Large Engine Control Module
(LECM)

Applications

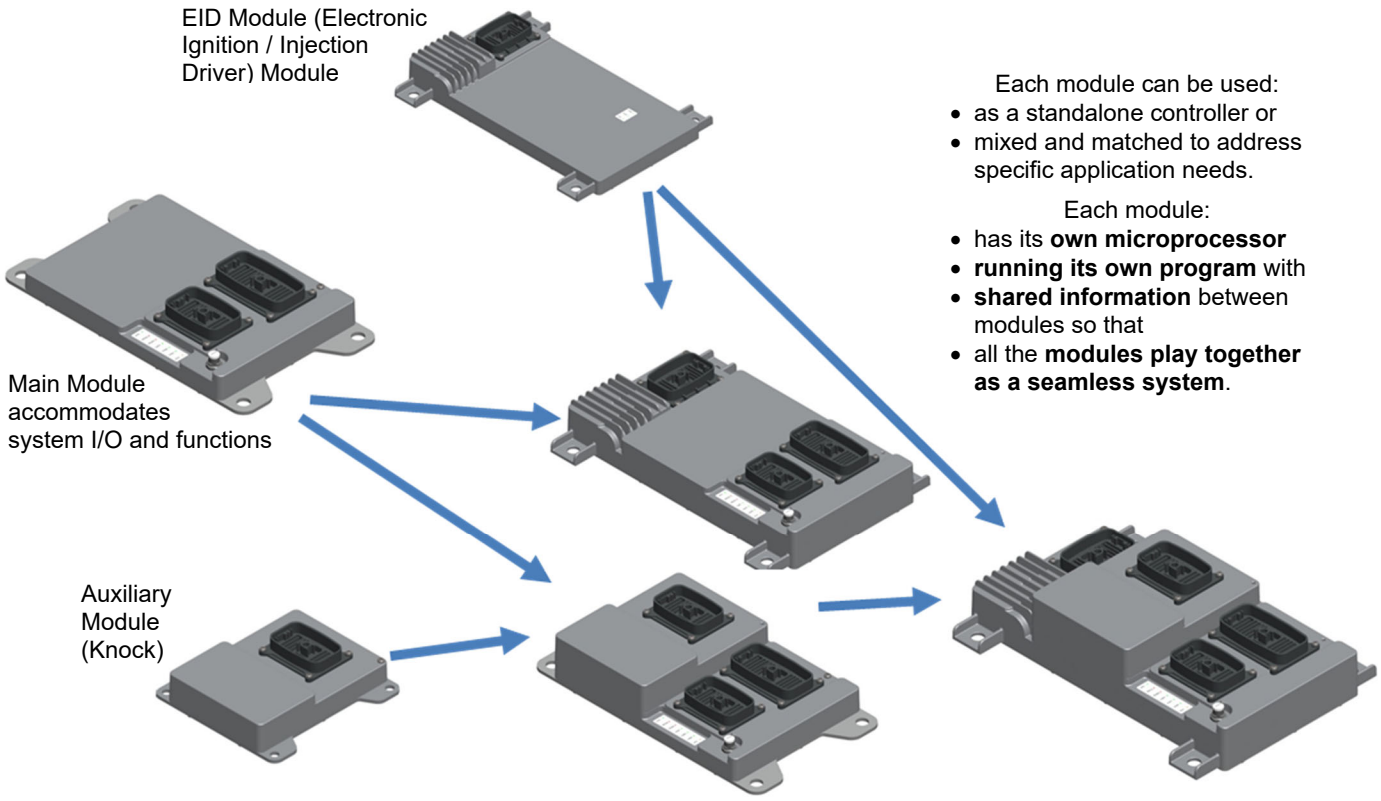
The Woodward Large Engine Control Module (LECM) manages and controls reciprocating engines (gas, diesel, or dual fuel) used in power generation, marine propulsion, locomotive and industrial engine, and process markets. The LECM provides a single, engine-mounted module that can be used to control all aspects of the engine's operation, including speed and load control, air/fuel ratio control, ignition or injector control, misfire and knock detection, air/gas/exhaust flow control, the engine's start and stop routines, along with all the monitoring and engine-protection-related alarms associated with each function, as well as on-board data logging and communications. The LECM's software also allows control system designers to insert their own market-differentiating control algorithms. This single-module approach lowers hardware, wiring, and troubleshooting costs, as well as reducing development and installation time. Additional advantages come from having only one software service tool to learn and support.

Description

The LECM provides a single-box approach that can be built up with interlocking modules into a single engine-mountable assembly. This control scheme uses a modular approach for both the electronic control modules and the software they use. These modules can be mixed and matched to address different applications; all use the same software interface. Each module has its own microprocessor and runs its own software routines, written in Woodward's MotoHawk® software using proven core functions and algorithms. The main module software can also be written in Woodward's Graphical Application Programmer (GAP™). The modules all share their information in a real-time manner, making the entire system act as one fully integrated control.

Woodward's ToolKit interface software provides an easy-to-use and support tool for configuring, operating, and monitoring the application software loaded into the LECM. This includes data logging and trending.

