



GESTIONE ELETTRONICA MOTORI DIESEL

290/295 - Ducato FL 2014

DIESEL ENGINES ELECTRONIC MANAGEMENT - DESCRIPTION

An electronic control system supervises and governs all engine parameters to optimise performance and fuel consumption by means of a real-time response to different operation conditions.

The concerned diesel engine are equipped with a COMMON RAIL type injection system.

This features the use of an electronically controlled high injection pressure. The supply of fuel, known as the pilot injection, is optimised by the electronic control unit by means of the injector, rather than being managed by the pump.

In this version with 4 valves per cylinder, the "COMMON RAIL" injection system uses "MultiJet II" technology.

In the previous MultiJet versions, the injector - capable of carrying out 5 consecutive injections during the same combustion cycle - was based on a hydraulic servo valve with unbalanced shutter, which required reduced sealing diameters and longer travels.

In the new MultiJet II injection system, the injector shutter is hydraulically balanced resulting in greater sealing diameters and reduced shutter travels. Thanks to this new servo valve, the quantity of fuel injected in the combustion chamber can be controlled more precisely and quickly. Up to 8 consecutive injections can be managed with very precise measurement.

This new injection mode ensures considerable advantages in terms of reduction of noise, fuel consumption and emissions.

The throttle body is also controlled electronically by the control unit: the throttle opening is calculated in accordance with a specific logic inside the engine control module.

The concerned engine (130 HP version) is provided with fixed geometry turbine with manifold differential pressure regulation solenoid valve.

Depending on the signals received from numerous sensors, the control unit manages the injectors connected to it, handling the following systems:

- fuel supply;
- air delivery;
- glow plugs;
- accelerator pedal;
- engine cooling;
- oil vapour heating;
- emission control (oxygen sensors, catalytic converter and particulate filter);
- E.G.R. control (on high and low pressure circuits).

For this version the diesel filter is available with a heater coil which prevents the filter paraffin from hardening when the outside temperature is particularly low (temperatures much below 0°C). This device thus prevents the failed vehicle starting during particularly cold days.

To comply with the most recent emission control regulation (EURO 6), the most recent electronic on-board management version is used that comprises new components (injectors, pressure regulator, pressure pump, two EGR modules and digital air flow meter) and the adoption of two oxygen sensors, one upstream and one downstream of the catalytic converter/periodic trap oxidizer (D.P.F.) assembly.

The oxygen sensors improve the air/fuel mixture in the combustion chamber regulating the flow of air: with the throttle open the power supply is at a maximum; closing the throttle gradually reduces the load, the engine rpm and also the emissions.

For this version (Euro 6 "Full") the exhaust gas recirculation system (EGR) has been extensively modified to permit the engine management to comply with the latest pollution control regulations during operating conditions.

The system as a whole can be considered as divided into two parts:

- an EGR valve on the high pressure side, called EGR HP (High Pressure);
- an EGR valve on the low pressure side, called EGR LP (Low Pressure).

In addition to the two oxygen sensors, a complex exhaust gas post-treatment system with a next-generation catalytic converter and periodic trap oxidizer (D.P.F. - Diesel Particulate Filter) is used. The system has four temperature sensors and one pressure sensor; for more details

E5070 PARTICULATE FILTER SYSTEM

Thanks to the electronic management described above, this engine carries out a continuous check according to the EOBD system (European On Board Diagnosis): this system allows continuous diagnosis of emission-related components and notifies the driver if any of the components should deteriorate by turning on a warning light in the instrument panel.

The aim of the system is to:

- monitor system efficiency;
- indicate an increase in emissions due to malfunction;
- indicate the need to replace damaged components.

The system is also controlled by dedicated relay switches in the engine compartment junction control unit. Lines supplying the control unit and various system components (sensors and actuators) are protected by dedicated fuses that are also located inside the engine compartment junction unit.

