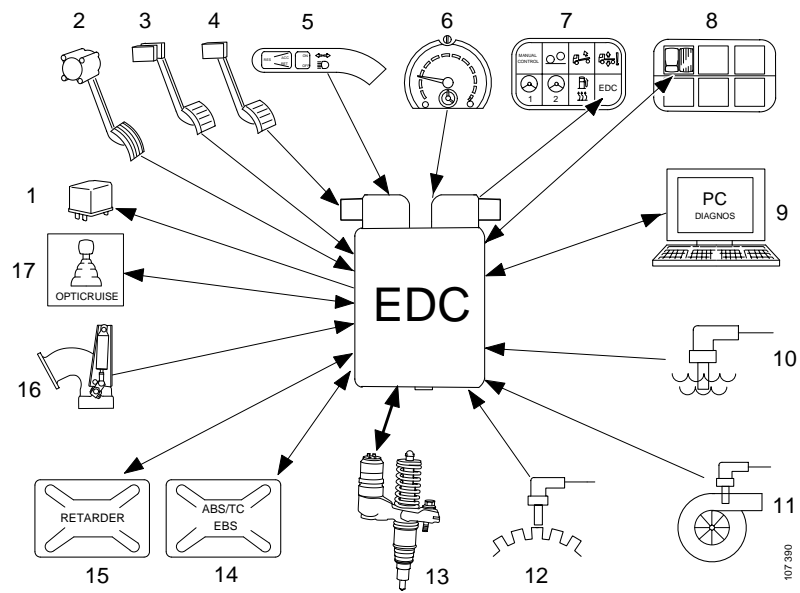


General troubleshooting of electronic control systems



Contents

General troubleshooting of the electronic control system	Background	3
	Tools	4
	Training	4
	Structure of the control system	5
	How to conduct fault diagnosis	6
	Checking wires and connections	7
	The control unit may become damaged	10
	Before replacing the control unit	10
	Warranty claims	11

General troubleshooting of electronic control systems

Background

The trend is towards an ever increasing use of electronics in the vehicle's control system.

Finding the cause of a fault in electronically controlled systems can be difficult without the right tools and skills. Common practice is to replace the control unit first, believing that this will rectify the fault.

Extensive study of control units returned under warranty has shown that some of these are not in fact faulty. Replacement has therefore been unnecessary. This indicates that troubleshooting has not found the actual fault. The fault itself has in the majority of cases been later discovered in parts of the system other than the control unit.

In most cases, the fault is in connections, wiring networks or other parts of the system which have been affected when the control unit was replaced.

Tools

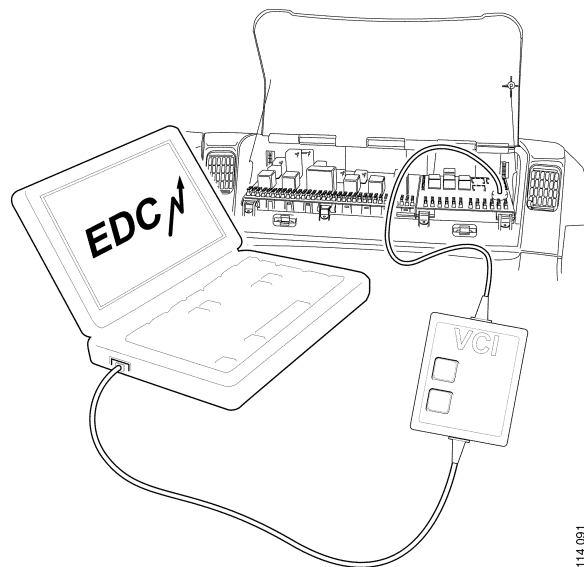
For troubleshooting the vehicle's electronic system, we recommend the following Scania equipment:

- Scania Diagnos SD2.
- Scania Programmer SP2. It is important that the software used in SD2 and SP2 is kept up to date.
- Instructions in the form of function and work descriptions and wiring diagrams
- Multimeter instrument kit 588 094. When measuring voltage or resistance, only a multimeter instrument may be used.

Training

When troubleshooting electronic systems, you should:

- Know how the systems work and how they interface.
- Know how to use SD2.



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The structure of the control system

An electronic control system comprises actuators, sensors and one or more control units.

The actuators control the various functions of the system, for example, the path of the control rod. Another task is to activate warning lamps and control lamps.

Sensors provide the control unit with information, for example, on the position of the accelerator or on the vehicle's speed.

The control unit reads signals from sensors and activates actuators. It can generate and store fault codes in the event of a fault in the system. Faults can be unpermitted values, open circuits or short circuits.

