A TARGETED LOOK INTO THE PROCESS

IDENTIFYING PROBLEMS QUICKLY, OPTIMIZING PROCESSES WITH AN ORIENTATION ON RESULTS

If errors creep into automated production processes with high frequency, it can be extremely irritat-ing and can lead to scrapping and complete production stops in the worst case scenario. This gets really critical when downstream processes are also affected by interference. Good advice is then usually expensive and a quick solution is often not in sight. But does it have to be this way?
Following a high-speed process with the naked eye to detect interferences or errors usually does not make sense. But what is needed to do this? Essentially, only a high-speed camera system for recording such processes and a powerful software tool for analyzing possible causes. This is the first important measure for systematically solving a problem in the process, as the following practi-cal example illustrates.

INEXPLICABLE PROCESS ERROR

A metalworking company processes universal joints of cardan shafts, which are rotated by 90° to various positions on a rotary transfer machine for this purpose. A turning unit approaches the universal joint holder, grips a workpiece, pulls it out of the holder when moving back, rotates the joint 90° and then re-turns it to the holder.
To ensure that the universal joints are securely seated in the receivers, a retaining clamp is located at one of the two holding points for the joint pins. However, some of these clamps have been damaged from time to time during processing. Due to the high processing speed of the turning unit, however, it was not possible to identify the reason.

The high-speed cameras can communicate with common controls in order to automate a recording via Ethernet or digital I/Os..

ON THE TRAIL IN A TARGETED MANNER

The company therefore decided to install a high-speed camera of the **OC29** series from ipf electronic. To record the turning process for an analysis that is simple as well as targeted, the camera's signal inputs were connected to the PLC of the rotary transfer machine and thus coupled to the function of the turning unit. As soon as this unit approached the universal joint holder, the camera received the corresponding control signal via the PLC. Recording then began and stopped when the joint, now rotated 90°, was placed back in the holder. This allowed the process to be observed in an automated manner, the individ-ual sequences stored to the camera system via a free software and the error source then very precisely analyzed.
After a short time, the problem was found: Due to the high dynamics of the gripper when rotating in the turning station, the universal joint shifted adversely such that when placed back in the holder, the retaining clamp bent. Optimizing the gripper fixed the problem both for the present and in the long-term.

ECONOMIC INTRODUCTION

The solution from ipf electronic for process observation and analysis currently consists of the two high-speed cameras, the **OC299720** for monochrome recording and the **OC299820** for color recording, as well as free software. Depending on the image resolution, the cameras achieve frame rates of up to 3,000 fps (frames per second), feature a C-mount lens thread for common lenses and can be connected to existing PCs or laptops using a USB 3.0 port (system requirements: USB 3.0 connection, from Windows 7 operat-ing system, from 1 GHz processor).

In an automated procedure for processing universal joints of cardan shafts, a previously inexplicable process error was identified and eliminated in a targeted manner by the system from ipf electronic.

SOFTWARE WITH VERSATILE FEATURES

Primarily due to the software, the plug&play solution is an extremely powerful overall system which ena-bles not only an optimized and therefore very result-oriented process analysis, but also offers a wide variety of practical functions for flexible further processing of all recordings.
During process observation, it is particularly important to consider the light conditions directly at the re-cording site in order to receive useful results. The primary brightness setting can therefore be adjusted directly using the camera lens aperture. If needed, fine adjustment can then be done using software through electronic amplification or the exposure time of the camera chip. The image height and width can also be flexibly adjusted to optimize image cropping and the achievable frame rates. The additional option of rotating the camera image in increments of 90° also ensures maximum flexibility during installation on-site.

The currently available monochrome and color cameras, combined with the free software, allow for an easy, economic introduction into professional process observation and analysis.

READY TO RECORD IN JUST A FEW STEPS

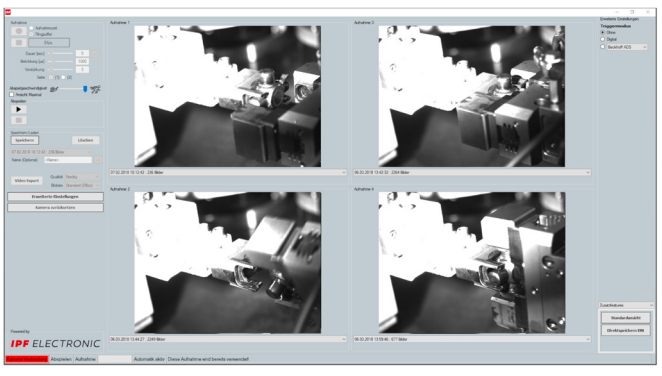
Every process is different and therefore places different requirements on recording when it comes to targeted image evaluation. That is why the user initially has the choice between the „Recording time“ and „Circular buffer“ recording modes. In the first mode, recording is done for a previously-defined length of time, while recording in continuous mode is done with the circular buffer, and the oldest image recordings are overwritten after a preset time. Furthermore, both cameras are able to communicate with common controls from Beckhoff, Siemens and B&R in order to, for example, start and stop recording via Ethernet or digital I/Os. Recording can therefore be automated in order to more quickly identify potential sources of error in dependence on individual process steps. In addition, this makes it possible to document only the really relevant processes so that unnecessarily recorded video material does not have to be viewed during analysis, which considerably increases effectiveness during evaluation.

Thanks to the clearly arranged switching elements (here the recording interface), the software can be op-erated intuitively without much training and can therefore be used right away.

PRAXISORIENTIERTE ANALYSETOOLS

After recording, the film material is instantly available for analysis. The playback speed of the recording can be continuously regulated using the software. If only parts of the recording are relevant, a cutting func-tion makes it possible to select the pertinent sequences.

With the „Individual image“ mode, on the other hand, the recording can be played back and analyzed image-for-image. A special feature of the software is that it can also display and compare up to four recordings at the same time. The playback times of each recording can be coordinated individually to one another in order to, for example, compare older with cur-rent sequences and, if necessary, make process changes easier to detect.



A special feature of the software is the simultaneous display and therefore comparison of up to four re-cordings. The playback times of each recording can be coordinated individually to one another, even dur-ing playback.

ipf electronic gmbh | Rosmarter Allee 14 • 58762 Altena • Germany | Tel +49 2351 9365-0 • info@ipf-electronic.com • **www.ipf-electronic.com**

TROUBLE-FREE SHARING, SAVING, EXPORTING

The software has a whole range of options for saving a recording for continuous documentation or sharing it with others. The so-called recording slots, for example, enable easy collaboration with recordings using the highest possible image quality. Exporting into a video file in the widely-used avi format means that it is perfectly suited for sending via e-mail or for archiving a recording. All important additional information (e.g. time stamp, sensor signals, etc.) is also stored in a file during saving and video export.

SYSTEM ALSO FOR PROCESS OPTIMIZATION

The new solution from ipf electronic opens up huge potential for an economic introduction into process observation and analysis. Identification of possible sources of error does not necessarily have to be in the forefront. Using the system for further process optimization is also imaginable, for example to minimize set-up times or increase cycle times.