DIESEL ENGINES ELECTRONIC MANAGEMENT - FUNCTIONAL DESCRIPTION

Engine management control unit M010 controls and governs the entire electronic ignition and injection system.

The ignition-operated power supply (15/54) arrives through a line protected by fuse F16 of the engine compartment relay module box B001 (pin 9 of connector C) at pin 75 of connector B of M010.

The main injection relay switch T09 of the control unit B001 manages the whole system: its coil is directly supplied by the battery through the line protected by fuse F18 of the engine compartment junction unit. The same power supply reaches pin 91 of connector B of M010.

This relay switch is energised by an (earth) control signal from pin 88 of connector B of the Powertrain Control Module M010 and then forwards a power supply:

- to pins 1, 3 and 5 of connector B of the control unit via a line protected by fuse F22 of B001 (pin 18 of connector C);
- to pin 42 of connector B of the control module itself (engine control module power), to the manifold differential pressure regulation solenoid valve L037, the oxygen sensor heating resistors upstream of the K040 catalytic converter and downstream of the periodic trap oxidizer (D.P.F.) K246, to the glow plug heating control module M015 (pin 6) and to the engine oil sensor signal control module M186 (pin 1), by means of the line protected by the fuse F11 of B001 (pin 7 of the connector C).

The plug preheating control unit M015 (pin 11) receives a direct battery power supply via the line protected by fuse F02 of the engine compartment junction unit B001 (pin B of connector B).

The electric fuel pump relay switch T10 of junction unit B001 provides a direct battery power supply to the electric fuel pump N040 - pin 1 - along the line protected by fuse F21 of the engine compartment junction unit B001 (pin 16 of connector A).

The coil is energised by pin 69 of connector B of the Engine Control Module M010; the coil for relay switch T10 receives a reference earth, via pin 11 of connector C of the engine compartment junction unit B001, coming from the NC contact for the inertia switch I050 (pin 3).

In the case of an impact the inertia switch opens, no longer supplying the reference earth to the coil for relay switch T10 and thereby interrupting the activation of the electric fuel pump N040 and the additional electric heating pump N044.

E6015 ADDITIONAL HEATER

In the same way, pressing the button for automatic intervention in danger conditions H134 (if present) interrupts this earth signal, energizing the coil and causing the change in status of the internal contact of the dedicated relay of junction unit B046.

The intervention of the inertia switch I050 and/or pressing the button for automatic intervention in danger conditions H134 (if present) also causes the electrical power supply for the injection system to be cut off and the activation of several safety functions.

E1010 POWER SUPPLY

Pins 2, 4 and 6 of connector B of M010 control unit are connected to the injection control unit earth C060.

The plug preheating control module M015 is connected, via pins 1, 2, 3 and 4 to the glow plugs A040 A, B, C and D and via pins 7, 9 and 10 to pins 28 (earth reference), 38 (preheating time/fault detection feedback) and 57 (plug preheating signal) of connector B of the engine control module M010.

Powertrain Control Module M010 receives signals from the various sensors, thereby keeping all the engine operating parameters under control.

The oxygen sensor K040 upstream of the catalytic converter-periodic trap oxidizer (D.P.F.) sends signals to pins 59 and 77 of connector B of M010 while pin 60 of the same connector provides a reference earth. Sensor K040 is heated by a coil to ensure efficient operation even when cold. The resistance is supplied by the line protected by fuse F11 of B001 and receives an earth signal from pin 41 of connector B of control module M010.

The second oxygen sensor K246 downstream of the catalytic converter-periodic trap oxidizer (D.P.F.) sends signals to pins 62 and 80 of connector B of M010 while pin 63 of the same connector provides a reference earth. Sensor K246 is also heated by a coil to ensure it works efficiently even when cold. This resistance is supplied by the line protected by fuse F11 of B001 and receives an earth signal from pin 58 of connector B of control module M010.

