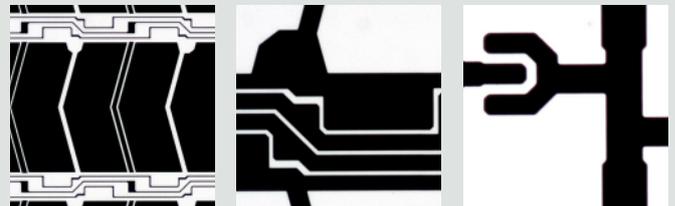
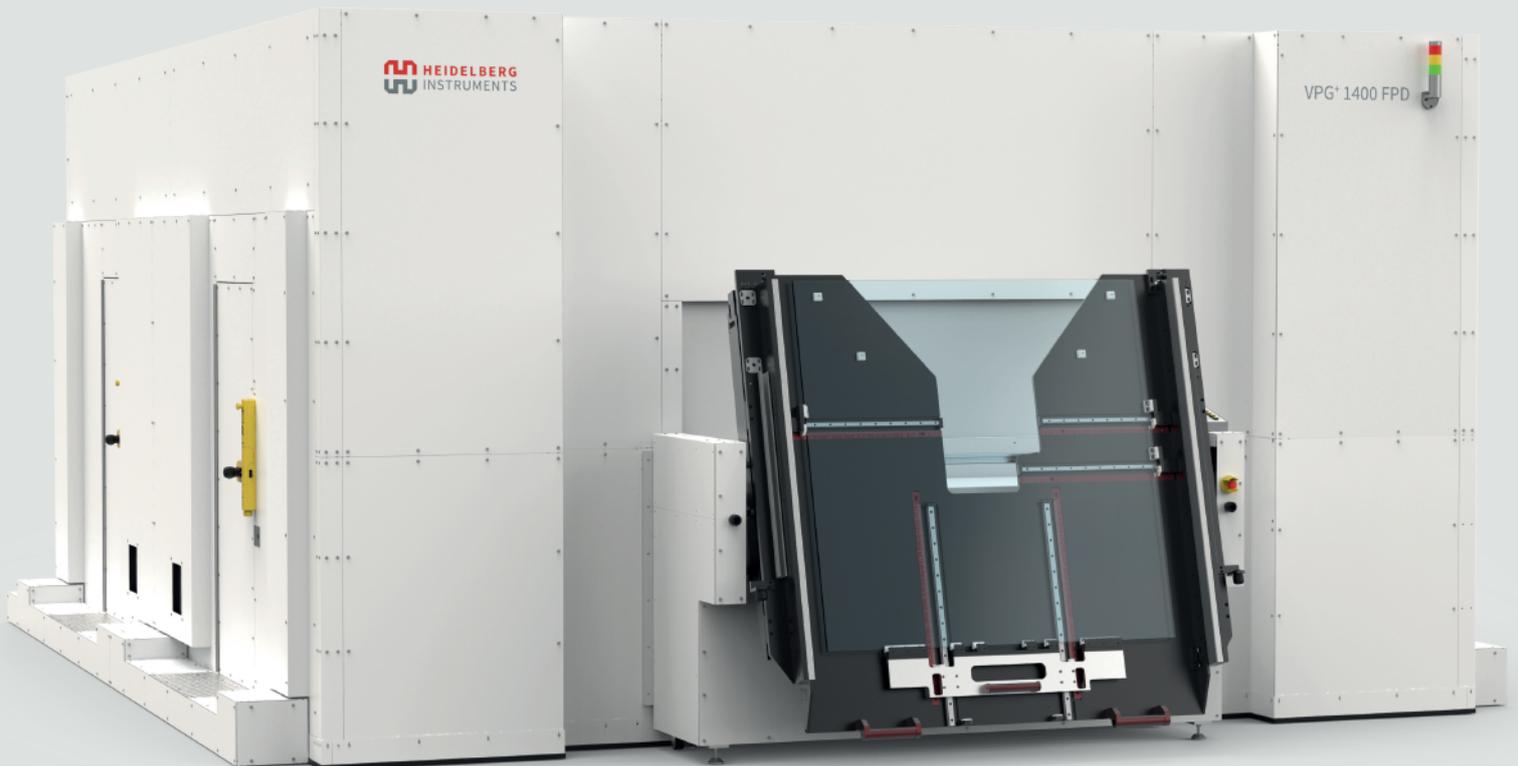


VPG⁺ 1400 FPD / VPG⁺ 1850 FPD

VOLUME PATTERN GENERATORS FOR
HIGH-VOLUME DISPLAY PHOTOMASK PRODUCTION



VPG+ 1400 FPD / VPG+ 1850 FPD

VOLUME PATTERN GENERATORS FOR HIGH-VOLUME DISPLAY PHOTOMASK PRODUCTION

These large-area volume pattern generators are specifically optimized for writing photomasks used in flat panel display (FPD) production up to G8 and G8.6 size respectively. They feature a maximum exposure area up to 1400 x 1400 mm² (1400 x 1800 mm²) and provide extremely accurate alignment as well as fast, high-quality exposures.

