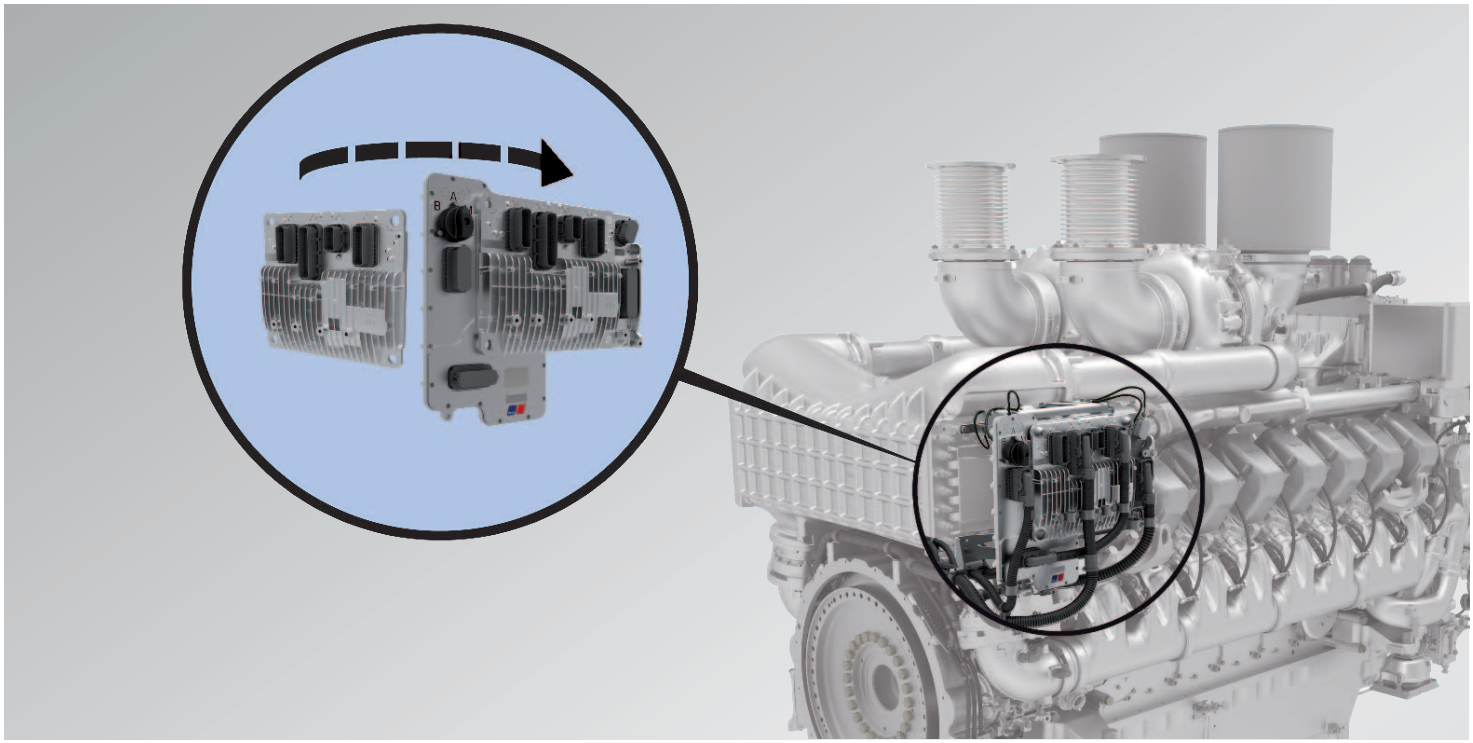
Engine Technology

Redundant engine controller for fire pump drive systems (NFPA20)



Authors:

Albrecht Rief
Project Manager

Jan Henker
Project Manager Technology

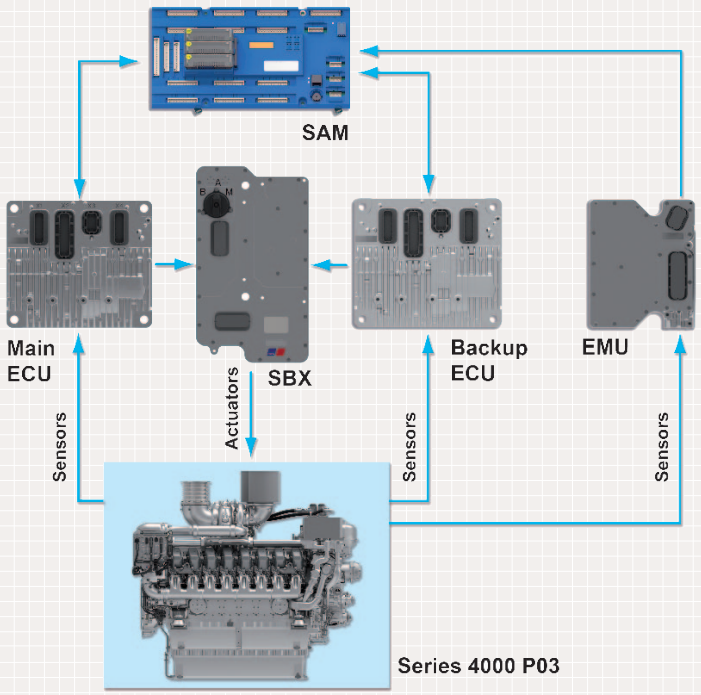
Over the last few years, the so-called NFPA20 standard has been established for fire pump drive systems in the oil and gas industry. This standard by the US National Fire Protection Association (NFPA) requires a redundant engine controller. The second engine controller must be installed on the engine, be permanently wired and, in the event of a fault on the first controller, must take over the engine control automatically without interruption of the fire pump water jet. MTU now offers its fire pump drive systems in line with this standard.

On an offshore platform approximately 10 me-ga-watts of power are installed nowadays solely to drive the fire pumps. Per hour, these pumps feed approximately 15,000m³ of fire-fighting water into the fire-fighting water system of the platform, usually at a pressure of 15 bar. Such plants are frequently equipped with up to four drive units. 4000P03 engines are particularly suitable for this application. The redundant controllers developed by MTU can be used in mechanical, hydraulic and diesel-electric drive systems.

Redundant controller system for common rail diesel engines

To redundantly record all engine data required for controlling, a second sensor set is installed on the engine. The ECU7 engine control unit is used as a main and backup-controller. As the

System overview of redundant engine controller according to NFPA20



injectors and high-pressure fuel control block are not installed redundantly, triggering of these actuators must be switchable between the two controllers. The new SBX1 switch box thus forms the heart of this system. NFPA20 results in new requirements regarding the functionality of the overall system. In the following paragraphs, three of these new requirements will be detailed as examples.

Switching

Switching is done via semiconductor switches and is designed such that it internally consists of two independent parts, thus achieving maximum system redundancy. Logic switching and the supply of the new unit are done via a cable each from both controllers, thus making optimum use of the ECU7 plugs. This results in simple wiring.

If, during switching, the injectors are not triggered for a longer period of time, the engine speed decreases excessively, the engine stalls or the load is shed. Interruption triggering of the high-pressure fuel control block extensively results in an increase in rail pressure until the mechanical pressure release valve opens. These speed reductions as well as the rail overpressure must be avoided. The maximum time from the occurrence of a fault to the completion of the switching depends on factors such as the type of application (direct, diesel-electric or diesel-hydraulic pump drive), the number of cylinders on the engine (12V, 16V or 20V) as well as the base speed of the engine (1500rpm for 4000P63 or 1800rpm for 4000P83). The MTU system is suitable for all of these combinations.

System behavior identical to single controller

To facilitate switching from the previous series solution consisting of one ECU7 to the new system for MTU customers, the new controller system appears to the application system – e.g. SAM (service and application module) – to be a single controller. Here in particular the CAN communication had to be amended such that only the ECU currently in control sends data via the relevant bus systems (e.g. PCS CAN).

In addition, the different sensor scope on both controllers as well as the switching process from the main to the backup controller must not result in fault messages being generated by the system.

The adaptations on the ECU7 are limited to software changes. The main amendment on the ECU7 was the addition of the following features: detection of controller operation, implementation of switching criteria, detection of switching status, fault suppression and communication. An EMU ensures that the key engine protection features are monitored during backup operation.

System installation position

NFPA20 stipulates that the cables used to connect the two ECU7 and the SBX1 with each other must be as short as possible. In addition, they must be installed on the engine to optimize the cable length for the triggering of the injectors. The new MTU system is installed in the same position as the previous control system.

In conclusion, MTU is offering a system that meets the necessary requirements as stated by NFPA20.

MTU Friedrichshafen GmbH
A Rolls-Royce Power Systems Company

www.mtu-online.com

May 2013

Photo credits: page 1, top, and page 2, Adam Wist for MTU Friedrichshafen GmbH. Page 1, bottom, Jens Bang (Statoil AS).