The EGR solenoid valve L030 controls gas recirculation in the high pressure intake circuit; it recirculates part of the unburnt exhaust gases coming from the exhaust manifold in the intake manifold. The EGR solenoid valve L030 is controlled by two signals (positive and negative) respectively from pins 85 and 64 of connector A of M010; the position sensor integrated into the solenoid valve L030 receives a power supply and earth from pins 40 and 92 and returns a position signal to pin 68 of connector A of M010.

Similarly, the EGR solenoid valve L118 controls the recirculation of exhaust gas in the low pressure circuit; it recirculates (upstream of the compressor) part of the exhaust gas pretreated by the DPF. Also the actuator control solenoid valve L118 is controlled by two signals (positive and negative) from pins 87 and 66 of connector B of M010, respectively; the position sensor integrated into the solenoid valve L118 receives a power supply and earth from pins 21 and 7 and returns a position signal to pin 31 of connector B of M010.

The engine oil control module M186 is powered (pin 1) from the line protected by fuse F11 of B001 and connects (pin 4) to the front left earth C010 (connector A).

It receives to pin 3 (positive) and 6 (negative), the data from the engine oil level sensor K032, and sends these signals, from pin 2 (signal level oil) and 5 (earth signal), to the M010 control module (respectively 36 and 79 pin connector A)

The engine rpm sensor K046 supplies, through frequency signals exchanged with pins 63 (negative) and 62 (positive) of connector A of M010, information on engine speed.

Timing sensor K047 is supplied from pin 18 of connector A of M010; this receives a reference earth from pin 94 of connector A, and sends a signal with frequency corresponding to the phase to pin 34 of connector A of the control unit.

The engine coolant sensor K036 receives a reference earth from pin 97 of connector A of control unit M010 and sends a signal proportional to engine coolant temperature to pin 91 of connector A of the control unit.

The control unit M010 receives - at pin 8 of connector A - a signal from the minimum engine oil pressure sensor K030.

The mass airflow sensor (air flow meter) K041 receives a reference earth from pins 20 and 33 of connector A of control module M010, respectively, and sends a signal proportional to the air flow rate to pin 51 of connector A. An air temperature sensor inside K041 also sends an air temperature signal to pin 9 of connector A of M010.

Accelerator pedal K055 contains two built-in potentiometers (a main one and a safety one). The former receives power and earth respectively from pins 35 and 52 of connector B of M010 and sends a corresponding signal to pin 68 of the same connector. The latter receives power supply and earth respectively from pins 37 and 78 of connector B of M010 and sends a corresponding signal to pin 87 of the same connector.

According to the signal from accelerator pedal K055, control unit M010 controls the throttle opening by means of a motor built into throttle body N075. The internal solenoid valve chokes and closes the throttle, for example when the engine is turned off. It is controlled by two signals from pins 65 and 86 of connector A of M010. Pins 75, 42 and 47 of connector A of M010 manage the solenoid valve control function.

The water in diesel filter sensor, integrated in the diesel filter K101, receives an ignition-operated supply (INT) from fuse F51 of the Body Computer M001 (pin 7 of connector C) and is connected to the front left earth C010 (connector A), sending the corresponding signal to pin 51 of connector B of control module M010.

The fuel temperature sensor, incorporated in the diesel filter K101, detects the temperature of the incoming diesel fuel. It receives a reference earth from pin 61 of connector B of control module M010 and sends the same fuel temperature signal to pin 71 connector B.

The diesel filter heating resistance K101 (pin 1) is regulated by relay switch T20 of the junction unit B001 (pin 18 of connector A) and receives the reference earth (pin 2) of the left front earth C010 (connector B).

The power contact of the relay switch is supplied directly by the battery via the line protected by fuse F04 of engine compartment junction unit B001 (pin B of connector D).

The coil of T20, ignition-operated (INT/A) by Body Computer M001 (pin 3 of connector D), is connected to earth C010 of the front engine compartment (connector B) through pin 17 of connector A of engine compartment junction unit B001.