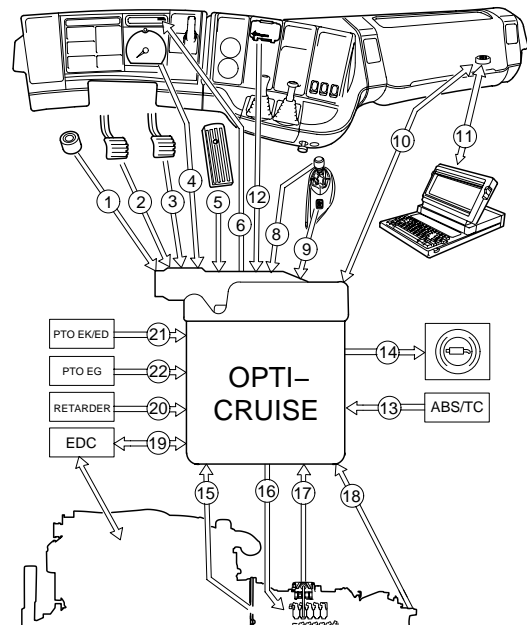
The voltage level in the systems varies between 0 and 24 V. This means that the wiring network between the sensors, control unit and actuators must be fault-free for the system to work correctly. The wiring network and its connectors is a common source of faults in electronically controlled systems.

In addition to the above, the systems can contain mechanical, hydraulic or pneumatic components.

When troubleshooting, it is important to view the systems as an interactive whole. View all components as possible sources of faults.

The systems communicate via data in the CAN network. For more information, see under the appropriate system description, for example in booklet 03:02-01.

Using Scania Diagnos 2, you can control the function of most of the actuators in the system by activating the appropriate component. You can also control the function of most of the sensors by reading the value from the sensors.



A system is often connected to other interacting systems.

How to conduct fault diagnosis

- 1 Ask the driver if he has experienced anything abnormal. Try to build up a complete picture of the problem.
 - Symptoms of the fault.
 - Which function is not working?
 - Under what circumstances does the fault occur?
 - How often has the fault occurred?
 - If the control lamp came on, did it go out by itself?
 - Has anyone erased any fault codes?
 - Has anyone already tried to repair the fault? If so, what did he do?
 - 2 Check whether the function in question should be present on the vehicle. If it is possible to program using Scania Programmer 2, check that the control unit has been correctly programmed.
 - 3 Read off the fault codes from all systems, using Scania Diagnos 2. Note all fault codes.
 - 4 Determine whether the driver's description of the problem agrees with a displayed fault code.
 - The way in which the control unit shows faults is to store and display fault codes. The fault code indicates in which circuit(s) a fault has been recorded.
 - The fault may affect several functions, sometimes in other systems. For example, the accelerator sensor is connected to the EDC control unit and further connected to the Opticruise. A faulty gearchange may be caused by a faulty signal from the accelerator sensor the fault code of which is shown in the EDC control unit.
 - 5 Check which components are part of the faulty function. Don't forget the mechanical, pneumatic and hydraulic components.
 - 6 If there is no stored fault code which corresponds to the symptoms of the fault, continue troubleshooting for faults which do not signal a fault code. Use the work and function descriptions and the wiring diagram for continued troubleshooting.
- Common faults for symptoms which do not signal a fault code are:
- Poor contact between pins in a connection.
 - Poor contact between a wire and terminal.
 - Mechanical fault in a component.
 - Incorrect voltage level.
- 7 Once the assumed fault has been rectified, erase the fault codes. Try to recreate the situation in which the fault code was generated. Check if the fault code is regenerated. Scania Diagnos 2 shows the conditions under which the fault code is formed.

Checking wires and connections

Sources of faults in the wiring network

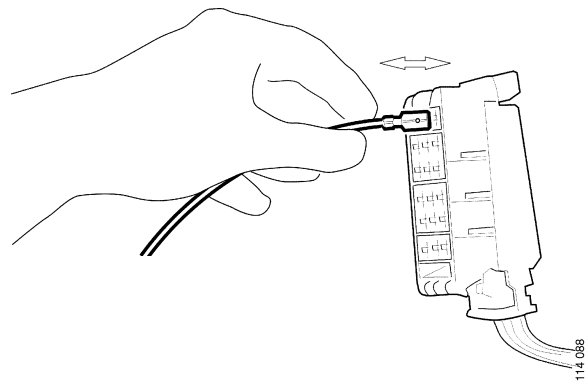
- Wiring in a damp environment, especially if this involves a connection, can cause a drop in voltage. Take into account the conditions the vehicle is subjected to in operation.
- Stretched or trapped wires can cause intermittent faults.
- A wire connected to a coil can generate a magnetic field and cause interference.

Always look for previous repairs. Faulty joins, connections or faulty conductor areas are common sources of faults.

Connections

Check pins and connections for the following:

- that the pin is not damaged.
- that the connection is properly put together.
- Feel that the pin is securely located in the connection.
- With a loose male pin check that the female pin makes good contact and that the pin is securely located if the male pin is gently pulled.
- That the pin is not corroded.



Open circuit in the wire

In the event of an open circuit, one or more functions fail. The open circuit can be on the wire itself or in the connection.

