

**Oxygen Sensors**

**NOTE:** It is critical that the Oxygen Sensors are mounted per the instructions below. The exhaust system **MUST** be properly sealed – any leak near the sensors (upstream or downstream) can cause incorrect operation of the fuel control system. Vehicle performance and/or driveability may be affected if sensors are not mounted as recommended or if an exhaust leak exists. Leak check the exhaust system to ensure adequate sealing (even small leaks can affect fuel control).

Oxygen sensors should be mounted in the collector area of the headers or manifolds in a location that allows exhaust from all cylinders to be sampled equally (stock exhaust manifolds include a mounting boss for the oxygen sensors). Be sure the connectors and wiring are routed away from high heat areas. The oxygen sensors should be mounted with the sensor tip pointing between horizontal and fully downward – do not mount with the tip oriented upward. Weld in the mounting bosses supplied (7/8" hole) if using headers.

**Engine Wiring Harness**

The following lists the engine and vehicle side connections. Optional circuits are described in the 'System Features' section below:

**NOTE:** A Malfunction Indicator Lamp (MIL) is mounted inside the fuse/relay center. A redundant MIL output is also available in the 12-way bulkhead connector (see Bulkhead Connector Outputs below) – it is recommended that a MIL also be installed in a visible location in the passenger compartment.

**Connections Required for Correct Operation**

Coolant Sensor	Connector
Mass Air Flow (MAF) Sensor	Connector
Camshaft Position Sensor	Connector
Electronic Throttle Control	Connector
Manifold Absolute Pressure (MAP) Sensor	Connector
Oxygen Sensors (2 total)	Connectors
Knock Sensors (2 total)	Connectors
Ignition Coil Blocks (2 total)	Connectors
Fuel Injectors (8 total)	Connectors
Crankshaft Position Sensor	Connector
Accelerator Pedal Sensor	Connector
Ignition Switch Input (Wire)	Wire
Fuel Pump Control (Wire)	Wire
Engine Grounds (3 total)	Eyelets
Battery Power (Stud at Fuse/Relay Center)	Stud at Fuse/Relay Center

**Optional Connections (Not required for operation)**

Cooling Fan Control	Wire
Alternator Control	Connector
Engine Oil Pressure Sensor	Connector
Vehicle Speed Sensor	Connector
Optional User Outputs	Bulkhead Connector (12-way)

Connect all engine/vehicle-side connectors before connecting the harness to the ECM. All engine/vehicle-side connectors are functionally labeled, consult a service manual if necessary to determine connection locations (see following service manual information). It may be easier to install the harness on the engine before installing the engine into the vehicle.

The harness includes a fuse/relay center containing all required fuses and relays, and also a 12-way bulkhead connector (with sealed mating connector) which contains outputs that may be useful to the user (see 'Bulkhead Connector Outputs' section below). The fuse/relay center should be mounted as high in the engine compartment as possible to avoid unnecessary splash and road debris. Likewise, keep the 12-way bulkhead connector and diagnostic link connector (both connect from the fuse/relay center) as high and protected as possible. The 3 ECM connectors are indexed to connect only in the correct locations. Install by pressing down firmly until the connector is seated, then pull the top slider bar down until it snaps and locks into place. The bar should slide easily and will not move unless the connector is seated properly, do not use excessive force.

Attach the harness ground eyelets (3 total) to the engine block, ensuring the connections are clean and secure, and attach the fuel pump wire from the fuse/relay center to the power side of the pump (this feed is fused and relay-controlled from the ECM). **Make sure all intended engine and vehicle side connections have been made before proceeding to connect power.** Attach a 12 volt ignition switch feed from the vehicle to the pink ignition switch wire in the harness (this is required to enable the proper power-up sequence of the ECM). This can be routed into the passenger compartment with the accelerator pedal connector and diagnostic link connector.

Next, connect battery power (minimum 8 gauge wire ) to one of the studs on the fuse relay center (3 studs are available, only 1 is required to be connected), and the harness installation is complete. **However, read the 'System DOs and DON'Ts' section below before attempting to start the vehicle. Note that if the engine will not come off idle after the control system installation, check for an illuminated MIL (malfunction indicator light, which is located in the fuse/relay center) which indicates stored fault codes. Check for codes and make any required repairs if the MIL is illuminated (typically an accelerator pedal or electronic throttle wiring issue), consult a service manual if necessary.** Additional features and bulkhead connector descriptions are also included below.

**LS Series Crate Engine Control System**      **REV 010C07**      **PARTNO. 19171935**      **SHEET 2 OF 12**

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DATE	REVISION	AUTH	DR

**TITLE**      **INSTALLATION INSTRUCTIONS**  
**LS Series Crate Engine Control System**

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