Sensor K044 measures the air pressure and the temperature in the intake chamber, downstream of the turbocharger. It is supplied by pin 16 of connector A of control unit M010 and receives a reference earth from pin 69 of the same connector. The signal corresponding to the pressure value is sent to pin 74 of connector A of control unit M010. An air temperature sensor, housed in K044, sends a signal to pin 5 of connector A of M010.

Fuel pressure sensor K083 supplies the injection control unit with a feedback signal to modulate injection pressure and duration. It receives power and a reference earth respectively from pins 39 and 29 of connector A of Powertrain Control Module M010 and then sends a pressure signal to pin 72 of the same connector.

The fuel pressure regulator on the N077 pump controls the high pressure produced by the pump itself; the two control signals come from pins 88 and 67 of connector A of control module M010.

The manifold differential pressure regulation solenoid valve L037 adjusts the turbocharger operation according to the engine load: it is supplied by the line for fuse F11 of B001 and is controlled by a negative signal from pin 11 of connector A of control module M010.

The Powertrain Control Module M010 controls the opening of the individual injectors N070, through dedicated signals sent from pins 2-23 (cyl. 1), 3-24 (cyl. 2), 4-25 (cyl. 3), 87-22 (cyl. 4) of connector A.

The clutch pedal switch I031, with analogue potentiometer, receives supply and reference earth respectively from pins 34 and 67 of connector B of the Powertrain Control Module M010 and provides the pedal position signal (from maximum extension with pedal pressed to pedal released position) to pin 89 of the same connector.

Pin 43 of connector B of control module M010 receives an NO signal from the switch on brake pedal I030, provided by an ignition-operated supply (INT) via a line protected by fuse F42 of the Body Computer M001. The latter receives the same signal at pin 57 of connector D.

Body Computer M001 receives an NC signal from the switch on brake pedal I030 at pin 11 of connector D. This also has an ignition-operated supply (INT) via a line protected by fuse F37 of the Body Computer. The latter forwards this signal to the control unit M010 through the C-CAN.

The control unit M010 is then connected via the CAN - pins 30 and 31 of connector B - to the Body Computer M001 - pins 38 and 37 of connector D - and to the other network nodes; information is sent, via this connection, for the management of the indicators and warning lights in the instrument panel E050, in particular for the management of:

- rev counter;
- engine coolant temperature gauge and warning light;
- minimum engine oil pressure warning light;
- heater plug warning light;

- Injection system/EOBD failure warning light;
- "general failure" warning light and corresponding icon on display (where provided) lit up for the failure of the engine oil pressure sensor or the operation of the inertia switch.
- "water in diesel filter" icon.

E4010 INSTRUMENT PANEL

The control unit M010 receives a speedometer signal generated by the braking system control unit M051 via the C-CAN.

It is also connected:

- from pins 90, 22 and 11 of connector B to manage the engine cooling fans;

E5020 ENGINE COOLING

- from pins 16, 72, 66 and 40 of connector B for managing the compressor engagement function;

E6021 COMPRESSOR ENGAGEMENT

- from pins 19, 44, 49, 27, 65, 50, 70, 48 and 55 of connector B and from pins 32 and 48 of connector A, to manage the post-treatment function of exhaust gas;

E5070 PARTICULATE FILTER SYSTEM

- from pin 28 of connector A, with the alternator A010 for management of the insufficient battery charge/alternator fault (D+) signal;

