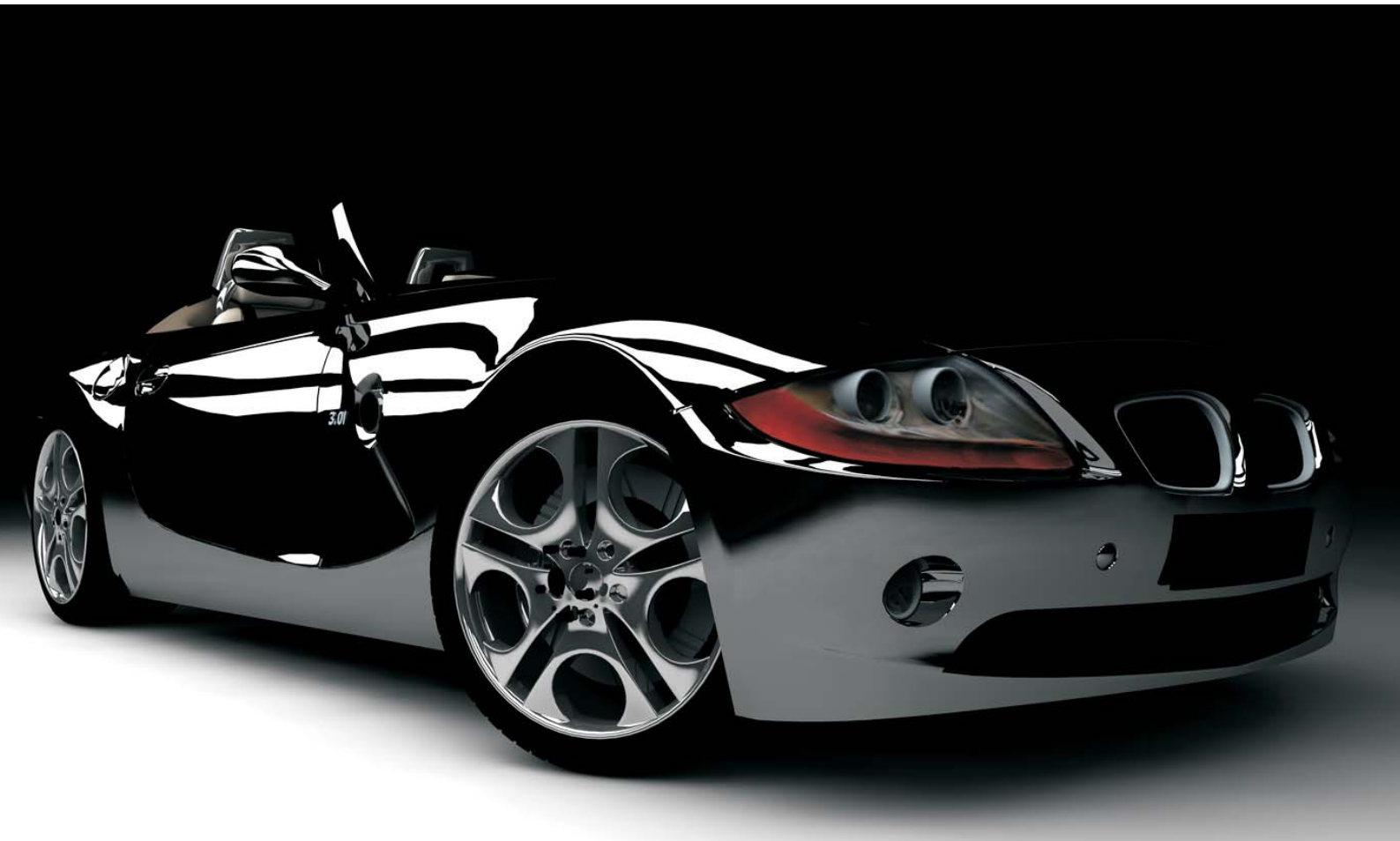
EUROTECH

> APPLICATION STORY



The Power of Balancing Technology

Turbochargers play an essential role in today's motoring technology. Air compressed by the turbocharger creates the vital "boost" to the power that is generated by an engine. Through this means, for instance, a four cylinder car can achieve performance close to that of a six cylinder car without adding engine weight or increasing fuel consumption.

Accurate balancing of the turbochargers used in cars and commercial vehicles is vital to ensure engine efficiency and longevity and it is carried out in both the manufacturing and remanufacturing of these units. If not measured and corrected through the balancing process, turbochargers will be noisy and in severe cases bearing failure can occur. Measuring imbalance that causes vibration in the rotor system is carried out by running the assembled cartridge at high speed on a flexible suspension.

