

Engine Control System ME

The Engine Control System (ECS) for the ME engine is prepared for conventional remote control, having an interface to the Bridge Control system and the Local Operating Panel (LOP).

A Multi-Purpose Controller (MPC) is applied as control unit for specific tasks described below: ACU, CCU, CWCU, ECU, SCU and EICU. Except for the CCU, the control units are all built on the same identical piece of hardware and differ only in the software installed. For the CCU on ME and ME-C only, a downsized and cost-optimised controller is applied, the MPC10.

The layout of the Engine Control System is shown in Figs. 16.01.01a and b, the mechanical-hydraulic system is shown in Figs. 16.01.02a and b, and the pneumatic system, shown in Fig. 16.01.03.

The ME system has a high level of redundancy. It has been a requirement to its design that no single failure related to the system may cause the engine to stop. In most cases, a single failure will not affect the performance or power availability, or only partly do so by activating a slow down.

It should be noted that any controller could be replaced without stopping the engine, which will revert to normal operation immediately after the replacement of the defective unit.

Main Operating Panel

Two redundant main operating panel (MOP) screens are available for the engineer to carry out engine commands, adjust the engine parameters, select the running modes, and observe the status of the control system. Both MOP screens are located in the Engine Control Room (ECR), one serving as back-up unit in case of failure or to be used simultaneously, if preferred.

Both MOP screens consist of a marine approved Personal Computer with a touch screen and pointing device as shown in Fig. 5.16.02.

Engine Control Unit

For redundancy purposes, the control system comprises two engine control units (ECU) operating in parallel and performing the same task, one being a hot stand-by for the other. If one of the ECUs fail, the other unit will take over the control without any interruption.

The ECUs perform such tasks as:

- Speed governor functions, start/stop sequences, timing of fuel injection, timing of exhaust valve activation, timing of starting valves, etc.
- Continuous running control of auxiliary functions handled by the ACUs
- Alternative running modes and programs.

Cylinder Control Unit

The control system includes one cylinder control unit (CCU) per cylinder. The CCU controls the multi-way valves: Electronic Fuel Injection (ELFI) and Electronic exhaust Valve Actuation (ELVA) or Fuel Injection and exhaust Valve Actuation (FIVA) as well as the Starting Air Valves (SAV) in accordance with the commands received from the ECU.

All the CCUs are identical, and in the event of a failure of the CCU for one cylinder only this cylinder will automatically be cut out of operation.

Auxiliary Control Unit

The control of the auxiliary equipment on the engine is normally divided among three auxiliary control units (ACU) so that, in the event of a failure of one unit, there is sufficient redundancy to permit continuous operation of the engine.

The ACUs perform the control of the auxiliary blowers, the control of the electrically and engine driven hydraulic oil pumps of the Hydraulic Power Supply (HPS) unit. On engines fitted with ACOM, it is controlled by one of the ACUs too.

Cooling Water Control Unit

On engines with load dependent cylinder liner (LDCL) cooling water system, a cooling water control unit (CWCU) controls the liner circulation string temperature by means of a three-way valve.

Scavenge Air Control Unit

The scavenge air control unit (SCU) controls the scavenge air pressure on engines with advanced scavenge air systems like exhaust gas bypass (EGB) with on/off or variable valve, waste heat recovery system (WHRS) and turbocharger with variable turbine inlet area (VT) technology.

For part- and low-load optimised engines with EGB variable bypass regulation valve, Economiser Engine Control (EEC) is available as an option in order to optimise the steam production versus SFOC, option: 4 65 342.

Engine Interface Control Unit

The two engine interface control units (EICU) perform such tasks as interface with the surrounding control systems, see Fig. 16.01.01a and b. The two EICU units operate in parallel and ensures redundancy for mission critical interfaces.

The EICUs are located either in the Engine Control Room (recommended) or in the engine room.

In the basic execution, the EICUs are placed in the Cabinet for EICUs, EoD: 4 65 601.

Control Network

The MOP, the backup MOP and the MPCs are interconnected by means of the redundant Control Networks, A and B respectively.

The maximum length of Control Network cabling between the furthestmost units on the engine and in the Engine Control Room (an EICU or a MOP) is 230 meter.

Should the layout of the ship make longer Control Network cabling necessary, a Control Network Repeater must be inserted to amplify the signals and divide the cable into segments no longer than 230 meter. For instance, where the Engine Control Room and the engine room are located far apart. The connection of the two MOPs to the control network is shown in Fig. 5.16.01.

Power Supply for Engine Control System

The Engine Control System requires two separate power supplies with battery backup, power supply A and B.

The ME-ECS power supplies must be separated from other DC systems, i.e. only ME-ECS components must be connected to the supplies.

Power supply A	
System	IT (Floating), DC system w. individually isolated outputs
Voltage	Input 100-240V AC, 45-65 Hz, output 24V DC
Protection	Input over current, output over current, output high/low voltage
Alarms as potential free contacts	AC power, UPS battery mode, Batteries not available (fuse fail)

Power supply B	
System	IT (Floating), DC system w. individually isolated outputs
Voltage	Input 110-240 VAC, output 24V DC
Protection	Input over current, output over current, output high/low voltage
Alarms as potential free contacts	AC power, UPS battery mode, Batteries not available (fuse fail)

High/Low voltage protection may be integrated in the DC/DC converter functionality or implemented separately. The output voltage must be in the range 18-31V DC.

Local Operating Panel

In normal operating the engine can be controlled from either the bridge or from the engine control room.

Alternatively, the local operating panel (LOP) can be activated. This redundant control is to be considered as a substitute for the previous Engine Side Control console mounted directly onto the MC engine.

The LOP is as standard placed on the engine.

From the LOP, the basic functions are available, such as starting, engine speed control, stopping, reversing, and the most important engine data are displayed.

Hydraulic Power Supply

The purpose of the hydraulic power supply (HPS) unit is to deliver the necessary high pressure hydraulic oil flow to the Hydraulic Cylinder Units (HCU) on the engine at the required pressure (approx. 300 bar) during start-up as well as in normal service.

In case of the STANDARD mechanically driven HPS unit, at start, one of the two electrically driven start-up pumps is activated. The start-up pump is stopped 25 seconds after the engine reaches 15% speed.

The multiple pump configuration with standby pumps ensures redundancy with regard to the hydraulic power supply. The control of the engine driven pumps and electrical pumps are divided between the three ACUs.

The high pressure pipes between the HPS unit and the HCU are of the double-walled type, having a leak detector (210 bar system only). Emergency running is possible using the outer pipe as pressure containment for the high pressure oil supply.

The sizes and capacities of the HPS unit depend on the engine type. Further details about the HPS and the lubricating oil/hydraulic oil system can be found in Chapter 8.