E5010 STARTING AND RECHARGING

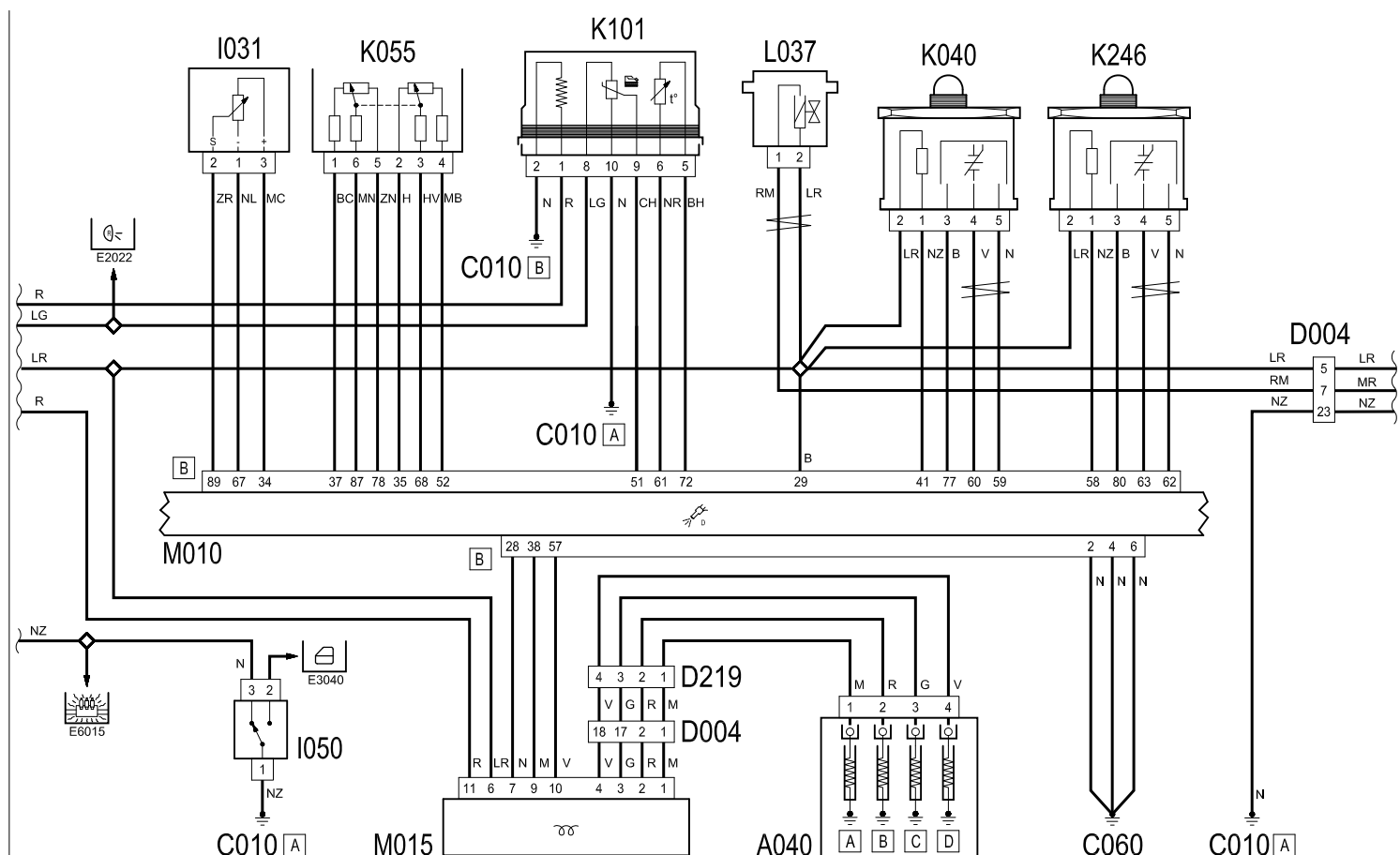