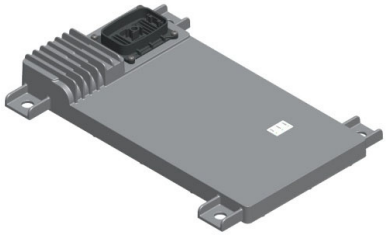
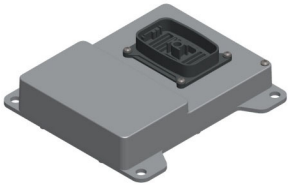
- Consolidates all engine control functions into one module
- Engine mounted
- Single Service Tool used for all engine functions
- Accommodates diesel and gas engine applications
- Ability to add exclusive control algorithms
- Modular approach to optimize control I/O to application requirements
- Supports a wide array of communication physical layers: RS-232, RS-485, CAN & Ethernet



Each module can be used:
- as a standalone controller or
- mixed and matched to address specific application needs.

Each module:
- has its **own microprocessor**
- **running its own program** with
- **shared information** between modules so that
- all the **modules play together as a seamless system**.

Each of the basic LECM platform modules has its own dedicated complement of inputs and outputs as shown below.

Module	Inputs	Outputs
Main Module 	• 16 digital • 29 single-ended analog • 8 differential analog • 8 T/C or RTD • 2 wide-band oxygen sensor • 4 VR/HE/PWM speed sensors	• 8 HS digital • 12 LS/PWM digital • 2 analog • 4 HS/LS/PWM digital **Communications:** • 3 CAN • 1 RS-485 • 1 RS-232 • 1 Ethernet
EID (Electronic Ignition / Injection Driver) Module 	• 2 VR/HE/PWM speed sensors • 1 additional Hall Effect/PWM speed sensor • 2 digital jumpers	• 1 HS digital • 20 electronic ignition/injection drivers **Communications:** • 2 CAN
Auxiliary Module 	• 24 knock, pressure, or T/C • 2 VR/HE/PWM speed sensors • 2 digital jumpers	• 2 HS digital • 2 analog **Communications:** • 1 CAN

Specifications

Operating Voltage: 18 to 32 VDC, able to function down to 9 VDC during cranking

LED indicators are provided for module health and status of each communications channel with final use configuration customized in the application software.

Table 1. LECM Configuration Specifications

Configuration	Operating Temperature	Current	Mass	Overall Size of Equipment (L x W x H):
Aux	-40°C≤Tamb≤105 °C	0.8 A	1.6 kg 3.5 lb	22.9X16.5X5.3 cm 9.0 X 6.5 X 2.1 in
Aux + Main	-40°C≤Tamb≤100 °C	6 A	4.2 kg 9.3 lb	22.9X33.0X8.1 cm 9.0 X 13.0 X 3.2 in
Main	-40°C≤Tamb≤100 °C	5 A	3.1 kg 6.8 lb	22.9X33.0X5.3 cm 9.0 X 13.0 X 2.1
EID	-40°C≤Tamb≤85 °C	20 A	4.1 kg 9.0 lb	30.5X43.2X7.1 cm 12.0 X 17.0 X2.8 in
Main + EID	-40°C≤Tamb≤85 °C	5 A (Main) 20 (EID)	5.9 kg 13.1 lb	30.5X43.2X8.0 cm 12.0 X 17.0 X 3.13
Aux + Main + EID	-40°C≤Tamb≤85 °C	6 A (Aux + Main) 20 A (EID)	6.9 kg 15.3 lb	30.5X43.2X10.2 cm 12.0 X 17.0 X4.0 in

Environmental Ratings

The Large Engine Control is designed for engine-mounting, skid-mounting, and marine industry environmental requirements. Validation tests include extreme operating temperatures, thermal cycles, humidity, pressure washing, fluid resistance, mechanical shock, vibration, and EMC.

Table 2. Environmental Specifications

Storage Temperature	–40 to +120 °C (–40 to +248 °F)
Humidity	95% at +60 °C (+140 °F)
Mechanical Vibration	12.8 Grms (accelerated qualification level)
Mechanical Shock	40 G
CE Compliant	EMC Directive, LVD, ATEX Directive (Zone 2, Group II), RoHS
Enclosure Protection	IP-69k, IP-67
Maximum Altitude	3500m/11,483 ft
Pollution Degree	2 (inside LECM cavity and under completed connectors)

Regulatory Compliance

Ordinary Location listed for the European Union and North America:

EMC, LVD, RoHS and North American 61010-1 (Class 2252 86 and 2252 06).

Hazardous Location listed for the European Union and North America:

Class I Div 2 and Zone 2 Ex nA IIC T4 Gc for North America (Class 2258 82 and 2258 02), EU, and IECEx

Marine Certification to IACS7:

ABS, BV, CCS, DNV, KRS, Lloyds, NKK (others available upon request)

Please see installation manual 26757 for a complete listing of the various compliance and limitations.

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Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world. Complete address / phone / fax / email information for all locations is available on our website.

For more information contact: