Integrated Vision Unit (IVU)

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Because the sizes of tools to be machined are increasingly in micro and even nano dimensions, traditional means of measurement – like mechanical sensors – often are not up to the task. The thinness and fragility of machined parts pose additional challenges because mechanical stress on the workpiece presents the risk of deformation.

GF AgieCharmilles’ Integrated Vision Unit (IVU) represents a solution to these challenges. With IVU, a charge-coupled device (CCD) camera is embedded on the machine. Lights on the front and back make it possible to capture an image of the workpiece surface and “get the edge.” This camera moves over the workpiece and generates images in various X-Y coordinates of the piece.
A front light (episcopic mode) on the upper head generates incidental light which allows accurate Z height adjustment in order to know the exact position of the top surface and then the measured edge. Before starting any measurement an auto focus can to be performed to adjust the distance between camera and top surface of the piece (± 55mm).

A backlight (diascopic mode) located on the lower arm generates transmitted light ensuring the contrast of light going through the form and appearing dark due to the upper light being switched off.
Backlight is used to light the part in silhouette to measure profiles such as through holes. Direct lighting is integrated into the optical beam path and lights the part from a direct vertical angle. The light is focused on a camera that contains an optical chip, or CCD. The CCD has a light-sensitive pixel array. The chip converts the light intensity value for each pixel into an electronic signal with a corresponding value for each pixel. This is what is called a “gray-scale value” located on a scale between 0 and 255. The software finds an edge by determining where the gray-scale value between two neighboring pixels is different in high proportions. Several pictures can be taken at different X-Y coordinates. The CCD camera transmits every image to the PC controller, which analyzes them and delivers several metrological outputs in terms of distance, diameters or contour profiles. The measurements can come from an image analysis of a form included in the static area vision (4 x 3 mm) or from a sequence of image acquired step by step from a contour automatically followed by the machine according to the analysis given by the camera. In parallel, the cycles can be visualized as each image is transmitted directly to the human-machine interface (HMI) screen.

As a preliminary statement, the accuracy of the IVU can be set at ± 1.4 μm at 95 percent confidence level (2σ).
IVU SYSTEM HAS SEVERAL FEATURES

Take the references
Many pieces contain inaccessible or areas too small to take reference point with a standard probe. In these cases, the optical measuring system offered by IVU is absolutely necessary. Thus, external or internal centering between two faces or two cylindrical holes can be achieved. Taking references on corners or inside diameters may allow correction of the starting point program. The alignment of the part can also be achieved, resulting in automatic rotation of the part program.

Local measurements
To perfect the machining, it is good to control the position and the quality of some details of the parts being machined or finished. Thus, a correction may be made either to the part being machined or on finished parts. It is therefore possible to correct local radii, circles, and distance thanks to information given by the IVU.

The full scan of a cavity
One of the most amazing possibilities available with the IVU is the full scanning of a complete or partial form, as the starting point and ending point are positioned manually on the form in question. Successive points from the contour scanning can be compared with the data exchange file (DXF) representing the ideal contour. To match the measurements made by IVU with measurement devices present in the workshop and calibrated as required, it is possible to introduce an offset corresponding to the offset setting with measurement devices present in the workshop. The measured dimension is perfectly consistent with all metrology equipment used to validate parts.
At a glance

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