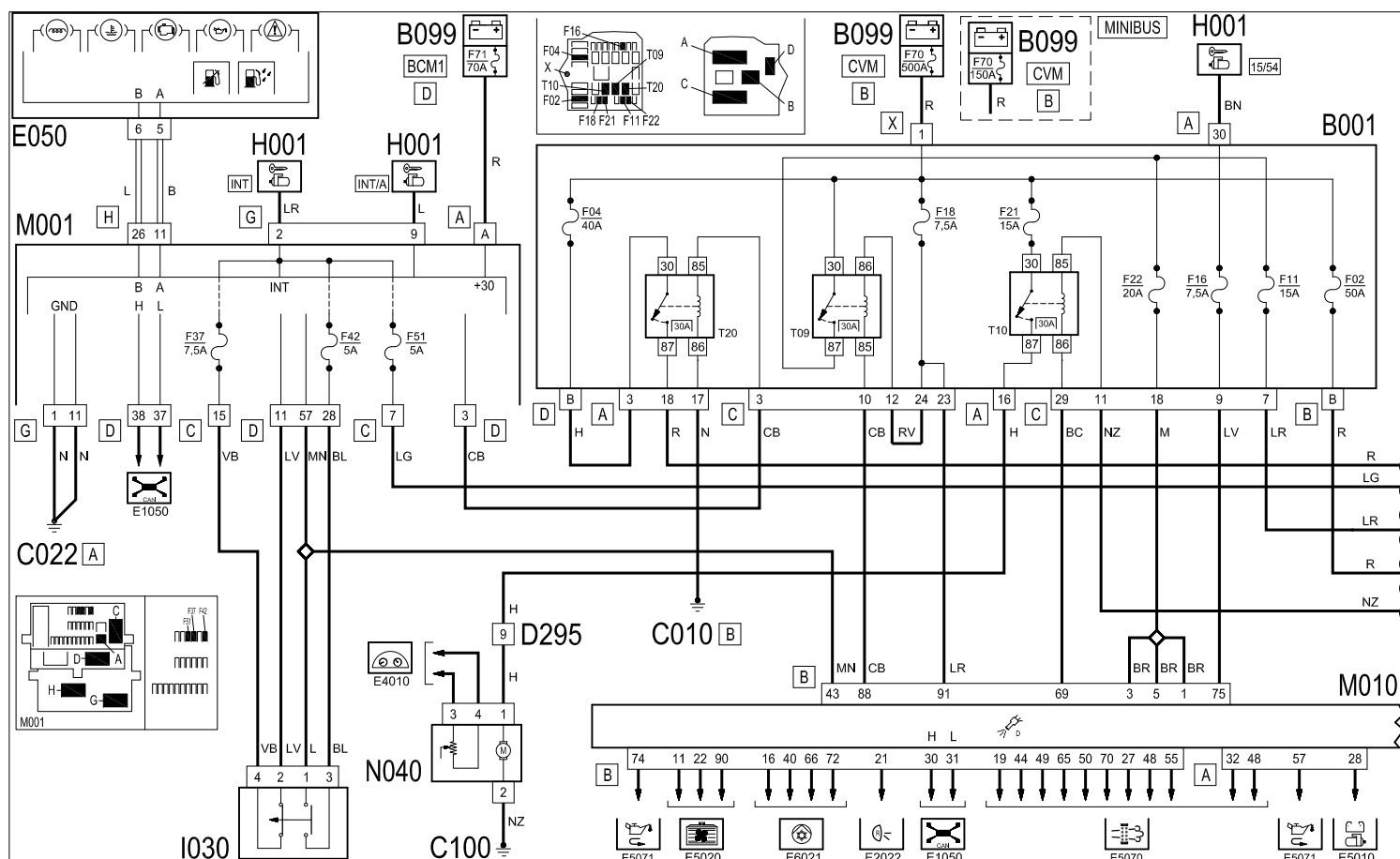
- from pin 21 of connector B, with the reversing switch I020;

