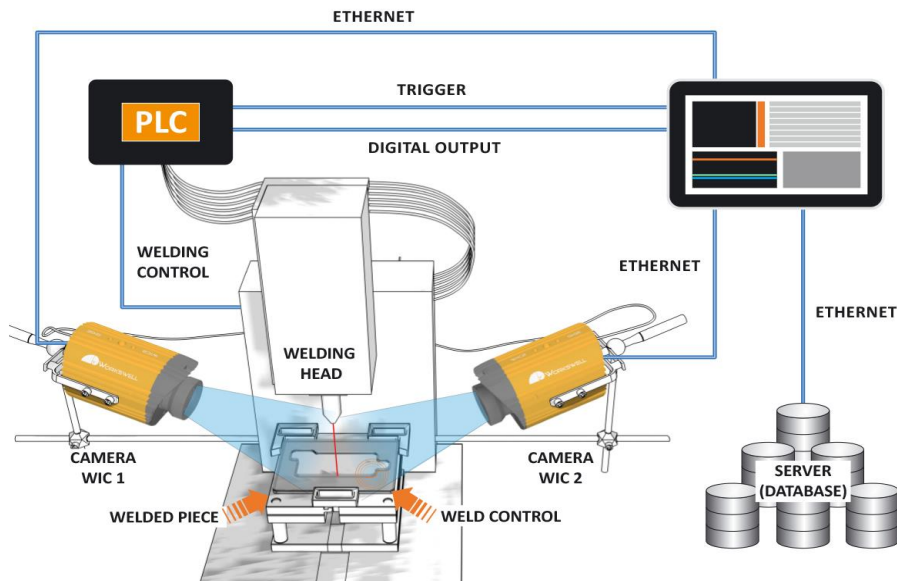


SURFACE TEMPERATURE MONITORING DURING CONTOUR LASER WELDING OF PLASTICS

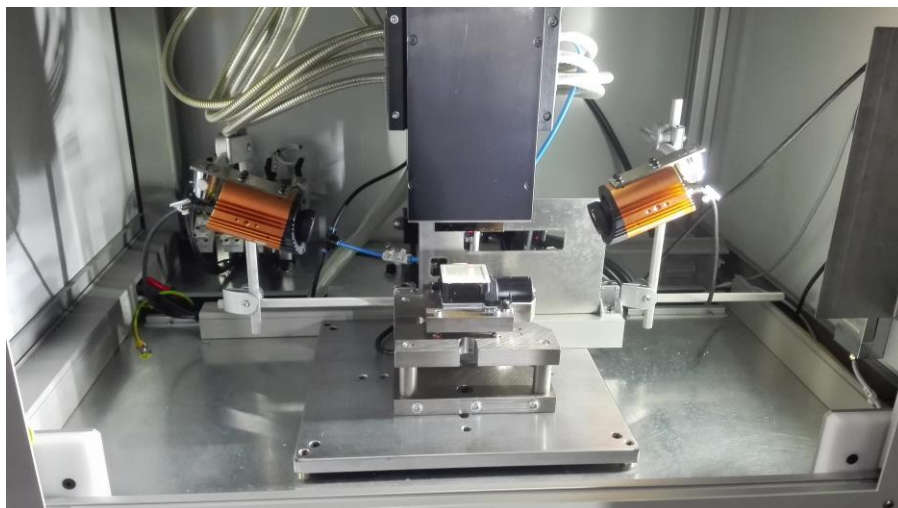


Welding of plastic parts is nowadays a very used technology in the industry for permanent joining parts together. There are several types of plastic welding technologies: hot body welding, hot gas, friction and ultrasound but also **laser welding**. Laser beam welding is advantageous for welding very small and narrow plastic parts due to the size of the laser beam. When placing several

laser beams side by side we can create any shape and size of the welded contour. The laser beam passes through a transparent part of the plastics and stops at the base part. At this point, the joint begins to heat until the two parts are joined together. The process needs to be monitored to maintain a constant and long-term weld quality.

① Setting of the Assignment

One of the leading automotive companies, Xxxxx, focuses on innovative solutions for compression-ignition and combustion engine support systems. In this case, **the entire contour of the weld** needed to be monitored when welding plastic parts of the DC motor case **to reach the desired temperature** and thereby to ensure that the weld is tight. The objective is, among other things, to achieve **homogeneity throughout the weld contour** to detect a damaged laser beam in the welding head and therefore to prevent the production of other non-compliant pieces. The data from each measurement were sent to the data archiving database for each specific piece.



➔ Solution of the Assignment

To address the application, the ThermoInspector thermal imaging system was used, which is primarily intended for the applications **monitoring production processes, monitoring temperature stability and homogeneity during processes, input – output temperature monitoring, etc.**, and where up to 4 WIC thermal imaging cameras may be connected simultaneously.

In this particular case, due to the size and shape of the welded parts, **two WIC thermal imaging cameras** were used which are connected to the ThermoInspector control unit via the **Ethernet cable**. The thermal imaging cameras were placed on the static holders facing each other, each on one side of the welded piece to cover the entire contour of the weld. The system was configured to the **Fixed Time Measurement Mode**, which means that the camera monitors the respective areas in the image (ROI) for a fixed number of pictures after the trigger signal, in this case it is only one picture. The Trigger signal was brought to the ThermoInspector system from the control PLC and it is activated when the welding head starts to weld. Since the weld is not visible because of the welding head, it is necessary to use **Start Delay** until the welding head is up and the cameras have a direct view on the weld. The postponement of the measurement start may be used for **thermal imaging cameras calibration (NUC)** which needs to be performed at least every 10 min to ensure the consistency and accuracy of the measured temperatures. If the temperature limit on one of the ROI is not met, an alarm is displayed on the screen that informs the operator and **saves the appropriate record** to the control computer. The system has also digital outputs that inform the control PLC of the wrong weld. After each weld, the measured data are also sent via the TCP/IP protocol to the internal database where they are paired with the data-matrix code of the respective piece to archive the results of the monitoring.

Optionally adjustable ROI were used to check the welds, in which the camera **evaluates the measured data in real time**. The rectangles along the entire weld contour were chosen as the optimal ROI, where each rectangle corresponds to one laser beam on the welding head. Therefore, it is then easy to discover which particular beam is damaged. In these areas, the maximum measured values/temperatures are monitored in real time and compared with the set limits. Visualization of the entire process for operators was displayed on the ThermoInspector touch control computer.

