



E²CON-M

Modular control system for combustion engines in marine applications

A major ship and engine builder turned a four-stroke medium speed diesel auxiliary engine into a dual fuel (DF) engine to allow vessels to meet IMO Tier III NOx limits in Emission Control Areas and to comply with cold ironing rules.

INDUSTRY

Maritime Automation

REGION

Asia Pacific

PRODUCT

Engine Control System

THE CHALLENGE

In the process of developing a new 35 cm bore, 9 MW rated DF engine to drive marine generator sets, the engine builder needed an engine control system (ECS) which fulfills the requirements for multi engine power generation:

- Control of pilot fuel injection for the DF engine's gas fuel operating mode
- Control of gas admission via electronically-controlled valves at the inlet ports
- Control of unit pump injection system for the DF engine's 100 % liquid fuel mode
- Control of turbocharger wastegates to adapt charge-air delivery to gas and liquid fuel operation
- Full integration of the control system into the automated vessel control system
- Mounting of the ECS onto the engine with exacting requirements for temperature and vibration resistance

OUR SOLUTION: OPEN CONTROL SYSTEM ON A MODULAR BASE

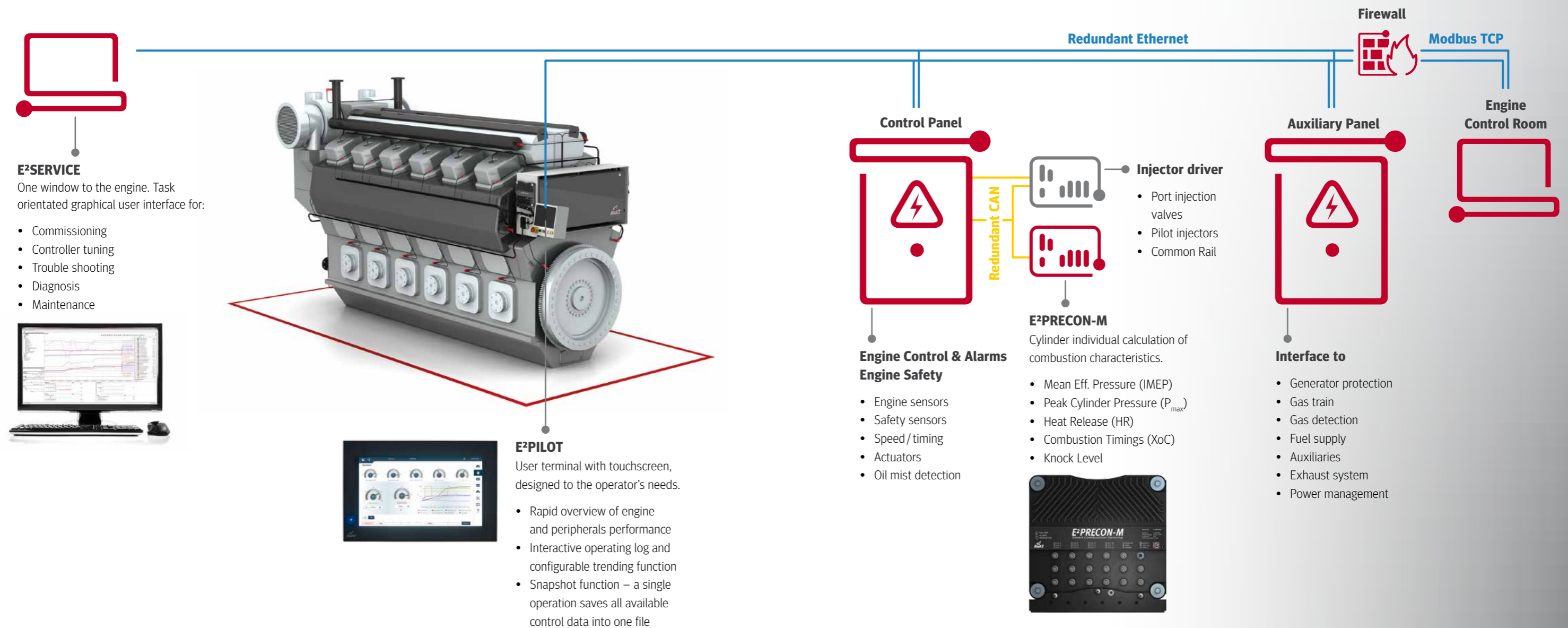
The customer's wish of accessing the benefits of scalability, flexibility and modularity in one product that already has Classification Society type approvals was fulfilled using our openECS, which allows him to further develop control and automation functions with his own resources.

E²CON-M consists of three units. The control panel with an engine control and alarms module and an engine safety system, the E²PRECON-M component and the auxiliary panel. The control architecture is based on the Bachmann M1 PLC system. All modules and devices operate according to the principle "smart sensor" and "smart actuator". They deliver pre-processed information and are controlled and configured by the PLC. All control and monitoring functions access the same data and thus all data are usable in the total system and are displayed on the user interface.

The reinforced switch cabinet of the control panel and E²PRECON-M are vibration-damped mounted on the engine. Wiring of sensors and actuators is directly connected to terminal blocks inside the control panel.

The auxiliary panel is placed away from the engine to simplify wiring of auxiliary inputs and outputs. Redundant Ethernet and CAN connections ensure high operational safety.

All sensors, limit values and sequences have been specified by the engine builder. The engine control prototype was developed for the 35 cm DF bore engine, but is now in use for further DF type series of the engine builder. The engine control system is fully integrated into an automated vessel control system.



ENGINE AND AUXILIARIES' CONTROL – CUSTOMIZED AND EXPANDABLE AT ANY TIME

A month before the first test run the E²CON-M was functionally completed and in operation on a hardware-in-the-loop (HiL) simulator. The first trainings and the customer acceptance test could be carried out. The prototype system allowed commissioning on the testbed within 7 days. No major software changes were required during subsequent engine testing and performance optimization.

Major factors in the smooth implementation of the ECS on the 9 MW auxiliary engine were:

- All hardware components already have marine type approvals by major MCS
- Marine requirements regarding safety and redundancy are rapidly implemented with the Bachmann M1 PLC system
- Based on our software platform development progresses rapidly since all basic control functions are integral to openECS
- E²SERVICE tool provides developers with a powerful testbed facility from the start of the project

A TIGHT TIMESCALE

Project start	Testbed run	Start of production	MCS TA	Sea trial
	6 M	3 M	3 M	3 M

The development process was completed in a tight 9 month schedule from the setting of the specifications to start of series production, including a fixed 6 months test stand occupancy, 3 months for marine type approvals and another 3 months sea trial on the first vessel equipped with the DF auxiliary. Finally the engine builder's employees were trained.

HIGH PERFORMANCE PARTNER

We are a trusted partner to the gas-engine industry since more than 25 years. Our extensive know-how in cylinder pressure-based engine control systems makes us a reliable engineering provider for the maritime industry.

- Leader in control technology for large gas & DF engines
- More than 8,500 engine control systems in operation worldwide
- Extensive experience gained from automation projects with a total exceeding 12,500 MW installed electric power
- Smart solutions featuring process and control automation for sustainable power generation and distribution

