



On the trail

Monitoring of fuel consumption by diesel engines

The DIMAR-TEC Pte. Ltd. with head office in Far Eastern Singapore is a specialist for the service and the condition-based maintenance of diesel engines in ship building, for offshore-applications and onshore facilities. On basis of the Bachmann M1-Automation System the enterprise had developed the »Fuel Efficiency Controller« (FEC): A solution, which displays ship operators the efficiency of the propulsion system and point out fuel saving opportunities.

With 14 employees, the 2003 established DIMAR-TEC Pte. Ltd. offers sensors and technical support for performance optimization of marine engines. »The fuel costs for a medium to large container ship amounts to 10-20 million US Dollar per year«, says managing director Olaf Kuss, and hence explains that the so-called Specific Fuel Oil Consumption SFOC is also a Key Performance Indicator KPI for the efficiency of the propulsion system. If this value is compared

with other ship-specific data, like the speed through water STW and above the ground SOG, then the ship owner receives reliable data for performance evaluation on fleet level. »With the current data collection procedures however, it is difficult to arrive at meaningful key performance indicators KPI for the determination of fuel consumption, as the system accuracy is often in the range of 10-25%« explains Olaf Kuss his motivation to develop an own solution. The



FEC system now makes it possible for Chief Engineers, captains and shipping companies to identify saving potentials within the fuel consumption of their vessels, and last but not least also save the environment with an optimal utilization of the energy output from diesel engines.

Actual values compared with theoretical values

When using heavy fuel oil HFO in diesel engines. Unlike gasoline, diesel oil or other distillate fuels, the chemical composition of heavy fuel oil varies, and thus the energy content. Based on its density, its specific heat value (widely known as calorific value) can be calculated and

combined with operational and engine-specific data, the fuel consumption characteristics of a vessel are calculated. »The engine manufacturers specify the SFOC value based on the International Standard ISO 3046-1 under defined operating conditions of the engine«, explains Olaf Kuss at the very outset. These include not only the heavy oil density, but air pressure, air intake and coolant temperature as well as many other parameters. An evaluation of the consumption data contains errors as long as they are not ISO-corrected according to ship-specific fuel system requirements. The maritime industry is yet not aware of the fact that these errors easily reach a magnitude of 10-25%.

KPI Parameters are now practically measurable

With 10 to 15 sensors on different parts of the ship's propulsion system, the Fuel Efficiency Controller thus records the actual operational conditions of the diesel engine. »With the FEC we make different parameters actually measurable continuously and represent them in real time in relation to the specified data« says Olaf Kuss. The shipping company has thus the opportunity to assess precisely the consumption values and to compare with data from other vessels. Appropriate conclusions can be drawn from this and can be taken into account for the daily operation as well as for the regular maintenance of the ship and the whole fleet.

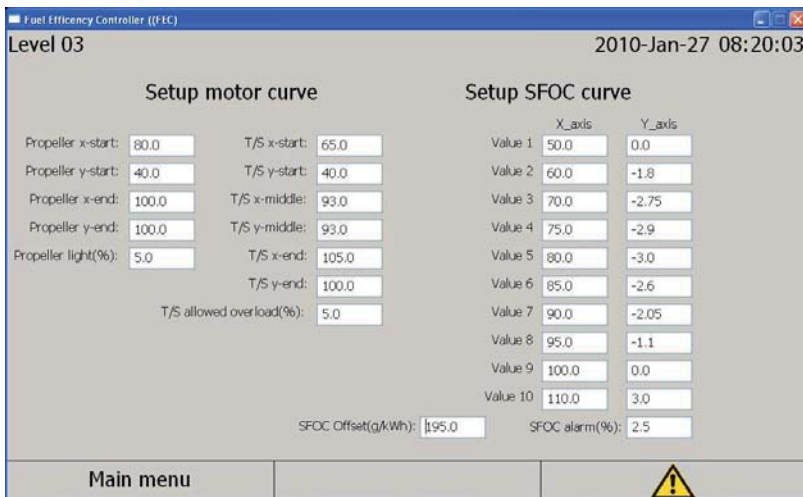
The system layout and the configuration of the FEC will be made ship-specific by DIMAR-TEC. The additional consideration of the sensor-specific tolerances on board allows a further optimization, as well as an indication of the overall system accuracy and the output values.

The openness and flexibility of the system is outstanding

With the implementation of the FEC, it is possible to ensure complex requirements with regards to user interface, the flexibility of the data acquisition as well as the evaluation of measuring data. This is the free I/O mapping of the input and output signals and the monitoring conditions which enables the use of the system in a variety of maritime applications. »This is important, because independent from the individual assignment of the in- & output signals on various vessel types the FEC shall ensure the collection and provision of reliable consumption data« says Olaf Kuss describing one of the essential requirements of the system.