THE VPG+ 1400 FPD / VPG+ 1850 FPD

The VPG+ 1400 FPD and VPG+ 1850 FPD represent a huge step forward in the production of mainstream display photomasks in the flat panel display industry. The systems are based on the well-established and field-proven technology of the Heidelberg Instruments Volume Pattern Generators (VPG+), however compared to the VPG+ 1400, the updated FPD version offers a reduction of the pixel size by 20% and consequently higher resolution and better Mura performance. It also features a complete redesign of the stage to enlarge the write area beyond G8. The manufacture of flat panel displays usually involves sets of over 16 masks, which need to correspond seamlessly across various manufacturers and tools. This means that outstanding overlay performance as well as tool matching options are key requirements for the lithography tool, all of which both systems are designed to deliver. Precise measurement capabilities are necessary for calibration of the coordinate system and specifically for manufacturing multilayer products like half-tone photomasks, which usually require additional process steps.

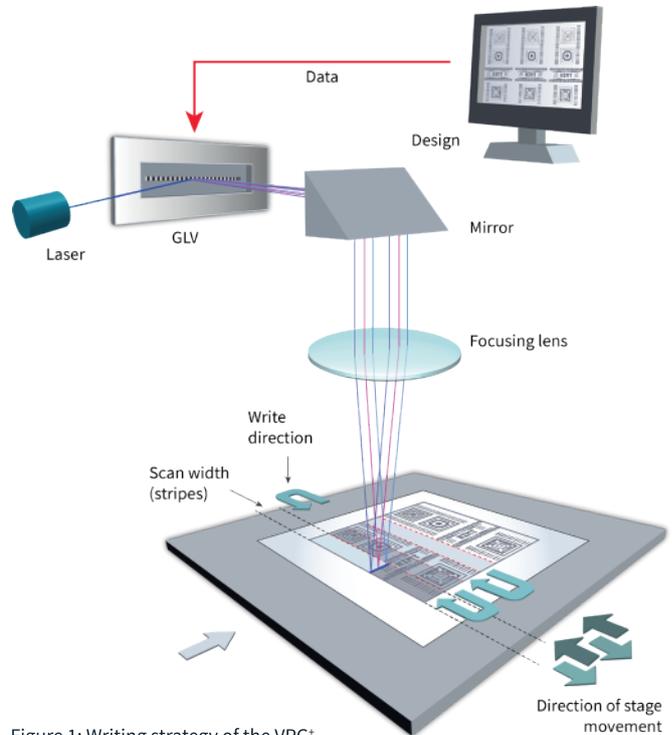
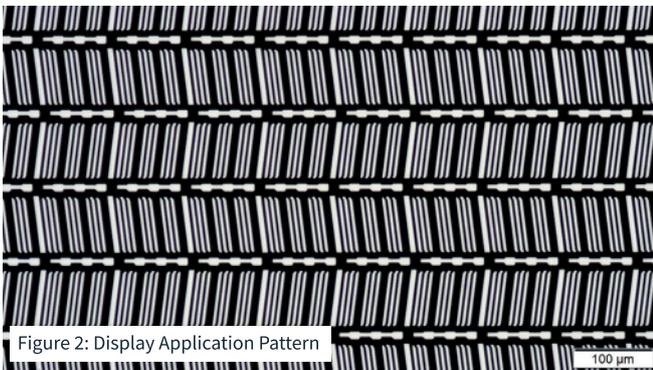


Figure 1: Writing strategy of the VPG+



APPLICATIONS

The VPG+ 1400 FPD and VPG+ 1850 FPD are optimized for the creation of high-resolution photomasks – including halftone masks – used in the production of key flat panel display (FPD) components, such as color filters (CF), thin film transistor (TFT) arrays, Indium Tin Oxide (ITO) electrodes, TP (touch panel), FMM (fine metal masks) or AMOLED (active-matrix organic light-emitting diodes), or other LCD (liquid crystal displays) and OLED (organic light-emitting diode) related layers.

