



Function driven by precision

Implementing and standardizing optical measurement methods for a better surface characterization in the industry. Combustion engines should offer fuel efficiency and emit hardly any pollutants, while offering ample performance and a high level of driving comfort. This requires the optimum interaction of all components. In turn, this demands compliance with precision shape tolerances for the individual functional components. For the manufacturer, this means that compliance with these tight tolerances must be guaranteed during quality checks in manufacturing to preclude customer complaints or even recalls.

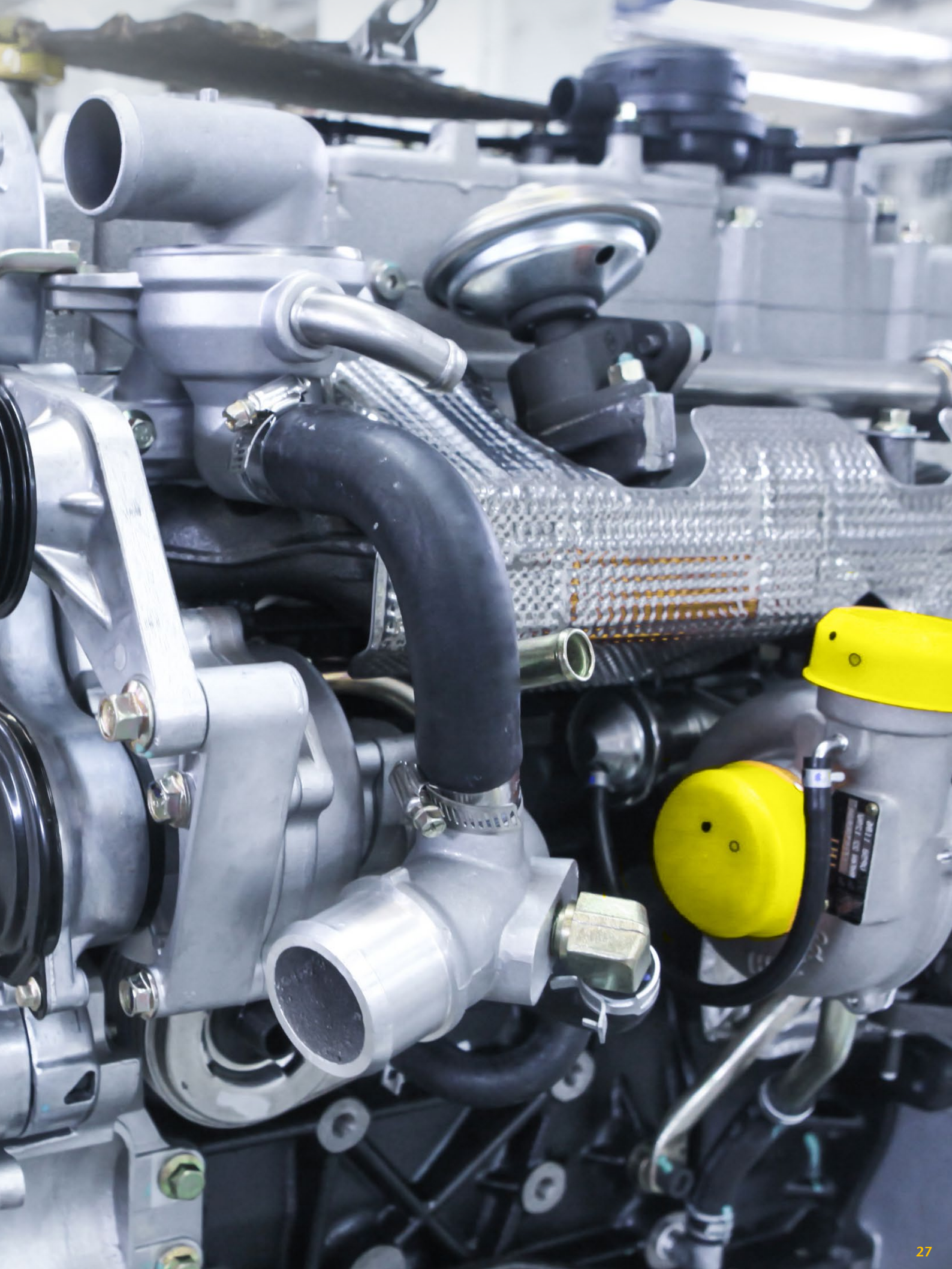




Figure 2: TopMap Pro.Surf sensor integrated into a production line

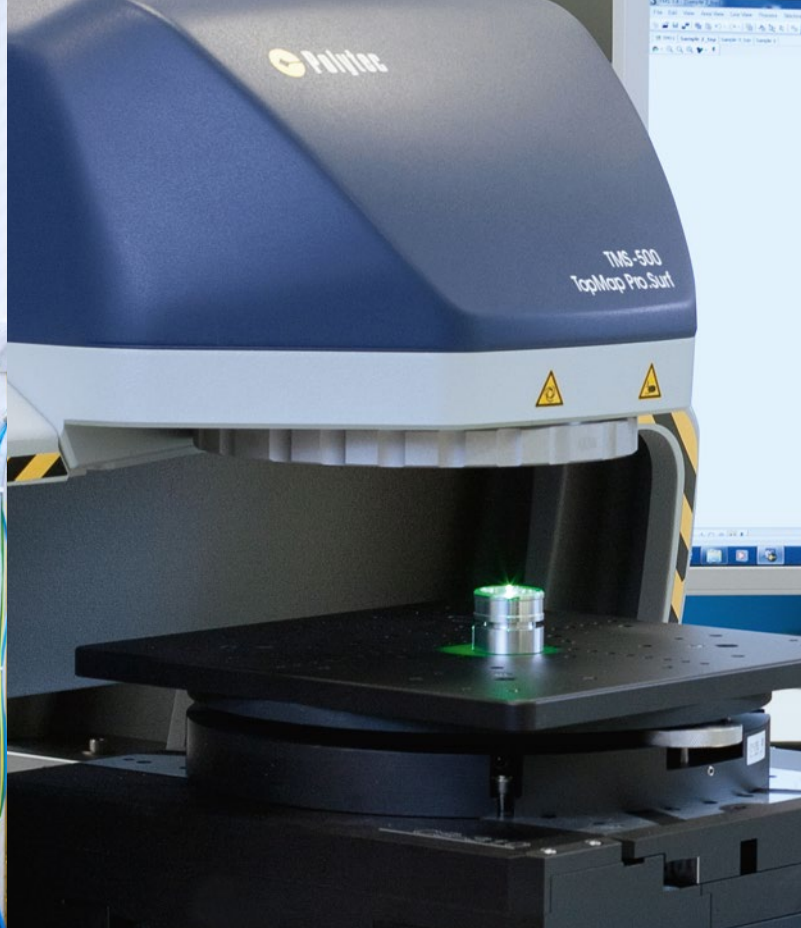


Figure 3: Measure in hard-to-reach areas like holes with a special optical design and a 70 mm vertical scan range

High vertical precision with a large lateral field-of-view

In many cases, flatness measurements are critical for the functionality of a surface and this may be related to several individual surfaces. Stylus (contact) profiler methods have been used to characterize surfaces for a long time. With these methods, the tolerances are inspected using individual measurement points or through linear scans. Line-only profiles are often inadequate, especially when the entire surface must be analyzed to determine flatness or parallelism. To determine the surface topography using stylus methods, many parallel line profiles are recorded and combined into a single surface. These measurements are very time-consuming and are not acceptable in production quality control situations where throughput is critical. Because fast measurements over large surface areas are easily accomplished using optical

measuring methods, these techniques are increasingly in use for production applications.