Check as follows:

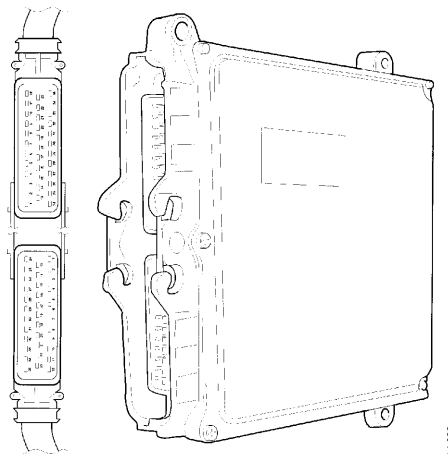
- Disconnect the wire at both ends.
- Measure the resistance using an ohmmeter across the ends of the wire.
- The ohmmeter must show 0 Ohm or a very low value.

Open circuit in the connections

The open circuit can be caused by a poor contact in connections.

Check:

- Always check the pins in the connections and on the control unit when measuring a circuit. The pins should not be bent or damaged in any way.



Intermittent faults

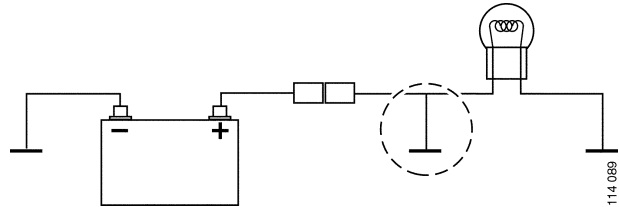
- Gently shake the wires when measuring.
- Bend the wiring network during measurement.
- Gently pull the connections so that the pin and contacts move.

Short circuit to ground

If a wire is short-circuited to ground, a function will probably stop working, a fault code may be generated or a fuse will blow.

Check as follows:

- Remove the connections from both ends of the wire
- Check pins and connections to ensure that pins in a connection are not bent.
- Measure the resistance using an ohmmeter between the wires.
- The ohmmeter will show an infinite value if no components are connected.

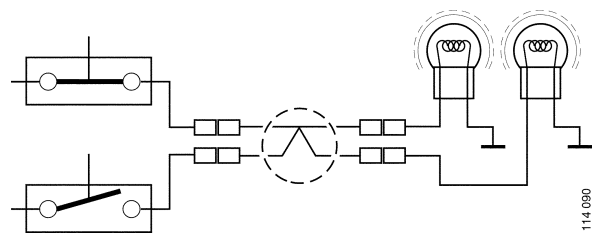


Short circuit to voltage supply

If a wire is short-circuited to voltage supply in a damaged wiring network, a function will probably receive voltage at the wrong time or at the wrong voltage level. The control unit may receive signal voltage at the wrong time and a fault code may be generated.

Check as follows:

- Remove the connections from both ends of the wire
- Check pins and connections to ensure that pins in a connection are not bent.
- Measure the resistance using an ohmmeter between the wires.
- The ohmmeter will show an infinite value if no components are connected.



The control unit may become damaged:

- if the engine is started without the battery being securely connected.
- if the battery is disconnected when the engine is running.
- if the control unit is removed without the power being switched off with the starter key.
- if the battery is connected to the vehicle's electrical system when boosting or electric welding.
- if a pin in the control unit which is not normally connected is powered or grounded.

Before replacing the control unit

Experience has shown that some control units which have been replaced and returned under warranty are not faulty. In such cases, replacement has not rectified the actual fault.

When troubleshooting faults both with and without fault codes, it is only natural to assume that the control unit is faulty. Therefore, take into account the following points before assuming that the control unit is the cause of the fault:

- 1 Deterioration in the performance of an engine is seldom caused by the control unit. Check sources of faults such as escaping exhaust, low-quality fuel, low fuel pressure and faulty sensor values before replacing the control unit.
- 2 Check that a mechanical fault in one of the components has not caused the fault code in question or the symptom.
- 3 Check that the control unit has the correct voltage supply and ground point. Check that the sensor's and control unit's earth is correctly connected.
- 4 Check that components have the correct voltage supply.
- 5 Check that the pins are securely located in the control unit's connector.
- 6 Erase fault codes and take a new reading.
- 7 If the fault code is still present and you think the fault is in the control unit, test the vehicle as follows:
 - Replace the control unit.
 - Try to recreate the situation in which the fault code was generated.
 - If the original fault code is regenerated, the control unit is probably not faulty.
 - If the fault code is not regenerated, reinstall the original control unit. Continue troubleshooting the wiring network and components. A fault code can disappear after replacing the control unit. This does not necessarily mean that the fault is rectified. The fault code may return after driving for some time or above a certain speed depending on the conditions in which the fault code was generated. See the instructions in Scania Diagnos 2. If the fault code returns, the control unit is not faulty and the fault is in a sensor, the wiring network or an actuator.
- 8 Check that the symptoms of the fault have been rectified before returning the vehicle to the customer.

Warranty claims

There are special documentation rules for control units returned under warranty, see the warranty instructions.

In the case of warranty, note all fault codes and parts replaced for test reports to be made.