

MODULAR ELECTRONIC CONTROL SYSTEMS

A software configurable electronic control system for HamiltonJet propulsion systems



GENERAL DESCRIPTION

The HamiltonJet Modular Electronic Control System (MECS) is a software configurable control system for waterjet steering and reverse, engine throttle and gearbox control. It comprises a number of standard modules which may be connected together in varying combinations to build a vessel control system. A key feature of MECS is that each module is standard and the configuration of a complete system for a particular vessel, with the exception of engine and gearbox interface wiring, is achieved solely through menu driven software configuration carried out during vessel commissioning.

The system modules are interconnected using a set of pre-terminated (plug-in) cables supplied with each system. The only additional hard wiring that the ship builder is required to complete is the power supply and interlock to a Power and Interlock Module and the engine and gearbox interfacing connections to the engine control module.

Within MECS there are two separate control subsystems. Normal control allows fully proportional control of the steering, reverse and throttle as well as control of the gearbox. Backup is provided as an independent set of controls intended for use if normal controls are not available.

In addition to the electronic modules, a complete system includes a jet mounted and driven hydraulic power unit (JHPU) on each jet, inboard hydraulic steering and reverse actuators and feedback units, engine and gearbox interfaces (or actuators) and other interfacing and sensing options.



Typical MECS helm station.

SCOPE OF USE

MECS is available on HamiltonJet models HJ422 to HM811 inclusive, in the following system configurations:

- Single Jet
- Twin Jet
- Triple Jet
- Triple Jet, centre boost
- Quadruple Jet
- Quintuple Jet, centre boost

In addition, it is possible (subject to the approval) to use MECS on two different jet models within the same installation where, for example, a Triple or Quintuple installation may feature a different jet model as the centre booster.

CONTROL STATIONS

The MECS system can be configured to suit up to six control stations. The modular nature of the MECS system means each station can be configured differently.

MECS SYSTEM DESCRIPTION

Normal Control

During NORMAL operation, the system acts as an intelligent proportional control system where the steering, reverse and throttle positions follow the helm and lever positions at the active control station.

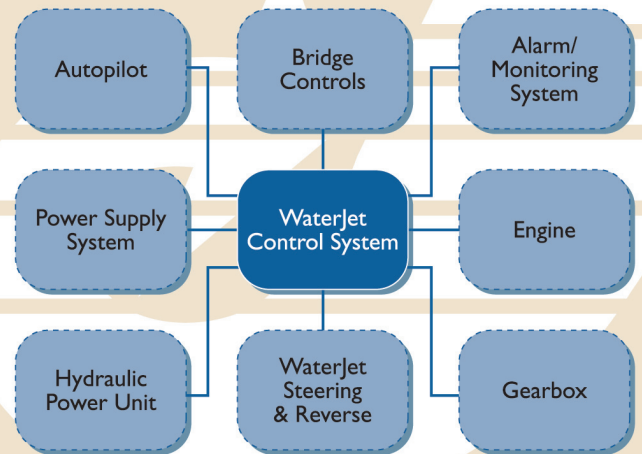
The Normal control mode uses a digital network communications system (CanBus) between all control modules. All information is transmitted over the network and is available to every control module.

Backup Control

During Backup operation, the system acts as a dumb “bang-bang” (non-proportional) control system where the steering, reverse and throttle settings are controlled by a 4-way jogstick and rpm increment/decrement buttons on the control panels.

The Back-Up control system is independent of the Normal control system and does not use the communications network.

INTEGRATED PROPULSION SYSTEM CONTROL ELEMENTS



The Backup Control System is completely independent of the Normal Control.

ENGINE CONTROL MODULE (ECM)



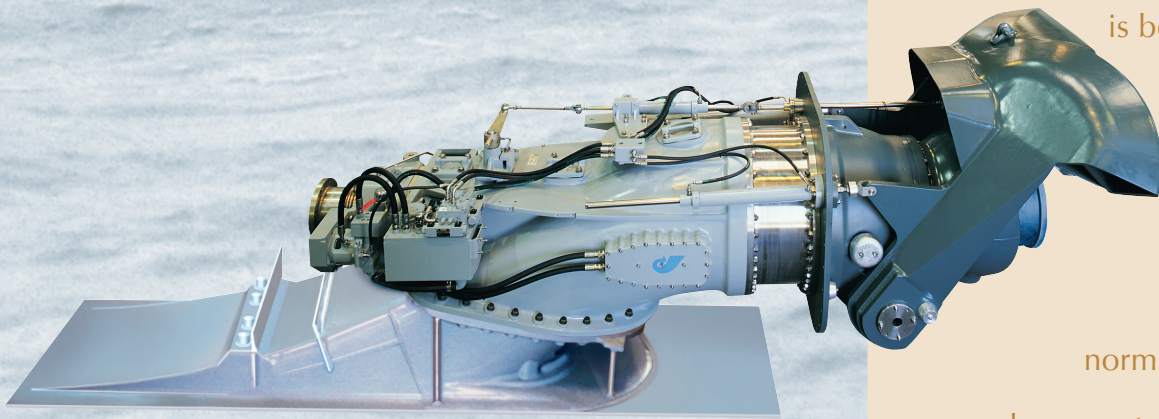
The engine control provides an interface between the MECS system and a variety of gearbox types.

The Engine Control Module (ECM), which is normally mounted in the engine room, provides the interface between the MECS system and a variety of engine and gearbox types.

During Normal operation, the ECM receives demand signals from the control panel(s) and converts them into primary throttle signals for the engine.

During Backup operation, the rpm+ and rpm- buttons on the CPM send a secondary throttle signal to the engine via hard-wired connections. The ECM also provides interlocks for engine start and gear shift operations.