In many cases, flatness measurements are critical for the functionality of a sample and this may be related to several individual surfaces, such as the relation of the surface at the bottom of a blind hole and the surface at the top of the hole. For such applications white-light-interferometry is a great solution, since the vertical resolution is independent of the lateral field-of-view. This enables the measurement of large surfaces with high vertical resolution. Polytec developed the TopMap white-light interferometers for mastering these measurement tasks. This product line offers an excellent price/performance ratio and can, for example, quickly and reliably measure flatness, roughness parallelism and step height. As in the example shown in Figure 2, TopMap Pro.Surf was designed to be integrated into production lines.



Figure 4: High aspect ratios can be easily characterized with telecentric optics used in Polytec large FoV systems

Figure 5: Protection housing for harsh production environments

Measuring flatness, roughness, and parallelism in quality control

Top and bottom workpiece surfaces displayed in Figure 3 are to be inspected for flatness, roughness and parallelism, where one surface is 60 mm deeper than the other. The TopMap white-light interferometers with its vertical scan range of up to 70 mm and a telecentric optical path is the ideal solution for completing such measuring tasks. The light beam virtually runs parallel to the object (Figure 4) and, unlike microscopes with their cone-shaped beam patterns, the telecentric optics of TopMap large field-of-view (FoV) white-light interferometers do not show shadows and even reach deeply recessed surfaces.

The surface of the workpiece to be measured can be smooth or rough, dark or light, with a specular or a

light-scattering surface. A special measurement and analysis algorithm Smart Surface Scanning technology ensures excellent results, even if the surface has spatially varying optical properties. The measurement duration depends on the task at hand and usually takes only a few seconds. The concept of „measurement recipes“ also allows you to easily automate routine measurements and ensures that the necessary data is acquired for a pass/fail analysis or for external quality assurance software. If the measurement is to be taken on the production floor, Polytec offers a dust-free and vibration-insulated protection housing (Figure 5). With very fast measuring speed, the TopMap systems can easily hold up with the required cycle times in production.