Targeted view into the process

Identify problems quickly, optimize processes with a focus on results

If errors creep into automated production processes with high cycle rates, this is extremely annoying and, in the worst case, can lead to rejects and a complete production stop. It also becomes really critical when downstream processes are also affected by interference. Then good advice is usually expensive and a quick solution is rarely in sight. But does it have to come to this? Following a fast-moving process with the naked eye in order to detect interference or errors usually makes no sense. But what is needed for this? Basically just a high-speed camera system to record such processes and a powerful software tool to analyze possible causes. The first important measure is to eliminate a problem in a process flow in a targeted manner, as the following practical example illustrates.

Unrecognizable process error

A metalworking company processes universal joints for cardan shafts, which have to be rotated by 90° at various positions in an automatic rotary transfer machine. A turning unit moves to the joint cross holder, grips a workpiece, pulls it out of the holder as it moves back, turns the joint by 90° and then places it back in the holder.

To ensure a secure hold of the joint crosses in the holders, there is a holding clamp at one of the two mounting points for the joint journals. However, some of these clamps were damaged from time to time during machining. However, the cause could not be traced due to the high process speed of the turning unit.

The high-speed cameras can communicate with common control (units) to automate recording via Ethernet or digital I/Os.

Targeting the cause

The company therefore decided to purchase a high-speed camera from the **OC29** from ipf electronic. In order to record the turning process for simple and highly targeted analysis, the signal inputs of the camera were connected to the PLC (programmable logic controller) of the rotary transfer machine and thus linked to the function of the turning unit. As soon as this unit approached a cross-joint holder, the camera received corresponding control signals via the PLC (programmable logic controller), which started the recording and stopped it again when the joint, which had been rotated by 90°, was placed back in the holder. This made it possible to monitor the process in an automated manner, save the individual sequences via free software for the camera system and then analyze the source of the error in detail. After a short time, the problem was identified: due to the high dynamics of the gripper, the joint cross sometimes shifted so unfavorably when turning in the turning station that the holding clamp bent when it was set down again in the pick-up. Optimizing the gripper finally solved the problem.

Economic entry

The solution from ipf electronic for process monitoring and analysis currently consists of the two high-speed cameras **OC299720** for monochrome images and **OC299820** for color recordings as well as free software. Depending on the image resolution, the cameras achieve frame rates of up to 3,000 fps (frames per second), have C-mount lens threads for commercially available lenses and can be connected to existing PCs or laptops via a USB 3.0 port (system requirements: USB 3.0 connection, Windows 7 operating system or higher, processor 1 GHz or higher).

In an automated process for machining universal joint crosses for cardan shafts, the ipf electronic system was able to specifically identify and eliminate an initially untraceable process error.

Software with versatile features

The software in particular makes the plug & play solution an extremely powerful overall system that not only enables optimized and therefore very result-oriented process analysis, but also offers a wide range of practical functions for the flexible further processing of all images. During a process observation, it is particularly important to take into account the lighting conditions directly at the recording location in order to obtain usable results for the analysis. The primary brightness setting can therefore be adjusted directly via the aperture of the camera lens. Fine adjustments can then be made as required via software using electronic amplification or via the exposure time of the camera chip. The image height and width can also be adjusted to optimize the image section and the achievable frame rates. The additional option of rotating the camera image in 90° increments also ensures the greatest possible flexibility for on-site installation.

The currently available monochrome and color cameras, in combination with the free software, enable an easy, economical entry into professional process monitoring and analysis.

Just a few steps to recording

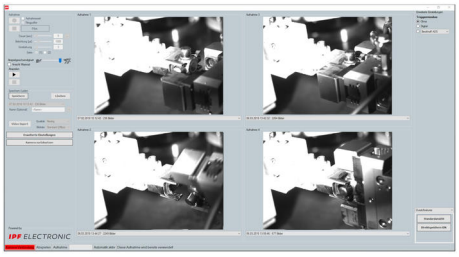
Every process is different and therefore places different demands on the recording in terms of target-oriented image evaluation. For this reason, the user can choose between the recording modes "Recording time" and "Ring buffer". In the first mode, images are recorded for a predefined period of time, while in ring buffer mode, images are recorded in continuous mode and the oldest images are overwritten after a preset time. In addition, the two cameras are able to communicate with common control (units) from Beckhoff, Siemens and B&R in order to start or stop a recording via Ethernet or digital I/Os, for example. A recording can thus be automated, for example to identify potential sources of error more quickly depending on individual process steps. Furthermore, it is possible to document only the really relevant processes so that unnecessarily recorded video material does not have to be viewed during analysis, which significantly increases the effectiveness of the evaluation.

Due to the clearly arranged switching elements, here the interface for recording, the software can be operated intuitively without much training and can therefore be used instantaneously.

Practice-oriented analysis tools

After recording, the film material is available for instant analysis. The playback speed of the recording can be continuously adjusted via the software. If only individual parts of a recording are relevant, a cut function allows the relevant sequences to be selected.

A single-frame mode allows a recording to be played back and analyzed frame by frame. Another feature of the software is the ability to display and compare up to four recordings simultaneously. The playback times of each recording can be individually coordinated, e.g. to compare older sequences with current ones and to recognize process changes more easily.



One of the software's features is the simultaneous display and comparison of up to four recordings. The playback times of each recording can be individually coordinated, even during playback.

Easily share, save and export

The software also offers a range of options for saving a recording for complete documentation or sharing it with other people. Recording slots, for example, make it easy to collaborate with recordings in the highest image quality. Export to a video file in the widely used avi format is also included, which is ideal for sending by e-mail or archiving a recording. All important additional information (e.g. time stamps, signals from sensors, etc.) is also stored in the file when saving and exporting the video.

System also for process optimization

The new solution from ipf electronic opens up a wide range of potential for cost-effective entry into process monitoring and analysis. The identification of possible sources of error does not necessarily have to be the main focus here. It is also conceivable to use the system for further process optimization, e.g. to minimize changeover times or increase cycle rates.