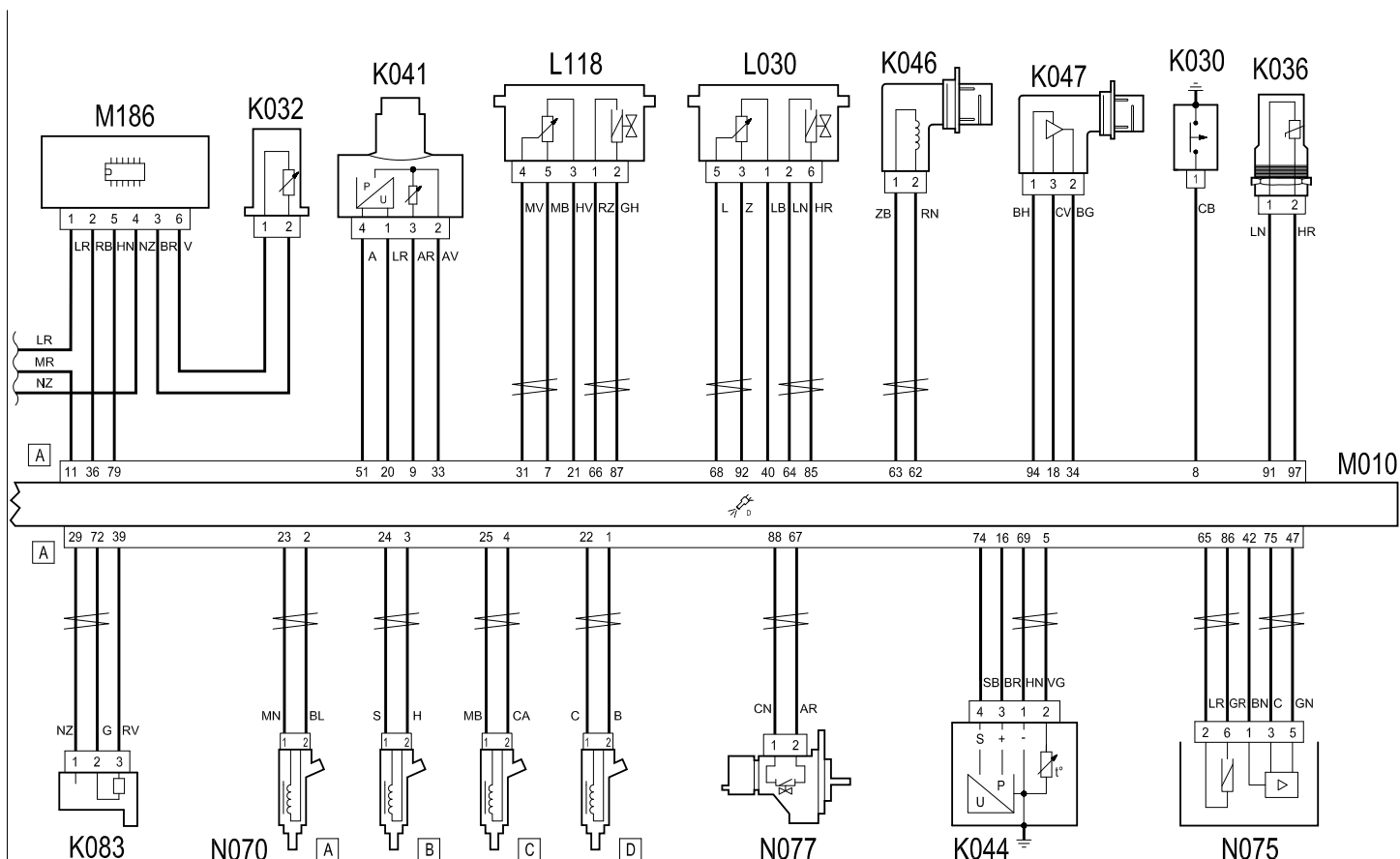
E2022 REVERSING LIGHTS

- from pins 74 of connector B and 57 of connector B for the management of the blow-by oil vapour heating system function.

E5071 OIL VAPOUR HEATING SYSTEM

DIESEL ENGINES ELECTRONIC MANAGEMENT - WIRING DIAGRAM





8/8

