The Circuit Automation DP-4000 Automatic Coating and Drying System can fully meet the needs of the large volume manufacturer of high quality printed circuit boards. It is the result of many years of experience with the coating of liquid photoimageable soldermask (LPISM), and incorporates many features designed to reduce cycle time, increase product yield, and improve process reliability.

The DP-4000 System consists of the DP-4000 Automatic Dual-Sided LPISM Coater, the SYS-120 Conveyorized Tack-Dry Oven, an IP-04 Automatic Ink Pump, and Infeed and Outfeed Conveyor modules. The DP-4000 Coater is the latest and most sophisticated model of dual-sided vertical screen printer from Circuit Automation. Dual-sided screen printing provides the highest quality coating, fine line capability, and the lowest operating cost of any coating technology. The DP-4000 combines these attributes with an automatic loader/unloader to produce a coater with proven and robust performance.

Integration of LPISM coating and tack-drying leads to higher yields with less dependence on operator efficiency. Handling defects are reduced as both sides are coated and dried simultaneously. The automatic process is enclosed, further protecting the operator. A comprehensive safety interlock system is provided.

ISOprinting is a system to remove the ink that remains on the back of the screen, for example, over holes or slots. ISOprinting forces the residual ink back to the front side, where it is incorporated into the next flood stroke. The superior quality of ISOprinting is exclusive to Circuit Automation.

Optional on the DP-4000 is Circuit Automation's newest development: the ISOprint Cycle. ISOprinting eliminates the ink that remains on the back of the screen, for example, over holes or slots. ISOprinting forces the residual ink back to the front side, where it is incorporated into the next flood stroke. The superior quality of ISOprinting is exclusive to Circuit Automation.
DP-4000 Dual-Sided LPISM Coater

The DP-4000 is fast: cycle time for 18" x 24" panels is 30 seconds. High productivity is maintained even when a variety of jobs are encountered due to the DP-4000’s QC (Quick Change) Technology. QC Technology allows complete changeover of panel size and ink in less than ten minutes. This is accomplished by the unique design of the squeegee and ink reservoir assembly: both can be swung completely out so that the screen frames can be removed without disturbing the alignment of the squeegee assembly. This also provides complete access to the squeegees and flood bars, so that they may be exchanged or cleaned readily. The productivity benefits of QC Technology are only available on Circuit Automation equipment.

Quality of the coating is enhanced by the screen printing technique employed by the DP-4000. Printing occurs at high squeegee pressure, but with a shallow squeegee angle. This technique ensures uniform coverage over and between traces. Three mil lines and spaces can be encapsulated without skips or bubbles. Even 8 mil high traces are coated reliably.

SYS-120 Conveyorized Tack-Dry Oven

When integrated with the DP-4000 Coater, the SYS-120 has a capacity of 133 panels per hour with a 30 minute tack-dry, and 90 panels per hour with a 45 minute tack-dry.

The SYS-120 ramps up to temperature rapidly and smoothly, and then maintains the set-point temperature within a range of ±1°C. Air distribution is extremely even throughout the oven, with temperature maintained by an SSR controller. The SYS-120 has a heated chamber of 2.5 meters, and comes standard with an operator interface, a programmable logic controller, and chart recorder.

IP-04 Ink Pump

The IP-04 Ink Pump automates ink delivery to the DP-4000 Coater. It is an air actuated piston pump controlled by the coater PLC. The IP-04 is robust and easy to clean, and will accept 4 to 24 kg ink containers.
Advantages of Simultaneous Dual-Sided Coating

- Elimination of Side-to-Side Variation
- Increased Productivity
- LPISM Applied to Two Clean Surfaces
- Elimination of Handling Defects

Uniform coverage
Screen printing provides precise metering of the ink deposit over circuitry, and screen printing inks have the highest viscosity and lowest solvent content. Once deposited on a circuit, the ink will not flow or slump off. The result is controllable thickness in the center and at the knee of the circuit.

Fine line and feature capability
The uniform and controllable thickness of screen printed LPISM allows the imaging of very fine features. In many cases, these features cannot be imaged with curtain coated LPISM.

Efficiency
Screen printing is much more efficient than curtain coating or spray coating. In typical use, screen printing can be expected to coat nearly twice as much surface area as other processes, and thus cost half as much.

Lower solvent emissions
The efficiency of screen printing combined with the lower solvent content of the ink actually applied reduces solvent emissions by two to five times over other processes. This reduces, and may eliminate, additional air pollution control costs.

DP-4000 Automatic Coating and Drying System

Panel Dimensions
- Minimum panel size: 12" x 12" (305 x 305 mm)
- Maximum panel size: 24" x 29.5" (610 x 750 mm)
- Minimum thickness: 0.040" (1.0 mm)
- Maximum thickness: 0.165" (4.2 mm)

Coating Thickness and Fill
Thickness of ink deposited will vary with the type of ink, the circuit height, and the mesh used. Typical thickness over a 3.0 mil (75µ) trace is 0.6 mil (15µ) using 110 tpi mesh and 1.0 mil (25µ) using 86 tpi mesh. 3.0 mil lines and spaces may be coated without skips or air encapsulation.

Productivity

<table>
<thead>
<tr>
<th>Panel Size</th>
<th>Flood/Print</th>
<th>Flood/Print/Print</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot;</td>
<td>25 sec</td>
<td>30 sec</td>
</tr>
<tr>
<td>24&quot;</td>
<td>31 sec</td>
<td>36 sec</td>
</tr>
<tr>
<td>29.5&quot;</td>
<td>35 sec</td>
<td>39 sec</td>
</tr>
</tbody>
</table>

Cycle time is between identical points in the machine cycle for consecutive panels. "Panel Size" is the dimension in the direction of screening. "Flood/Print" and "Flood/Print/Print" are the coating modes most commonly used.

Utility Requirements

<table>
<thead>
<tr>
<th></th>
<th>DP-4000</th>
<th>SYS-120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>115V, 1ø, 10A or 230V, 1ø, 5A</td>
<td>480V, 3ø, 50A, 60Hz or 380V, 3ø, 70A, 50Hz</td>
</tr>
<tr>
<td>Pneumatic</td>
<td>10 psi @ 100 psig (17 m³/hr @ 7 bar)</td>
<td>N/A</td>
</tr>
<tr>
<td>Exhaust</td>
<td>250 cfm (425 m³/hr)</td>
<td>760 cfm (1300 m³/hr)</td>
</tr>
</tbody>
</table>

IP-04 and Conveyor Modules do not require external utilities.