Foreword

The Multi-Tester plus/pro software cassette is the component that gives the diagnostic equipment its unique test characteristics: All data required to make the test system operate are stored on the software cassette.

The software cassette can be easily replaced enabling the Multi-Tester plus/pro to be rapidly adapted to the trouble-shooting job at hand.

These Trouble-Shooting Instructions describe how to use the equipment on Bosch fuel injection systems type LE/LE2/LU-Jetronic.

Multi-Tester plus/pro checks all input and output signals that have bearing on the control system and can also diagnose a faulty control unit.

Contents

System Description

General

The LE/LE2/LU-Jetronic system is a development of the earlier Bosch L-Jetronic fuel injection system. LE is the German designation of the European version of their air flow meter, with LU being the designation of the US version, i.e. a system incorporating a lambda sensor and lambda correction in the control unit.

This system measures the volume of air inducted. The measurements must therefore be corrected to allow for air temperature and a separate air temperature sensor is used to do this. This provides the data required to arrive at the amount of fuel to be injected as determined by the lambda sensor and the corrections it makes in the control unit.

Summary - Car Models

The following car models are equipped with LE/LE2/LU Jetronic:

BMW	CITROËN	VAUXHALL	OPEL
320i	Visa GTi	Astra GT/E & 1.8i	Manta-B GT/E
323i	CX 25	Belmont 1.8i	Rekord 2000i
318i	CX 25 Turbo 2	Cavalier 1800	Rekord 2.2i
518i		Carlton 2000i	Senator 2.5E
520i		Carlton 2.2i	& 3.0E
525i			Monza 3.0E
528i			
628 CSi			
728i			

VOLVO	PEUGEOT	FIAT	LANCIA
360 GLE/GLT	205 GTi 1.6/CTi	Uno Turbo ie	Thema 2000 ie
	205 GTi 1.9	Croma 2000 ie Turbo	Thema Turbo ie
	309 XS/SRi/GTi		Delta HF 4¥4
	505 GTi		

Please check the workshop manual to verify if the actual car is equipped with a system described in this manual.

Sensors, signals and switches

- Air-mass meter or air flow sensor – measures the air volume ingested.
- Coolant temperature sensor.
- Throttle switch – indicates idling and full-load.
- Lambdasensor – measures the oxygen content of the exhaust gases.
- Air temperature sensor – measures the temperature of the air ingested.
- Rpm data are received from the ignition system via Terminal 1 pulse from the coil.

Control functions

- Control of injection valve(s).
- Fuel metering.
- Lambda control – only in the LU system.

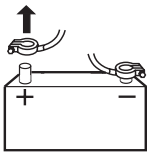
Users Guide

Connection of equipment

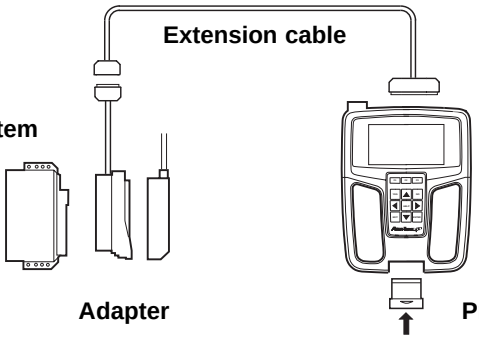
1. Preparations

Turn off ignition!

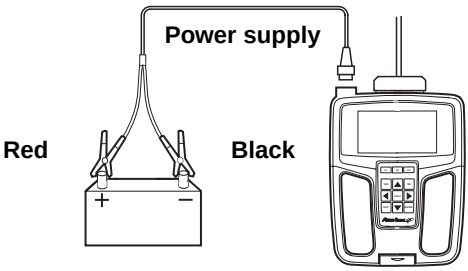
Disconnect positive battery terminal!



2. Connect adapter and program cassette



3. Connect power supply



Starting the program

General

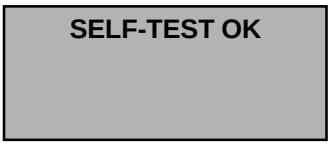
The program is re-started each time the power supply is interrupted and re-connected. When the supply is interrupted any faults and pre-sets recorded in memory are deleted.

At any particular moment, those keys which are not required are disabled. If such a key is pressed, the unit emits a long beep signal.

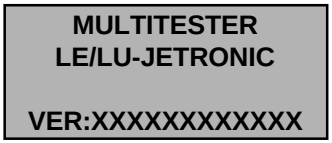
The program starts automatically when the Multi-Tester plus/pro is connected to the power supply. The unit executes steps 1 to 3 and pauses at step 5.

Working procedure

1. All fields in the display are tested (i.e. are illuminated) ***(Multi-Tester plus only).***
If no software cassette is installed or the cassette is incorrect, only the first and third row become illuminated.
At this point the display's contrast can be adjusted. Adjust the potentiometer to right of the switch inside the cassette opening (using a small screwdriver).



2. The Multi-Tester plus/pro performs a self-test....



3. ...and identifies the current versions of the hardware and software.

4. Snapshots *(Multi-Tester pro only)*

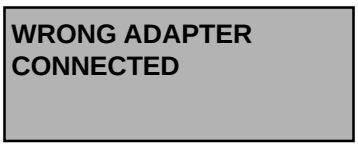
If the instrument contains stored snapshots, a menu for managing these is displayed.

