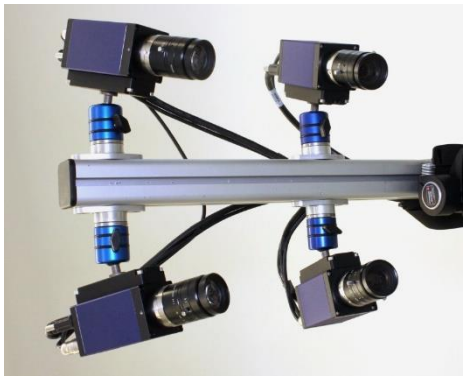
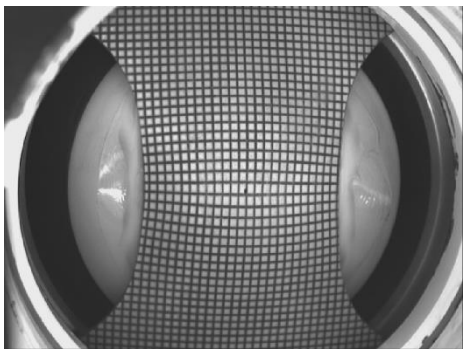
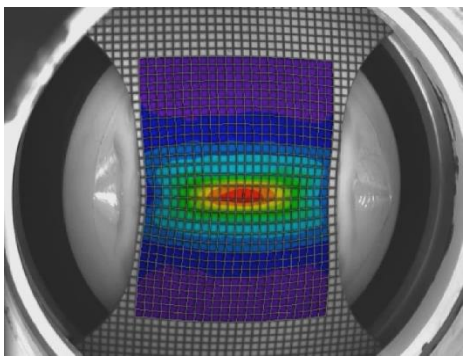
AutoGrid® *in-process*

Proven Solution for Formability Testing







The AutoGrid® product family enables for strain analysis on samples and components in sheet metal industry. It proved well suited for a variety of applications in deep drawing and hydroforming as well as for different materials including aluminium alloys, stainless steel, and fibre reinforced composites.

The AutoGrid® *in-process* has been designed to meet our customers' needs for flexibility in the optical setup, measurement volume and local resolution. The direct, fast and accurate measurement is based upon the automatic evaluation of grid patterns that are either printed or electrochemically etched. The system is able to determine a field of strain values up to more than 100 % without any unambiguity.

Typical applications are the analysis and evaluation of FLC and Bulge tests according to the corresponding technical standards. Of course, a time course covering strain analysis can also be performed for any other sheet metal forming material test.

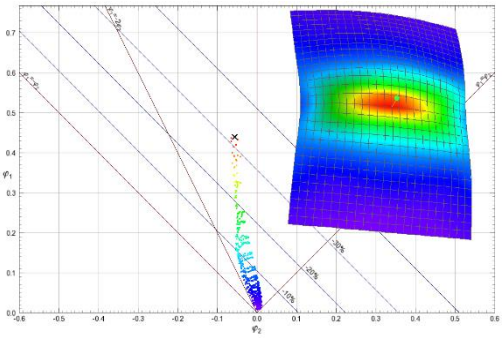
The AutoGrid® *in-process* device measures the specimen while it is being test loaded, i.e. the system supports the recording of deformations and strains during a forming process. For the measurement of forming limit curves (FLC) the measuring head is mounted on a sheet metal testing machine (Erichsen, Zwick, Interlaken or others). Four cameras observe the specimen from different perspective views. They are exactly synchronized and image sequences are recorded with a rate of up to 200 x 4 frames per second. Any blur or disturbances due to the object's motion are avoided by fully exploiting the potential of the IEEE1394b cameras. AutoGrid® *in-process* meets the requirement of testing new sheet metal materials at higher testing velocity. The maximum frame rate of 200 image sets per second allows a punch velocity up to 25mm/s. Directly connected to the testing machine, the AutoGrid® *in-process* system captures additional data, e.g. punch stroke and drawing force which can be used to trigger the recording. Measuring time for one specimen is 3-5 minutes.

Current PC memory capacity secures appropriate length of image sequences and allows complete recording of the test. The evaluation of image sequences by the AutoGrid® *in-process* software is a user-friendly solution that automatically yields a time sequence of strain fields developing during specimen's load cycle. The high precision image processing results in 0.1 mm punch depth resolution at punch speed of 20 mm/s.

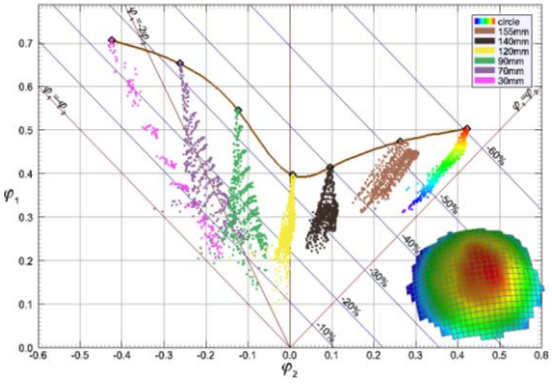
The AutoGrid® post-processing includes a fast and accurate tool for the determination of the forming limit. The data analysis provides precise access to the maximum strain value just *before* necking and subsequent cracking occurs.

Powerful, convenient functions allow to create FLCs from a set of specimens very effectively and independent of the operator. Polygon or spline functions can be used for the FLC interpolation. Data export is given in ASCII format, for example.

Users appreciate the unsurpassed performance for materials testing and component analysis with one methodology, which makes the AutoGrid® *in-process* and com*smart* devices the ideal solution for quality assurance purposes in sheet metal industry.



Forming Limit Diagram



Specifications

Measuring Head	4 CCD cameras (progressive scan) 640 (H) x 480 (V) Pixel, C-mount lenses focal length 16/25 mm, Single cable connection measuring head to PC (IEEE 1394b) including power supply, cable length 4 m
Computer Equipment	Trade Mark PC with worldwide service
Environmental Conditions	Operating temperature: +10 ... +35° C, Non-operating temperature: -40 ... +70° C, Humidity: 20%...93% non-condensing
Software	Microsoft Win10 64 Bit Full compatibility with MS Office applications
Max. Frame Rate	Up to 200 image sets per second
Grid pitch	1.0x1.0 [mm], 1.5x1.5 [mm], 2.0x2.0 [mm], 2.5x2.5 [mm]
Calibration	Automated, robust self-calibration procedure (3 min)
Measuring Time	3-5 min
Results	3D shape with coordinates x,y,z [mm] at grid line crossing points; Engineering strains ε [%], true strains φ, v. Mises equivalent strain, thinning [%], Thickness [mm], safety strain, max. failure, position- or time-dependent FLC values, Flow curves from bulge tests
Graphs	Colour encoded 3D visualization, 2D data profiles user defined, Forming limit diagram (FLD) with forming limit curves (FLC), Thinning limit diagram, FLD reports
Strain Accuracy	Δε = 0.1%
Graphic Export	Printer, clipboard, *.bmp, *.tif, *.png, *.jpg, *.vrml, *.ps, *.eps
Data Export	MS Excel®, ASCII, AutoForm®, Pam-Stamp®, *.stl, AutoCAD®, LS-Dyna®
Grid Size/ Recommended FOV	mm: 1.0 | 1.5 | 2.0 | 2.5 mm³: 80x60x30 | 120x90x45 | 160x120x60 | 200x150x75 *other sizes on request

ViALUX GmbH
Am Erlenwald 10
09128 Chemnitz
Germany

P: +49 371 33 42 47 0
F: +49 371 33 42 47 10
E: autogrid@vialux.de

www.vialux.de