

# Application Letter: „Acceleration sensors in the optic increase accuracy of contour welding processes“

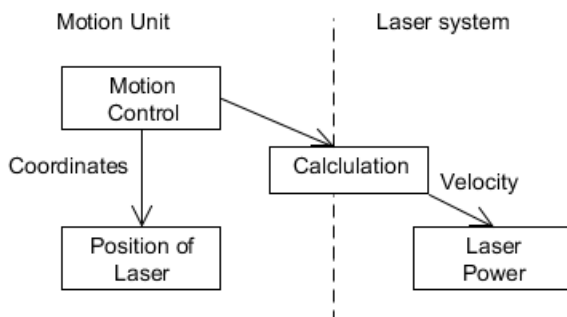
Laser welding of thermoplastics requires a minute dosage of the applied radiation power in order to ensure that the welding process is carried out within the process window. If the power is set too low, the weld will not lead to a satisfactory result. If the welding power is set too high, the plastic part may be damaged. Since the acceleration capacity of the motion system (which is moving the laser along the defined welding contour) is limited, the laser power needs to be reduced whenever the direction is changed abruptly (e. g. in corners of the welding contour).

It is therefore crucial to know the velocity of the motion unit. One possibility to obtain the velocity values is to have them provided by the control system or by the encoder of the motion unit. However, this means that the welding process is tightly linked to the motion process, which would delimitate the range of suitable motion systems.

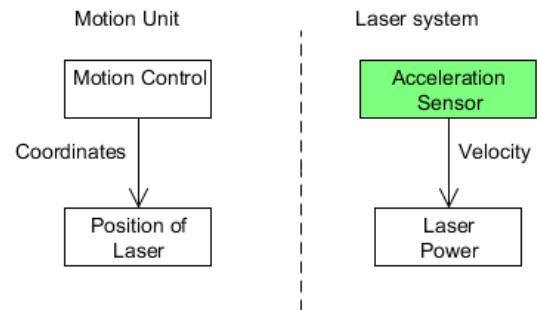
Possibly problematic issues are

- Path of communication: Interfaces of motion unit and laser system need to be compatible.
- Real time information: Velocity or position need to be communicated to the welding process in due time.
- Accuracy: The requirements concerning accuracy of the velocity signal delimitates the range of suitable motion systems

In order to avoid this close link of the welding process to the motion system, an acceleration sensor can be used in the optic head. This sensor will give out an acceleration signal, allowing immediate output of velocity values. Response time and accuracy of the velocity signal are in this case independent of any motion unit. The signal will be processed directly by the process control system.



**Fig. 1:** Conventional design: the current velocity value is forwarded to the welding process by the motion unit.



**Fig. 2:** Design using an acceleration sensor: The velocity can be read out directly via acceleration sensor.

Nowadays, acceleration sensors are widely used in systems such as airbags or in notebooks for shock protection of hard disks. The used MEMS Technology (**M**icro **E**lectronic **M**echanical **S**ystem) has become a standard in sensor technology. These micromechanical components are part of the chip. They are used to convert the change in motion into an analog or a digital signal. This signal will be directly processed by the power control of the laser unit.

Special microprocessors allow for further treatment of the sensor data before forwarding the data to the laser control unit.

Acceleration sensors may be used in combination with different laser optics (e. g. for contour welding using a spot optic, or for GLOBO-welding). The acceleration sensors can be used for both 2D and 3D geometries.