Turbochargers are assembled from separately balanced components, including the compressor and turbine wheels located respectively at the air inlet and the exit for exhaust gases. Because of the construction of the parts, vibration from balance error within the assembled turbocharger occurs at the compressor end. Problems can often be caused by small deficiencies affecting the shaft, compressor wheel, thrust collar or nose nut..

High Speed Balancing

Turbo Technics Ltd, based in Northamptonshire and operating since 1984, is the world's leading manufacturer of turbocharger high-speed balancing equipment. The company produces core balancing machines for use in both turbocharger production lines and repair facilities. Accessories for over 140 different turbocharger models are also supplied. Manufacturer approvals of their turbocharger balancing equipment include Garrett (Honeywell Technologies), 3K/Schwitzer (Borg Warner Turbo Systems), Holset (Cummins Technologies) and IHI (Ishikawajima-Harima Heavy Industries Co. Ltd).

The core balancing process recommended by Turbo Technics for the assembled turbocharger involves mounting the Centre Housing Rotating Assembly (CHRA) in a slave turbine housing adaptor. Air is directed into the turbine housing, rotating the turbine shaft. An accelerometer attached to the flange measures the vibration of the complete assembly. Admission of air to the turbine is controlled, allowing the CHRA to be accelerated slowly across the speed range. The compressor wheel is covered in a shroud for safety reasons and to reduce air 'windage'. The nose nut or shaft end is magnetised and a coil in the centre of the shroud converts the rotation of the magnetic field into a voltage signal which in turn is processed into a speed signal.

Being an intrinsic part of the vehicle's power system, measurement has to be 100% accurate and carried out in dynamic conditions that demonstrate the turbocharger's total operating efficiency at close to speeds expected under normal operating conditions. Typically this would be between 100,000 and 230,000 revs per minute, depending on the wheel size. In most cases, the turbocharger manufacturer will specify the maximum speed for balancing, which should be adhered to. Running a turbo core at excessive speed can fracture the compressor wheel, causing major damage and potential danger to equipment operators.

Computer Driven

A crucial element in the widely used Turbo Technics VSR (Vibration Sorting Rig) models - the Mk 3, Mk 4 and the newly introduced Mk 5 for large turbos - is the Eurotech SBC-GX533 embedded single board computer. This is integrated into the computer used for analysing and displaying balance measurements and, in some machines, for controlling the operating process.

The computer allows the operator to view the relevant information required on a touch screen with user-friendly functionality for carrying out fast and accurate balancing. The accelerometer and speed signals are processed electronically to remove unwanted frequencies, leaving the key readings of vibration level (g-level) against speed. Information is displayed in the form of a two dimensional graph plotting vibration against speed, with the required balancing position shown on screen in "clock" form. This data can be printed or saved for future reference via a USB port.

Eurotech, a global company specialising in the design and manufacture of embedded single board computers, has a long-standing relationship with Turbo Technics, having supplied three different embedded board solutions to meet the needs of developing turbocharger balancing technology. The first product, the ELAN 104, was provided by Eurotech in 2001. This was followed by the SBC-GX1 and subsequently the current SBC-GX533, introduced in 2006.

Tim Taberner, Sales Manager of Eurotech commented: "We have extensive experience in designing industrial electronics, from boards to systems, which are guaranteed to be robust, reliable and provide longevity of a product. Eurotech's engineering team ensures that it provides the best possible solutions for Turbo Technics turbocharger balancing requirements during the long period of our business partnership, meeting the need for processing speed and reliability in a demanding industrial environment."

Geoff Kershaw, Managing Director of Turbo Technics explained that his company has nearly 400 machines currently operating throughout the world, balancing an estimated 2 million turbochargers a year. "With their SBC-GX533, Eurotech has provided us with an essential component for these successful applications and their technical services support has been second to none," he said.

In addition to embedded single board computers, Eurotech also designs a range of application ready platforms and systems solutions for customers in Transport, Energy, Defence, Medical and Industrial Engineering. The company develops its products from the initial concept stage through to offering extended lifetime support, with its engineering and support teams providing extensive experience in hardware and system design, embedded operating systems and communications protocols.

Eurotech is present in Europe, North America, China and Japan. Eurotech develop digital technologies for a better world making every day life safer and more comfortable, today and for tomorrow.