Safe and easy Parameterization and Operation

In cooperation with Bachmann electronic, the software specialist Reinholz Software & Technology Ltd. from Itzehoe, has developed a special highlight on the basis of the M1-Automation system: Freely configurable I/O allocation. »Via a WT205 Web Terminal or FTP access, all input and output signals can be assigned individually without the operator's intervention on the SPS program«, managing director Karsten Reinholz explains this service-oriented functionality. Users can also handle this technology safely and easily without any programming knowledge to work with the system. »This facilitates the worldwide installation of systems and helps immensely in further minimizing the commissioning and servicing costs for the customer« says Karsten Reinholz. A special service mode of the software protects the vessel-specific parameterisation and prevent errors by the crew.



▲ **FEC in Service-Mode:**
Simple setup of the ship-specific parameter.



▲ **Meaningful graphics allow the operation at the ideal engine operating point and thus the optimization of fuel consumption:**
Display of the shaft power as a function of engine speed.

Fuel Savings in sight

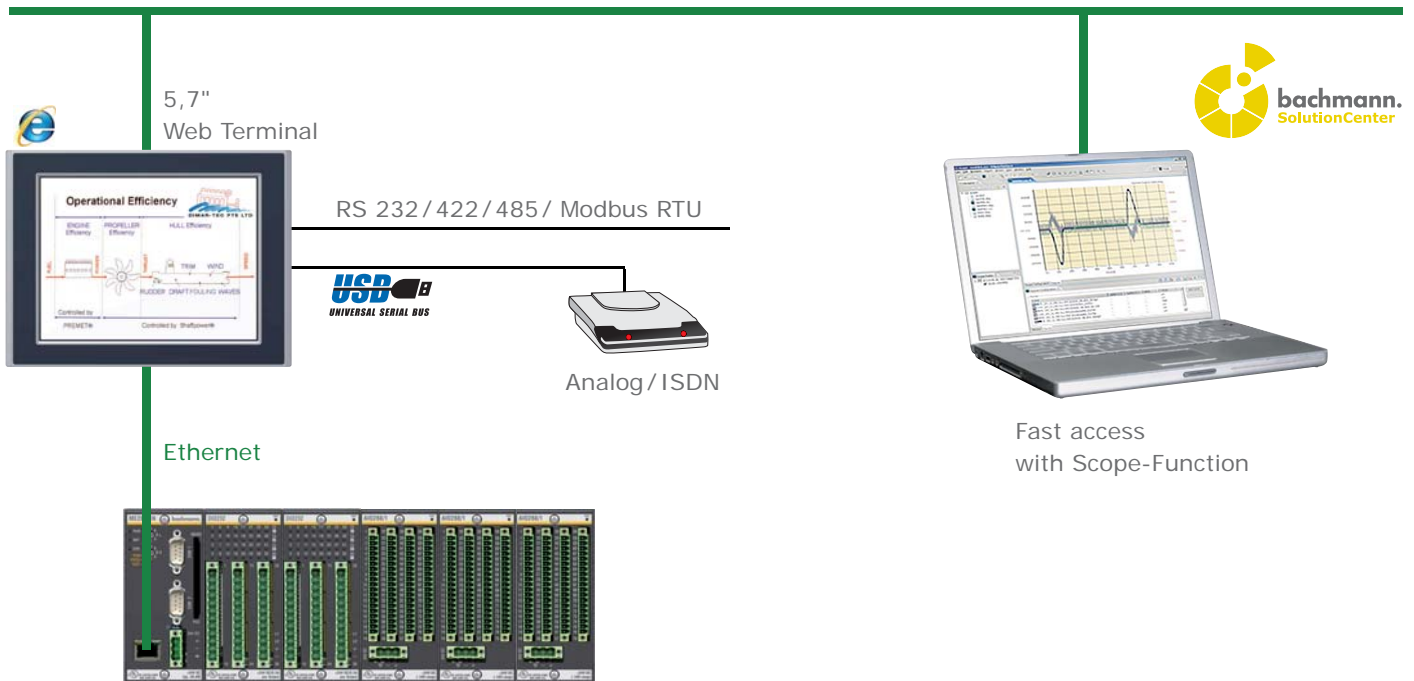
»The FEC based on the Bachmann Automation Aystem enables for the first time a very accurate assessment of the effectiveness of the propulsion system« says DIMAR-TEC Director Olaf Kuss. However, he has already the next optimization potential in sight, because the fuel consumption per Nautical Mile is not only dependent on optimum engine efficiency. Many parameters, from the propeller efficiency through rudder impact, trim and draft of the ship up to the mussel fouling on the ship's hull, beside the power at the shaft influencing the speed of the vessel. The next project is to record these variables, make them available for evaluation and develop decision support solutions where possible. ■



»Based on the Bachmann M1 System, we were able to develop a system with unprecedented flexibility and ease of service.«

Olaf Kuss, Managing Director,
DIMAR-TEC Pte. Ltd.

Ethernet / **PROFI
NET** / Modbus TCP



▲ Ideal Hardware-Platform: M1 Automation System as core of the FEC.