

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.

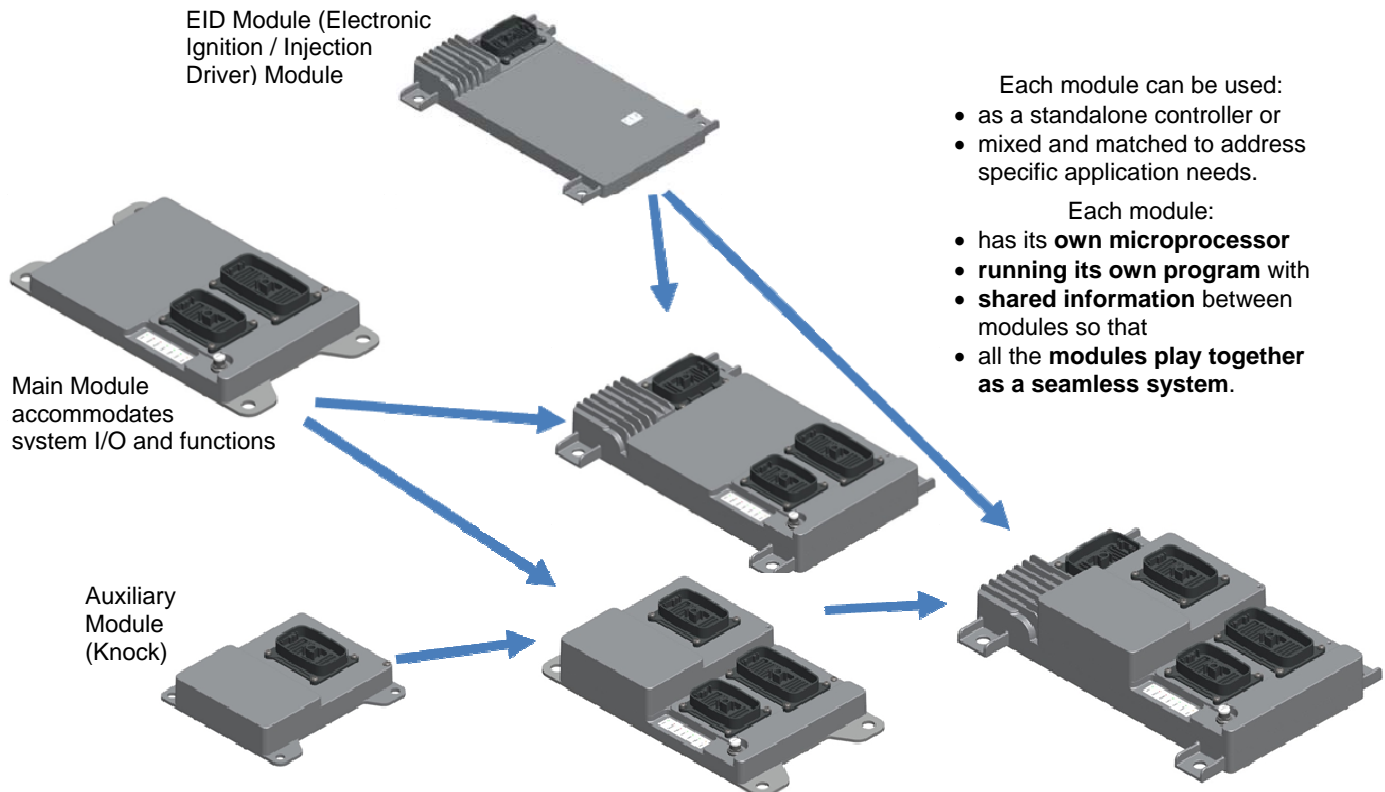
Description

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.



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

Module	Inputs	Outputs
<p>Main Module</p> 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 8 HS digital • 12 LS/PWM digital • 2 analog • 4 HS/LS/PWM digital <p>Communications:</p> <ul style="list-style-type: none"> • 3 CAN • 1 RS-485 • 1 RS-232 • 1 Ethernet
<p>EID (Electronic Ignition / Injection Driver) Module</p> 	<ul style="list-style-type: none"> • 2 VR/HE/PWM speed sensors • 1 additional Hall Effect/PWM speed sensor • 2 digital jumpers 	<ul style="list-style-type: none"> • 1 HS digital • 20 electronic ignition/injection drivers <p>Communications:</p> <ul style="list-style-type: none"> • 2 CAN
<p>Auxiliary Module</p> 	<ul style="list-style-type: none"> • 24 knock, pressure, or T/C • 2 VR/HE/PWM speed sensors • 2 digital jumpers 	<ul style="list-style-type: none"> • 2 HS digital • 2 analog <p>Communications:</p> <ul style="list-style-type: none"> • 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.

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.

Configuration	Operating Temperature	Current
Aux	-40 to +105 °C	0.8 A
Aux + Main	-40 to +100 °C	6 A
Main	-40 to +100 °C	5 A
EID	-40 to +85 °C	20 A
Main + EID	-40 to + 85 °C	5 A (Main) 20 A (EID)
Aux + Main + EID	-40 to + 85 °C	6 A (Main + Aux) 20 A (EID)

Storage Temperature	-40 to +125 °C
Humidity	95% at +60 °C
Mechanical Vibration	US MIL-STD 202F, Method 214A, TC(D) 0.1 G ² /Hz, 10–2000 Hz, 12.8 Grms, 3 hrs/axis
Mechanical Shock	40 G, 11 ms saw tooth pulse, 6/axis/direction
Enclosure Protection	IP69K

Regulatory Compliance

European Compliance for CE Marking:

EMC Directive:	2014/30/EU and 2004/108/EC
ATEX Directive:	94/9/EC Zone 2, Category 3, Group II G Ex nA IIC T4 Gc IP54
Low Voltage Directive:	2006/95/EC
RoHS:	2011/65/EU

International Compliance:

IECEX: CSA 14.0047X (Ex nA) for Zone 2, Category 3, Group II G, Ex nA IIC T4 Gc IP54

North American Compliance:

CSA: CSA Certified for Class I, Division 2 and Zone 2, Groups A, B, C, and D, T4 at the rated ambient temperature, for use in Canada and the United States.
CSA Certified for Class I, Zone 2, Category 3, Group II G, AEx nA IIC T4 Gc IP54

General Compliance:

Please see installation manual 26757 for installation constraints on cable lengths, power bus structure, grounding and shielding requirements.

Future Compliance Planned:

American Bureau of Shipping, China Classification Society, Lloyd's Register of Shipping, Nippon Kaiji Kyokai. Others available upon customer request.



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