JET HYDRAULIC SYSTEM (JHPU)



Each jet unit is fitted with an integral Hydraulic Power Unit (JHPU) which is belt driven from a pulley on the jet mainshaft. The reverse and steering deflectors are hydraulically powered normally under closed-loop control by MECS. The MECS system positions each cylinder by controlling proportional valves on the JHPU, and cylinder position is fed back by integral sender units.

JET CONTROL MODULE (JCM)

The Jet Control Module (JCM) is considered the “heart” of the system. As well as controlling the steering and reverse hydraulics on the jet, it provides a central point for setting-up and configuring the system and for performing system diagnostics. It is normally mounted in the engine room or jet compartment. During the NORMAL operation, the JCM receives demand signals from the helm and reverse/throttle levers via the control panel and converts them into movements of the jet steering and reverse deflectors.

An LCD on the JCM displays, via a menu, a range of information regarding system operation. Together with four keys, the LCD is used for all initial setup and system configuration.

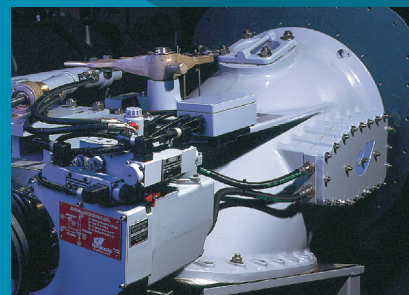
As with all the electronic modules, the JCM is a sealed unit with no user serviceable parts. Auto-resetting type internal fuses are used and any faults are rectified by module replacement.



JET JUNCTION BOX (JJB)

Attached to the Jet unit itself, the Jet Junction Box (JJB) provides the connection point for drive and feedback signals to and from the jet unit.

Apart from passing signals to and from the JCM, the JJB also provides signal conditioning for the jet sensors such as oil temperature, pressure and level.



CONTROL PANEL MODULE (CPM)

At each control station is one Control Panel Module (CPM) per jet, together with one or more reverse/throttle levers and a helm module. The CPM provides the operator with:

- Jet position indication
- Jet status & Alarm displays
- Gearbox control & Position indication
- Engine idle adjust (Normal mode only)
- Power alarm indication
- Warning buzzer & Cancel button
- Adjustable lamp dimming
- Backup select switch
- Backup jet controls (4-way jogstick)
- Backup engine controls (rpm+/-)

Optionally, at each control station, a mobile hand-held remote (HHR) may be used in place of the reverse/throttle levers and helm modules.

POWER & INTERLOCK MODULE (PIM)

The Power and Interlock Module (PIM) allows the shipyard to connect power to the MECS system. Two power supplies are required – a Primary supply which is the default source normally used, and a Secondary supply for use in the event of Primary supply failure. Access to an auxiliary power supply from the MECS system, suitable only for connection to low current circuits, is also available through the PIM.



Hand-held remote for "walk-about" manoeuvring control



HAND HELD REMOTE (HHR)

The HHR provides a set of jet controls in a small portable unit which acts in exactly the same way as any other control station, except that it is carried on a neck-strap by the operator. It is connected, via an HHR Junction Box, to adjacent control panels with a light cable of sufficient length to move from one side of the bridge to the other. The HHR is primarily for low speed manoeuvring such as docking, and for safety reasons should only be used in close proximity to a set of Backup controls so that appropriate alarms can be heard in the event of a system failure.



MECS CONTROL STATION CONFIGURATIONS

For any MECS system, the following modules are required for each control station:

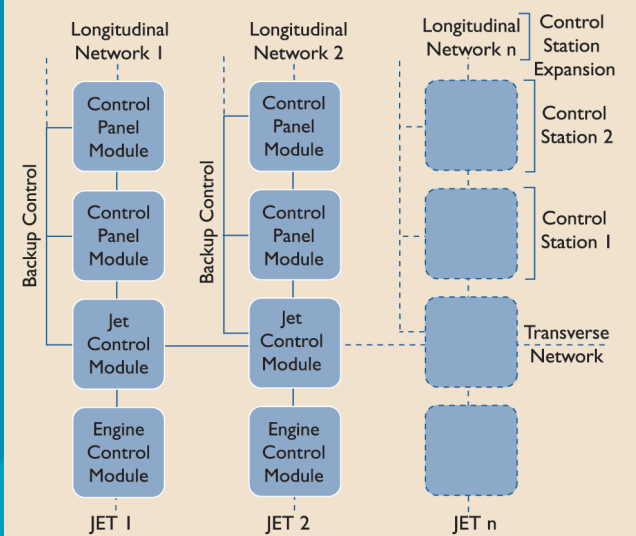
- Control Panel Module (CPM)
- Helm Unit or Joystick
- Hand-held remote (optional)
- Dual lever controller

An Autopilot Interface is also available which may connect at one Control Station only, usually the Master station.

CONTROL LEVERS

For Reverse and Throttle control on each jet configuration, a common dual lever control module, which may be configured differently depending on function, is used. The controller is supplied with a centre detent on both levers but this can be removed for throttle only function.

MODULAR CONTROL SYSTEM ARCHITECTURE



MECS SYSTEM CONFIGURATIONS

For each Jet unit/gearbox/engine combination, one each of the following modules is required:

- Power & Interlock Module (PIM)
- Jet Control Module (JCM)
- Engine Control Module (ECM)
- Jet Junction Box (JJB)
- Engine Servo Actuator (mechanical engine governor)
- or Electronic Engine Interface (electronic engine governor)
- Gearbox Servo Actuator (mechanical gearbox shift)
- or Electronic Gearbox Interface (solenoid gearbox shift)



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