Head Checking

There is a high probability that the car you are driving was - to a large extent - built by industrial robots. In this way the possibility of human errors in the assembly process can be kept to a minimum. At the same time there is still room for "robotic errors" which call for a detection of incorrectly mounted parts during assembly. In the old days vehicle quality used to be checked when the car rolled off the line but today photonic technology enables the scrutinising of quality of every process while it is being done.

A peek inside an engine assembly plant at - for example - GM, Opel, Audi, VW or Daimler-Chrysler shows laser displacement sensors from the German manufacturer GFM (Geselleschaft für Messtechnik) at work in several places. Here they solve a large range of measurement and inspection tasks, which require non-contact tracing with high resolution and high velocity. The GFM sensors operate on the principle of static triangulation. A semiconductor laser generates a small light spot onto the surface of the test object. By means of a set of high quality lenses the diffuse reflection of the spot is projected onto a SiTek linear position-sensing detector (PSD). Any displacement of the test object induces a shifting of the light spot image within the sensitive area of the PSD. The analog output of the signals of the PSD is amplified, digitised and transmitted via a high-speed serial interface for further data processing. (The interested reader can find more of the theory behind PSD triangulation systems in SiTek's 'PSD School').

A typical application is the checking of assembled cylinder heads. The GFM laser triangulation sensor (model ITS-3) carries out such a check quickly and free of contact. It checks each cylinder head while moving on the conveyor belt between two stations. A number of these sensors record the actual contour of the cylinder head centrally over the objects, which have just been fitted (figure 1). The control and evaluation processor compares this with the nominal contour of a perfectly fitted head and report errors to the station's PLC. In this way the stud bolt screwing depth and the valve assembly is checked (figures 2 & 3).

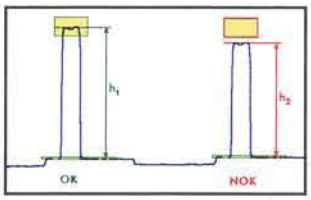

Fig.2

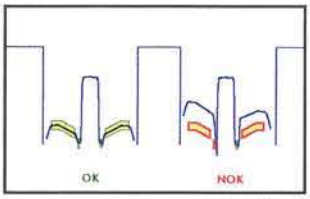

Fig.3

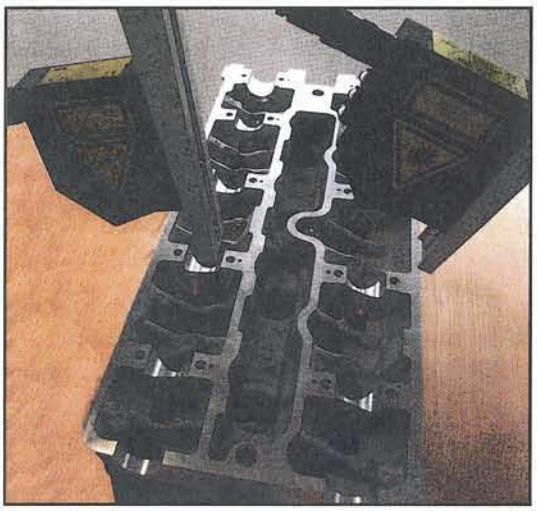

Fig.1

Car manufacturing is a conservative industry, so production-line designers have to stick to rugged, well-established and reliable technologies such as GFM laser displacement sensors.
To get optimal results from the PSD sensors in a harsh industrial environment GFM has provided its sensors with some special features:

- To reduce the influence of electronic noise the operational amplifier for the current to voltage conversion is mounted directly below the PSD to have the shortest possible length for the highly sensitive connection cables.
- The two signals of the PSD are both analog-digital converted within the sensor head. The calculation of the distance value is done digitally.
- To take into account the tolerances of the electronic devices and thermal influences on the electronics between the PSD and the A/D converter, the sensor head is automatically calibrated before every measurement. For this a constant current signal is given via a high precision dual resistor to both signal paths. The quotient of both received digitalised values is taken into consideration on calculating the distance value.
- To get optimum optical performance the PSDs are used without covering glasses to minimise optical losses and stray light is suppressed using the patented NT-type of PSD with built-in stray light suppression.