DATA PREPARATION | PANEL PITCH OPTIMIZATION

Since hierarchically organized large-area display patterns can have a size of several gigabytes and flattened patterns are even larger, the VPG+ 1400 FPD and VPG+ 1850 FPD feature only the fastest hard- and software for conversion of the patterns to machine data. Data preparation includes stripe optimization of single patterns with fixed pitch to improve mura performance. On larger panels it becomes increasingly common to include a variety of patterns with different pitches. The two systems both feature panel pitch optimization, where arbitrary pattern pitches can be exposed in one go by changing the stripe width within one exposure. Each repeating pattern element is analyzed and the optimal pitch is set. By running the job with a single exposure, writing overhead is minimized and job preparation is simplified.

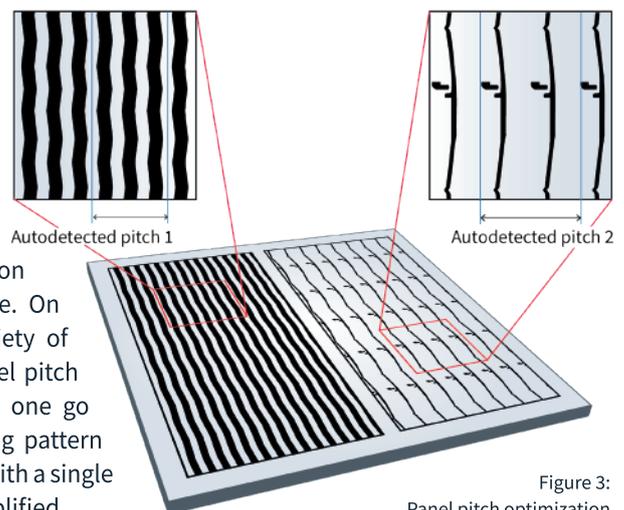


Figure 3: Panel pitch optimization

KEY FEATURES

SUB-MICRON RESOLUTION

The VPG+ 1400 FPD and VPG+ 1850 FPD provide a 20% write grid reduction as compared to the previous release of the VPG+ 1400. This leads to an improved Mura performance, as well as the capability of writing sub-micron features. The system features a custom-made double coated write lens (with sub-micron resolution and low optical distortions (20x/0.4 mag./NA)) which ensures an excellent CD uniformity over the mask.

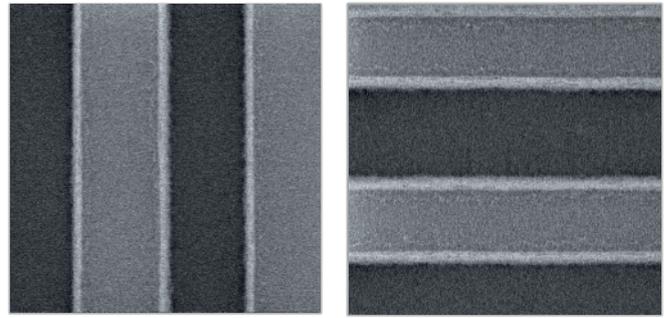


Figure 4: 800 nm half-pitch. Images acquired during resolution studies of the optical system in collaboration with IMS Chips

HIGH-ACCURACY POSITIONING WITH STABLE COORDINATE SYSTEM

The system features a differential interferometer with a resolution of 1.2 nm. Position measurement accuracies of 10-20 nm are enabled by the precise coupling of stage position to camera. Measurements on a golden plate from one pass to the next have shown a variation of 50 nm over a mask of 1220 x 1400 mm² (Figure 5). The stability of the coordinate system is demonstrated in Figure 6, showing regular calibration measurements over one year. This extreme stability means that in single-tool use, the second layer of a design can be positioned with down to 250 nm accuracy (position deviation plate to plate) on a G8 mask. The redesign of the stage system also allows the VPG+ 1850 FPD to have an even larger exposure area without requiring a larger system footprint.

