

# Circuitry layer printing



## How to Guide

This simple How to Guide will show you the best way to reliably screen print the circuitry layer for a conventional membrane touch switch or printed sensor application.

**Objective** - To predictably screen print functional inks onto MacDermid Autotype Autostat heat stabilised polyester film, using Autotype screen making products.

### Recommendations:

**Substrates** - The Autostat range of heat stabilised polyesters have low residual shrinkage at elevated temperatures, making them the perfect choice for MTS and circuitry applications. To help you select the best Autostat film for your application visit [macdermid.com/autotype](http://macdermid.com/autotype) and enter Autostat into the search field.

**Frames** - It is critical that the mesh releases from the ink film immediately after the squeegee passes, so a high tension mesh (> 25 N/cm) on a rigid metal frame is required. Autotype's 2-Part Screen Adhesive will hold the high mesh tensions that are required and will not slip when exposed to Autosolve cleaning solvents.

**Mesh** - Always choose the highest quality polyester or stainless steel mesh for printing conductive or dielectric inks. The required ink film thickness will ultimately dictate which mesh count to select. The table below provides some guidelines on where to start:

Application	Mesh	Mesh angle	Dry ink film
Silver conductive	68.64 to 110.34/cm polyester or 230.36 to 325.28 stainless steel	22.5°	8 to 12µm*
Carbon	61.64 to 90.40/cm polyester	22.5°	6 to 10µm*
UV Dielectric	77.55/cm polyester	0°	10 to 15µm*

\*Please refer to the ink manufacturers' recommendations for their up-to-date guidelines

It is essential that the mesh is completely clean and free from all ghost images before the stencil is made. Contamination in the mesh will lead to poor ink flow and may even affect the functionality of the ink. Always use Universal Mesh Prep or Auto Degreaser Concentrate to ensure the best mesh preparation possible. Use Autokleen Plus to remove any mesh staining from polyester screens if they have been used before.

**Printing** - To improve the image quality and to maintain overall dimensional accuracy always select a sharp, undamaged polyurethane squeegee blade and use the lowest squeegee pressure possible. Dual durometer squeegees provide an excellent choice, e.g. 90/70 shore.

**Stencil selection for conductive inks** - Controlled profile capillary stencil films are always recommended over emulsion stencils. Capillex CX has been specifically formulated to give a low EOM and low Rz stencil for optimum print reproduction and control with conductive inks. More technical information on the benefits of controlled profile capillary films for functional printing and how to get the best results from them, can be found on our website.

**Top tip:** - Controlling the EOM (stencil profile) is critical for quality printing, as even a 1µm difference in EOM can give up to a 1µm difference in wet ink film thickness.

If a conventional Capillex film is preferred, then either Capillex 20, 25 or 35 are recommended. For best edge quality and surface levelling, a slow print speed is advisable for both Silver and Carbon conductive inks as this helps to optimise the flow. Even small print defects that reduce the cross sectional area of the conductive track can have a large impact on their resistance. Good track edge definition also helps to reduce the potential propagation points for Silver migration failure.

### Drying conductive inks

High temperature curing of the conductive ink is required to give the lowest resistance possible. Efficient drying is also critical for interlayer adhesion and flex life. Autostat is heat stabilised in our factory to give minimum shrinkage at the high temperatures required to dry conductive inks. Consult the Autostat Technical Data Sheet for more details, a copy is available on request, email: [salesupport@macdermidautotype.com](mailto:salesupport@macdermidautotype.com)

**Dielectric inks** - Printing a complete, uninterrupted film for the dielectric layer is critical. These layers are typically large negative images so primary control of the printed ink deposit will be determined by the mesh. It is best to avoid high EOM stencils as these can lead to thick edges on the image. If the print speed is too fast this can generate air bubbles in the dielectric layer which will lead to pinholes and potential circuitry failure. Often a double print pass is used for the dielectric layer to mask any pinholes and provide the desired thickness and performance requirements.

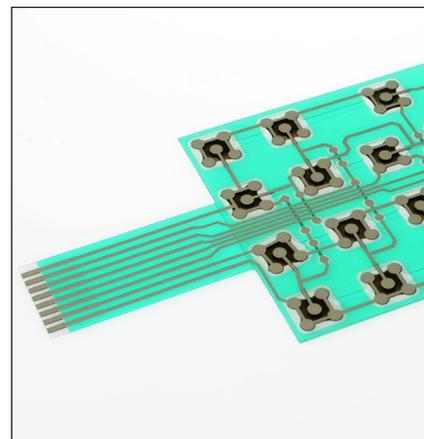
When printing the dielectric or carbon tabs, a quality dual-cure direct emulsion such as PLUS 7000 or PLUS 8000 is ideal, or if a one-pot emulsion is preferred, then PLUS 1-SR can be used.

**Curing dielectric inks** - Complete UV curing of the dielectric is critical for good interlayer adhesion and flex life. Follow the ink manufacturers' guidelines for their curing recommendations.

**How to minimise dust contamination**

Dirt or dust in the print can lead to circuit failure.

- Remove any contamination from the dry screen prior to printing with a low tack roller
- If the print room is not a 'clean room', then create a cleaner environment around the press by curtaining. Note that an extractor hood will be required for local exhaust
- The operators should wear clean room clothing
- Fit antistatic bars/static dissipaters to the press
- Try to restrict personnel movement in the area during printing
- Place tack mats around the press and entry points to the print room
- Cover the screen during stoppages or remove the ink
- Never return ink from the screen back into the pot
- A slightly higher relative humidity (RH) in the print room helps reduce static build-up during printing



**Ink cleaning - on press:** If the screen needs to be cleaned during printing, use Autosolve Press Wash AF or Autosolve Press Wash AF40 and allow the mesh to dry out completely before recommencing printing.

**Ink cleaning - archiving:** If the screen is to be archived for reuse, it can be cleaned with Autosolve Press Wash AF40 (Flash point 44°C) or Autosolve Press Wash AF55 (Flash point 57°C), paying particular attention not to damage the stencil.

**Ink cleaning - decoating:** If the stencil is to be decoated, use Autosolve Graphics (low VOC) or Autosolve Industrial AF which are water washable, screen cleaning solvents.

**Stencil removal:** Ghost images in the mesh will cause defects in the print, therefore to get the best results use Autostrip stencil stripper followed by Autokleen Plus, low caustic haze remover.

Our range of products for printing perfect circuitry layers	
Heat stabilised substrates	Autostat
Mesh adhesive	2-Part Screen Adhesive
Mesh degreasers	Universal Mesh Prep & Auto Degreaser Concentrate
Photostencil films	Capillex CX, Capillex 20, Capillex 25 & Capillex 35
Photostencil emulsions	PLUS 7000, PLUS 8000 & PLUS 1-SR
On press solvents	Autosolve Press Wash AF, AF40 & AF55
Screen wash solvents	Autosolve Graphics & Autosolve Industrial AF
Stencil stripper	Autostrip
Haze remover	Autokleen Plus

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**Europe: +44 (0)1235 771111**  
**US: 800 323 0632 (Toll Free)**  
**Asia: +65 (0)689 79670**  
 Email:  
[salesupport@macdermidautotype.com](mailto:salesupport@macdermidautotype.com)  
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