

Maximum Precision under Harsh Conditions

Automated fine-grinding systems use innovative robot grippers and high-resolution cameras

Rotating at high speed the milling head approaches the steel block. The cutting edges of the tool tip seemingly effortlessly remove the upper layers of the steel blank. In a second work step a special drill hollows out the future engine block. The main work is done using tools with indexable inserts.

These high-precision parts are manufactured, ground and coated in a complex process. The German company ROBOWORKER has specialised in automation solutions for producing these inserts. The high-resolution image data needed for controlling the robot grippers is delivered by cameras from the uEye® family by IDS.

To achieve the required strength of the indexable inserts, hard-metal powder such as tungsten carbide is pressed into moulds, sintered at high temperatures and then machine-ground. In the process the parts repeatedly need to be resorted, flipped over and repositioned for the next manufacturing step. As the inserts are shock-sensitive and easily chip if not handled with care, manual picking and placing can cause damage. Stähli Lapp Technik AG, a manufacturer of fine-grinding machines, therefore uses an unloading station from ROBOWORKER for the indexable inserts. The station, which is also available with a loading unit, appropriately repositions the inserts for the next work step.

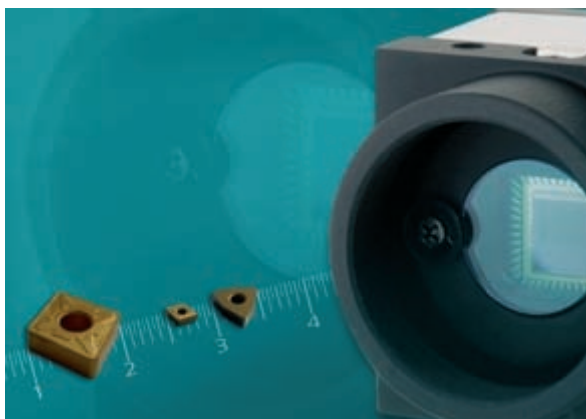
True to the corporate motto "It is the details which make for maximum precision," ROBOWORKER has become established in the automation market particularly through its cutting-edge gripping systems. Basically from the day the company was founded in Weingarten, Germany, in 1989, ROBOWORKER started off developing its own linear robots. The company meanwhile has over 40 employees and ships approximately 100 robot systems per year. Equipped with up to four movable axes, the flexible linear robots are clearly faster than their competitors with articulated arms. ROBOWORKER systems have delivered unsurpassed throughput rates for years.



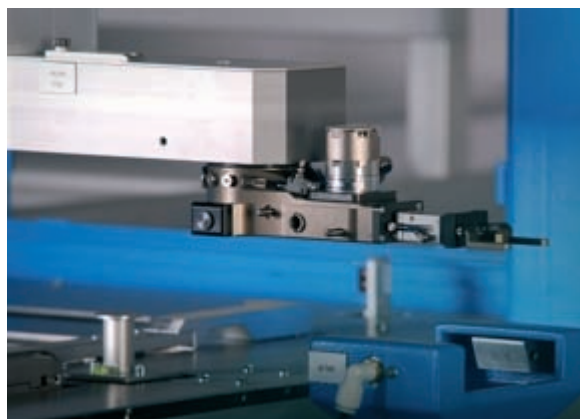
The images for detecting the position and orientation of the workpiece blanks are supplied by uEye® cameras with USB interface. The transmission rate of 480 Mbps on the bus allows reliably transmitting 100 frames per second in VGA resolution, for example.

The fine-grinding machine from Stähli transports the indexable inserts in special wheel-shaped fixtures called carriers. In these metal carriers the inserts automatically cycle through the grinding process. When the preset finish sizes are reached, the unloading station takes over. A magnetic gripper picks up the oil- and dust-covered metal parts from the carriers and deposits them on a conveyor belt. The conveyor belt then moves through transmitted light that displays the contours of each part in high contrast using red light. Directly above the part a camera takes high-resolution images that are immediately evaluated by a PC, which is integrated in the machine. The pattern matching algorithm of the HALCON image processing library allows quickly and reliably detecting the position and orientation of the individual parts. Based on this data a software PLC controls the grippers of the two RL-10 linear three-axis robots.

The precise control of these robots requires a positioning accuracy of 0.1 mm. To capture the image data with the necessary resolution,



Only a few millimetres in size, the indexable inserts require maximum precision in manufacturing automation.



ROBOTWORKER uses high-resolution IDS cameras for precise control of the robot grippers.

the engineers opted for a 5 Mpixel camera from the German machine vision specialist IDS GmbH. Even at the highest resolution of 2560 x 1920 pixels, the CMOS color sensor of the UI-1480-C model from the uEye® series still achieves a frame rate of 6 fps. The USB 2.0 interface ensures easy connection to the machine's industrial PC. Protected by a ruggedised, compact metal housing with lockable USB connector, the camera has performed flawlessly even in harsh environments. ROBOTWORKER has therefore included models from the IDS product range also in its new machine developments. As all uEye® cameras feature the same driver, even the most recent models with Gigabit Ethernet interface can be integrated without software changes.

ROBOTWORKER uses a software interface to HALCON, which is part of the Software Development Kit supplied with every uEye®. This greatly facilitates integrating the camera with the evaluation program—without compromising on functionality. Besides interfaces for ActiveX, DirectShow and various libraries, the uEye® SDK also comes with a direct programming interface for accessing the driver in C, C++, C# and VB. More than 20 ready-to-run sample applications complete with source code make it easy to get started with camera programming.

As accurate as the position data delivered by the combination of camera and image processing is, it cannot dispense with human involvement altogether. The product diversity with over 10,000 different indexable inserts frequently requires teaching in new shapes. As soon as the image processing system classifies a part as "unknown," the process is stopped and the operator programs the part by using a model.

From a gripper change station in the machine the operator chooses the proper gripper for each product. Besides the classical jaw grippers, magnetic and vacuum grippers are also available.

Once the teach-in process is complete, the inserts are detected, picked up and deposited at a rate of 1.0 to 1.2 sec per part. ROBOTWORKER's pick-and-place systems can also achieve far higher rates if necessary. The German automation specialist is currently implementing an innovative station featuring an integrated insert checking and palletising unit—again with a gripping performance from IDS cameras.

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