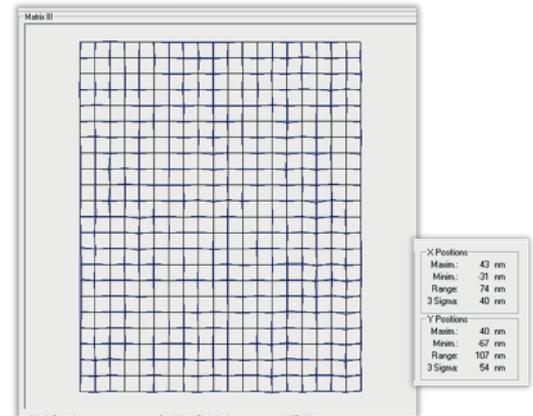


Figure 5: Pass-to-pass measurement G8 golden plate

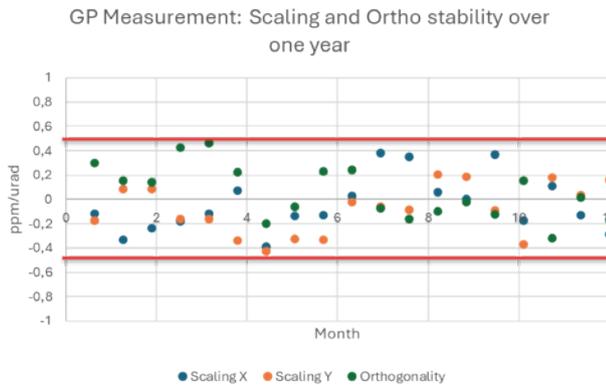


Figure 6: Regular tool calibration with golden plate measurements

ALIGNMENT

The alignment camera measures substrate positions through the same write lens as the writing beam, constituting a true position reference as well as a fixed dependency of metrology and exposure. The single cross measurement accuracy amounts to 10 – 20 nm.

The system includes an advanced metrology package and tool-matching functions for precise second layer alignment capabilities. The metrology package supports linear and nonlinear global and local position correction of the writing grid. The alignment hardware and software comprise precise pattern recognition, linear (scaling, shear, trapezoid errors) and non-linear compensation methods for the second layer exposure. Individual measurement recipes can be created by the user according to the specific level of correction needed.

HIGH-SPEED EXPOSURE ENGINE

The ultra-high-speed exposure engine with high-power DPSS laser (355 nm) reduces write times, which means high throughput (up to 2900 mm² / min) and maximization of production output. The light engine is based on a high-speed 1D optical modulator, the grating light valve (GLV).

The setup also ensures seamless “mix-and-match” operation, where the first layer is written on a different exposure tool. The highly precise alignment system in conjunction with the high-resolution mark recognition as well as the correction software means that in this context, the aligned second layer exposure can typically be aligned with under 300 nm accuracy.

The tool vision software Cognex includes AI-based image recognition algorithms and provides alignment mark recognition of any type of alignment mark. It can handle even multi-processed surfaces that cause a degradation of image quality. AI training helps the measurement recipe to recognize patterns in the images, so that even in the case of extremely degraded edges, the trained recipe can improve the overall measurement accuracy of the alignment crosses by up to 10 times.

VPG⁺ 1400 FPD / VPG⁺ 1850 FPD

SYSTEM SPECIFICATIONS

Write mode	QX	FX
Writing performance		
Minimum structure size [μm]	0.8	1
Address grid [nm]	8	8
Edge roughness [3σ, nm]	20	40
Global CD Uniformity [3σ, nm]		70
Local CD Uniformity [3σ, nm]	50	70
Plate-to-plate overlay (G8) [3σ, nm]		250
Stitching [3σ, nm]	40	50
2nd layer alignment (1000 x 1000 mm ²) [mean+3σ nm]		400
Write speed [mm ² /min]	1450	2900
System features		
Light source	High-power DPSS laser with 355 nm	
Maximum substrate sizes	1400 x 1500 mm ² (VPG ⁺ 1400 FPD) 1400 x 1850 mm ² (VPG ⁺ 1850 FPD)	
Substrate thickness	0 to 15 mm	
Maximum exposure area	1400 x 1400 mm ² (VPG ⁺ 1400 FPD) 1400 x 1800 mm ² (VPG ⁺ 1850 FPD)	
Autofocus	Realtime autofocus system (optical and pneumatic)	
Autofocus compensation range	250 μm	
Automation	Semi-automatic loading system	
Environmental control unit	Closed-loop temperature controlled environmental chamber	
Alignment	Camera system for metrology and alignment	
Other features	Matrix correction software for stage position calibration, Mura and panel pitch optimization, edge detector system, multiple data input formats (DXF, CIF, GDSII and Gerber files)	
System dimensions		
Main unit (doors closed, loader extended)		
Width [mm]	5370	
Depth [mm]	7000	
Height [mm]	2800	
Weight [kg]	25,000	
Installation requirements		
Electrical	400 VAC ± 5 %, 50/60 Hz, 32 A	
Compressed air	8 - 10 bar	

Please note: Specifications depend on individual process conditions and may vary according to equipment configuration. Write speed depends on exposure area. Design and specifications are subject to change without prior notice.



Tel: +86-512-62529622

Fax: +86-512-62522966

苏州工业园区北摆宴街8号
恒润商务大厦一楼A-3



www.stella-litho.com

联系人: 江俊葳 先生 / Wesley
移动电话: 186 0621 7371
Email: wesley@stella-litho.com



联系人: 邱重铠 先生 / CK
移动电话: 180 3682 6293
Email: ckchiu@stella-litho.com

