CIGS PHOTOVOLTAIC SOLUTIONS
for CIGS module production
PASSION FOR EFFICIENCY

Process machines and automation systems by Manz offer many advantages for customers in the photovoltaic industry. They are characterized by maximum efficiency and reliability. Maximum process quality and, at the same time, low cost of ownership are evidence of the high level of development and well-designed system solutions.

The presence of the Manz group, with its own production facilities in Germany, Slovakia, Taiwan and China, as well as worldwide service centers, guarantees short response and delivery times. You too can share in the benefits.
When developing new concepts, our focus is on the economical manufacture of solar cells and modules. The resulting cuts to production costs contribute bit by bit to grid parity being reached.

The CIGS technology is considered to be one of the future technologies of photovoltaics and has great potential for further technological developments. The semiconductor function of the silicon raw material is replaced by a differently doped copper, indium, gallium, selenide compound. The CIGS technology combines the advantages of conventional silicon solar cells with the innovative properties of thin-film technology.

Signing the exclusive know-how licensing and strategic alliance agreement with Würth Solar allows Manz to take the decisive step towards positioning itself as a supplier of integrated production systems including process expertise in the thin-film solar sector.

TABLE 1

<table>
<thead>
<tr>
<th>Year of Foundation</th>
<th>Headquarter</th>
<th>Core Competencies</th>
<th>Worldwide locations</th>
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<tbody>
<tr>
<td>1987</td>
<td>Reutlingen, Germany</td>
<td>Robotics, motion, metrology, control, process technology</td>
<td>Germany, China, Taiwan, USA, Spain, Slovakia, Hungary, South Korea, India, Israel</td>
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DEVELOPMENT OF CIGS TECHNOLOGY

1975: Establishment of Institute of Physical Electronics, University of Stuttgart
1975: Pilot production of CIGS modules at the IPE
1986: Establishment of ZSW Stuttgart
1995: Pilot production of CIGS modules at the ZSW
1999: Establishment of Würth Solar
2000: Start of pilot line for CIGS modules 1200 x 600
2006: Start of mass production in Schwäbisch Hall
2010: Co-operation agreement with Würth Solar

THREE STRONG PARTNERS – ONE BIG GOAL

- Manz: Most experienced CIGS module producer
  - Process and production expertise
- Würth Solar: Leading equipment manufacturer for photovoltaics
  - Manufacturing and machine expertise
- ZSW: Renowned research institute with CIGS world record 20.3%
  - Basic & advanced research expertise
Manz is the only supplier of an integrated and fully-productive turn-key production line for CIGS modules that generates profit. The CIGS production offers the lowest production costs of all thin-film turn-key lines due to high internal value creation at Manz and many years’ optimization of production at Würth Solar. It is the turn-key line with the highest efficiency in mass production (currently 12.8%). Additionally, there is a very high cost reduction potential thanks to the unique co-operation of machine manufacturer, research institute and experienced module manufacturer.

As the sole supplier of integrated CIGS production lines with a cadmium-free CIGS manufacturing process, Manz can offer a maximum investment security with its thin-film fabs due to the high potential increase of efficiency and the believable technology and cost roadmap. On the technological side, Manz has exclusive access to research results of the ZSW. With 20.3%, the ZSW holds the world record for efficiency for all thin-film technologies and employs the world’s leading research experts in the CIGS sector.

Another unique success factor of the CIGSfab is the support of Würth Solar in all stages from the planning to the realization as well as the initial operation of the production lines. Customers can convince themselves about the technology in the Würth Solar 30 MW CISfab which will also be used for further development. With the CISfab, Würth Solar managed to become the largest installer of CIS modules worldwide.