Going digital in manufacturing

Interfaces for laser measurement technology

All the talk about digitization and 'big data' has made manufacturers aware of the increasing advantages of digitizing their production processes. Not only can it improve the quality of the products themselves, it can also significantly reduce downtimes and optimize production overall. At the heart of the matter is the collection and storage of measurement data during processing. As a producer of measurement technology for lasers, MKS Instruments has risen to this challenge; its Ophir brand offers a broad portfolio of sensors equipped with a variety of data interfaces. In addition, several newly developed measuring devices can be integrated directly into automated production processes and deliver data for immediate use.

What counts most in automated production are high availability and productivity (OEE), coupled with energy efficiency and low downtimes. For laser systems, this necessitates correct adjustment of the laser beam. When the beam parameters deviate from the predefined process parameters, it results in lower quality, higher energy consumption and falling productivity – and it can lead to downtimes or, even worse, product recalls. To avoid this, it's essential to continually check the laser beam, whether that be in welding or cutting processes or in additive manufacturing. There are various ways of going about this, depending on the fault tolerance of the respective process. At the most basic level, just measuring the power of the focused laser beam provides enough information for processes with higher fault tolerances. No matter which measurement method is used, the issue of data storage – either locally or on a network – is becoming increasingly important.

Getting connected: coupling via PC interfaces

Traditionally, a power gauge consists of a calibrated sensor and a calibrated display, both of which operate independently of a PC. To read out the data, some of the display units have built-in interfaces. Instead of having a separate display, it's possible to let the PC handle this function; one simply needs the appropriate software and a calibrated interface. Basically, an Ophir PC interface is a display unit or meter without its own screen. The display unit's first and foremost task is to convert – very precisely – the analog sensor signal into a digital value that can be presented either on the device itself or on the PC (via software such as StarLab); there's a wealth of options. But above and beyond the classic hand-held display devices, it's becoming ever more important to show and evaluate process data on PCs and networks.

Like a remote control for your sensor

The first step in evaluating data takes us to a PC. External Bluetooth interfaces, such as Ophir's Quasar, allow the sensor and interface to be operated wirelessly from any PC.

Figure 1: Barely recognizable as a separate component: The USB interface is what connects the sensor

Classic, wired USB connectors can record pulse frequencies of up to 10 kHz – despite their small size. The interface works like a component of the cable running between sensor and PC. Along with its StarViewer, for instance, Ophir offers

Figure 2: The EA-1 adapter quickly and easily converts an Ophir measuring head into an Ethernet power meter.

a free Android app that can quickly transform smartphones or tablets into a power meter. These '4-in-1' systems are suitable for connecting multiple sensors.

Transforming a measuring head into an Ethernet power meter is quick and easy with an Ethernet adapter. The power-measuring heads connect to the Ethernet via a separate adapter and simply transmit the measured data on the existing network for further processing. This gives the user spatial freedom, an important factor in areas like industrial automation or R&D where a single test setup can be responsible for managing several hundred sensors.

Another interesting application of Ethernet-based sensors is remote monitoring. This is relevant, for example, for consultants who support field engineers with dedicated technical expertise, or for quality managers who have to monitor an entire factory's worth of sensors. Ethernet connectivity means that, wherever you are, you can perform these tasks via the Internet.

Cameras with GigE connectors

Ophir launched its SP920G at Lasys 2018 in Stuttgart. This camera is built into a small, robust housing and can be operated up to 100 meters away from the PC via a GigE connection, making it possible to measure laser beams in environments that, for security or spatial reasons, can't be served with a USB connection. This greatly simplifies OEM applications in mechanical engineering and plant construction. The measurement data transmitted via the GigE interface can be conveniently evaluated using BeamGage software.

Integrated power measurement in industrial networks

Power measurement in automated production, however, places even higher demands on the system: Besides offering flexible integration into industrial networks via PROFINET or RS-232 interfaces, the devices must also be compact and durable. Ophir developed HELIOS especially for solid-state laser applications in automated manufacturing. During a short irradiation period lasting from 0.1 to 10 seconds, the measuring system determines laser powers between 100 W

Figure 3: HELIOS was developed specifically for automated production and measures laser powers up to 12 kW.

and 12 kW and laser energy from 10 J to 10 kJ.

On the safe side: non-contact beam analysis

Especially in industrial laser processes where tight tolerances must be observed, one can only get reliable information about the quality of the laser beam by taking a measurement of its full beam caustic. To maintain high standards in your manufacturing processes, it's necessary to continuously monitor such laser parameters as the position of its focus and/or potential shifts due to age, soiling or temperature, as well as the laser's M2 quality score and power density. One of the technologies developed by Ophir for non-contact measurement of the laser beam knows virtually no power limits – and has already been tested on high-power lasers in the 100kW class. In order to apply this wear-free, precise and extremely fast technology to automated production, the company developed BeamWatch Integrated. Besides its optimized design and a built-in power meter, BeamWatch Integrated has several interfaces for direct transfer of the measurement data to production networks such as PROFINET, Ethernet/IP or CC-Link.

Figure 4: BeamWatch Integrated analyzes the beam profile of high-power lasers without touching the beam.

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