating costs and high productivity**
- **High cycle times**
- **Minimal breakage rates**
- **Available for use in clean-rooms**

- **The cassette buffer system allows “smart storage”**: With this system, you can save significant amounts of storage space and work more efficiently and cost-effectively.

- **The central automation corridor by Manz is modular and can be extended as required. This concept can also be applied to different glass sizes.**

- **The enclosed cassette stations can be purged with inert gas or dry air, as required. This reduces the clean room class requirements for the entire Fab, which also represents a considerable cost advantage.**

- **The central automation corridor for Fab automation provides an improved degree of flexibility. The central robot unit is in a position to reach every substrate cassette in the central corridor within a very short period of time and to transport it to the next process stage. This enables very short cycle times.**
Laser and Mechanical Scribing Equipment
FOR HIGH-PRECISION MECHANICAL (P2, P3 FOR CIGS SUBSTRATES) AND LASER-BASED (P1, P2, AND P3) Scribing.

GENERAL BENEFITS
• Increased module efficiency due to active tracking (Manz’s Inline Precision Control System) allows dead areas to be reduced by 150 µm – 300 µm
• Low operating costs
• High throughput and maximum efficiency due to parallel processing
• Sophisticated and flexible design for easy integration in completely automated production lines

LASER Scribing
• Lowest non-productive times due to on-line alignment, loading and unloading in parallel and ease of maintenance.
High throughput and efficiency
• More than double the throughput than most competitors due to number of beams/tools in parallel and scribing speed
• Accuracy/precision during scribing (alignment procedure; mechanical design of the stage; control)
Robust process
• Choice between different laser sources (ns/ps) allows biggest process window
• Dead area < 200 µm possible (Manz Inline Precision Control System/IPC)

MECHANICAL Scribing
• Modular design and integrated vision systems, high throughput
• High positioning accuracy of lines, vision systems for highly accurate positioning of the substrates
• Parallel processing with mechanical multiple tools for flexible adaptation to throughput
• Integrated quality assurance (resistance measurement; optical inspection)

FOR THE ELECTRICAL INSULATION OF THIN-FILM SOLAR MODULES AND HIGH MECHANICAL STRENGTH OF THE SUBSTRATES.

Laser Edge Ablation and Glass Cutting
FOR THE ELECTRICAL INSULATION OF THIN-FILM SOLAR MODULES AND HIGH MECHANICAL STRENGTH OF THE SUBSTRATES.

GENERAL BENEFITS
• Extremely high level of performance and reliability
• High process accuracy
• Cost effectiveness
• Low tact times
• For all currently available thin-film substrate sizes

LASER EDGE ABLATION
• For the electrical insulation of thin-film solar modules
• Highly productive with ablation rates of up to 60 cm² per second
• Ablated surfaces show a high level of transparency
• Reliable process, top process quality
The ablation system includes
• Vision systems for highly accurate positioning of the substrates
• Linear motor drives for highest dynamics
• Programmable ablation rates and areas
• Gentle glass transport
• Inline configuration
• Fast load/unload of substrates to minimize secondary time
• Efficient suction of particles
• Low operating costs

LASER GLASS CUTTING
• Manz’ full body laser cutting of glass avoids micro-defects providing an up to 2.5 times higher bending strength than mechanically cut glass
• No micro cracks
• Chip-free edges
• Higher bending stability
• Less sensitive to temperature variation
• Different cutting shapes possible
• No polishing needed
• Contact-free cutting
• Waste-free cutting
Metrology Solutions
FOR HIGH-PRECISION MECHANICAL (P2, P3 FOR CI(G)S SUBSTRATES) AND LASER-BASED (P1, P2, AND P3) Scribing.

GLASS INSPECTION SYSTEMS / IQ PLATFORM
- Quality control based on multiple testing tools
- High-level result summary, analysis and classification
- Modular concept, highly customizable
- Different strategies for full substrate mapping at inline throughput
- High accuracy positioning of substrate and test heads
- Inline testing of powered-up devices possible
- Line integration as fully-automated tester or stand-alone portals
- Perfect integration into the Manz Total Fab Solution
- Robust setup with industry proven components
- Powerful and intuitive software

IQ Inspect
- Full area quality scan at high speed
- Leading edge inspection technology
- High precision measurement of panel geometry

IQ Scribe Taster
- Inline inspection tool with full area scribe inspection
- Leading edge inspection technology
- High resolution measurements of scribe dimensions (width, scribe-to-scribe distance)
- Verify electrical insulation between scribes

FOR EFFICIENT CLEANING, ETCHING AND CHEMICAL BATH DEPOSITION OF MODULES.

Wet Chemical Solutions
GENERAL BENEFITS
- Leading edge inspection technology to locate and classify any irregularities on the surfaces and edges of your glass substrates
- Avoid glass breakage and down times by separating defective glass
- Optimize cleaning processes and the device quality by monitoring sheet contaminations
- Improve productivity by discovering systematic failures

GLASS CLEANING TECHNOLOGY (GCT)
- Excellent cleaning result on removable material (particles, glass separation material (Lucite), organic contamination)
- No cross-contamination or corrosion inside equipment, high throughput, very low breakage rate
- Highest safety standards, simple operation and maintenance

GLASS TEXTURING TECHNOLOGY (GTT)
- Efficiency increase of modules by simple expansion of the product line, later upgrades possible
- Highest process and safety standards, easy operation and maintenance
- No contamination or corrosion inside the equipment and low glass breakage rate minimize tool down time and service

CHEMICAL BATH DEPOSITION (CBD)
- Fully automated inline production system
- Little process variation
- High availability (uptime ≥ 96%)
- Easy maintenance
- Off-process clean station without impact to OEE
- Integrated clean solution makes process more stable

Manz butterfly wobbling system
- Competitive thickness uniformity of buffer layer
- Aggressive temperature uniformity
- Good chemical agitation
- Easy maintenance
- Single side deposition incl. protection against backside contamination
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 develops and manufactures in eight countries with around 1,700 employees.