



# Testing the turbo

## Measurement data acquisition for marine diesel engine turbochargers

**Turbocharger, injection and electronic systems are the key technologies in modern diesel engine development. Marine diesel engines of today are equipped with very compact turbochargers enabling optimal levels of performance, fuel consumption and emissions. The German company MTU Friedrichshafen GmbH develops and produces marine diesel engines and turbochargers. The high performance turbochargers are manufactured in-house and are then put through their paces at the company's test benches. The complex measuring requirements at the test benches are performed using hardware and software products from the company Delphin Technology AG. Dr. Johannes Jochum, from the German MESSTEC & Automation, visited MTU and had the measuring processes explained to him by Dr.-Ing. Joachim Ruck, head of the turbocharger and component testing department, Dipl.-Ing. Joachim Thiesemann, experimental engineer for exhaust gas turbochargers, and Dipl.-Ing. Dietmar Scheider, Sales Manager from Delphin Technology AG.**

### The perfect solution for any task

Delphin Technology AG, located in the German town of Overath-Brombach, develops and manufactures innovative hard and software products for test and process engineering, power generation, the chemical, food and pharmaceutical industries and for research and development. Delphin's product range includes hard and software for measurement data acquisition and evaluation, process monitoring and analysis, process automation, vibration monitoring, and the remote monitoring of plant and machinery.

### Specialist testing

MTU Friedrichshafen GmbH is one of the world's leading manufacturers of large diesel engines and complete drive systems. MTU manufactures diesel engines for shipping, power generation, and heavy road and rail vehicles - with power ranges from 116 to 900kW.

MTU also produce turbochargers for many of these engines. Turbochargers are vital components which are subjected to high levels of thermal and mechanical stresses. They can rotate up to 90 000 rpm, are exposed to temperatures of up to 750 °C and a pressure ratio of 5.0.

The test benches need to confirm in practice what has been calculated on paper during development. MTU is equipped with special test benches for exhaust gas turbochargers which, among other things, can measure power, air flow and pressures (figure 1). Highly sensitive methods are used to test those areas which have been calculated to be subjected to the most stress. Such procedures then optimize the robustness, efficiency and operation of the components.

### Comprehensive specification for measurement data acquisition

Specifications were drawn up for measurement data acquisition at two test benches. Both test benches were already operational so the specifications served mainly as a modernisation of measurement data acquisition procedures. "What we required was a comprehensive measuring system for the acquisition of voltage signals (pressures, volume flows, flap positions), temperatures and rotations. A high level of accuracy was especially necessary for the temperature measurements (+/- 0,2 °C)", explained Dr. Ruck. Joachim Thiesemann said, "We also needed decentralised measurement data acquisition, a Profibus interface with PLC control, virtual channel capability and above all calculation channels within the device itself".

#### Delphin Technology AG

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### **Start-up in just 2 days**

"We wanted a complete solution ranging from switch cabinet and hardware installation through to a software package which could evaluate and graphically portray our measurement data. Delphin's system met these requirements entirely. The TopMessage hardware devices were supplied to us built into switch cabinets and were connected up to the existing installations (figure 2). "Things went really well so that we were up and running within just 2 days", said Dr. Ruck. Dietmar Scheider from Delphin Technology AG said, "Because we manufacture in-house we can supply systems which exactly meet customer requirements – this is of major benefit to our customers. There are no problems installing our systems on site because Delphin hardware uses standard cabling which can easily be connected to existing company networks. There is also no need for amplifiers or signal conditioning – these are already integrated. Process signals are connected using detachable clamps and therefore require little maintenance". According to Dr. Ruck, "The whole system is so reliable that to date we have had no interruptions to our measurement data acquisition". Mr. Scheider explained, "We use high quality components which are built to last. Mechanically sensitive components such as potentiometers are no longer necessary. We also provide an on site calibration service – either annually or whenever the customer requests it".

### **Software – modular and flexible**

"Our marine diesel test benches generate a lot of measurement data which needs to be continually acquired, monitored, analysed and archived. This involves extremely complex measurement data acquisition and evaluation procedures. These are performed on our existing PCs using Delphin's MHouse software – a system hallmarked by its modular design and its flexibility", said Joachim Thiesemann. Dietmar Scheider added, "Our software is Windows compatible and supports automatic data acquisition for both continuous and batch processes. Measurement data can be acquired and visualised online and in real time. Historical data saved on the hard disk can be simultaneously evaluated. The TopMessage device's internal datalogger memory can be automatically read out at preset time intervals. This provides an additional data backup function. The module Process Visualisation can quickly generate a graphical view enabling operation and observation of the process (figure 3). The ProfiSignal software (available since the middle of 2005) significantly enhances the capability for test bench automation. ProfiSignal contains its own Configurable Programming Technique (Klicks) enabling users to perform their own system configuration without the need for any programming knowledge. This means simple generation of complete, fully automated testing procedures, with input masks and protocol procedures".