5. The adapter connected

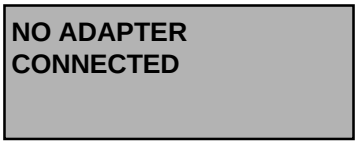
The Multi-Tester plus/pro confirms which adapter is connected and displays this information.

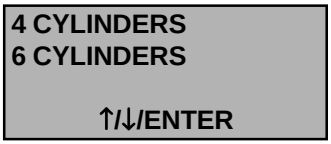
Is the information on row 2 correct? Respond by pressing ENTER.

This message is displayed if the adapter which is connected to the Multi-Tester plus/pro is of the incorrect type, i.e. not combined with the appropriate software cassette.



If the adapter is not connected to the unit, the message NO ADAPTER CONNECTED is displayed.





6. Questions during initialization

In order for the Multi-Tester plus/pro to perform the tests correctly it needs certain data on the system. The display shows either alternatives or questions.

Alternatives

Use the up or down arrow key to select the correct alternative and then press ENTER.

Questions

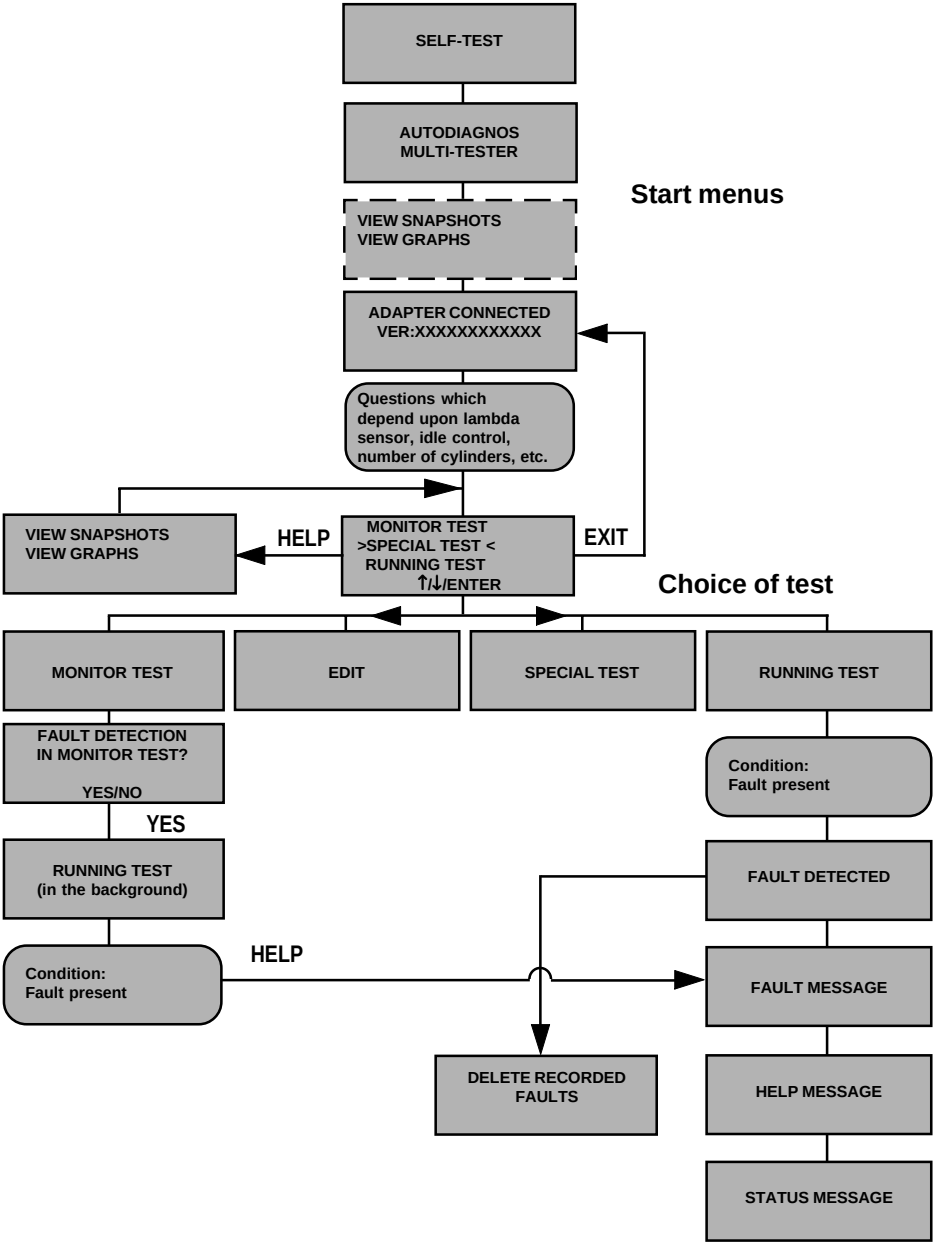
Answer the questions by pressing either the YES or NO key.

7. Cancel

To cancel work with the Multi-Tester plus/pro:

- Switch off engine.
- Disconnect the power cable from the unit.
- Disconnect the battery's positive terminal.
- Remove the adapter and re-connect the car's wiring harness to the control unit.
- Re-connect the battery's positive terminal.

Program structure



Programs and tests

The following types of test are available:

Monitor test Directs and displays the control system's signals without storing measured values.

Running test Records and stores faults which occur under both shorter and longer test periods.

Edit Can be used to disable fault detection on various signals.

Special tests A number of tests which are carried out in response to independent signals.

Monitor test

General
In Monitor test, values such as engine speed and coolant temperature are displayed.

Monitor test – with fault detection
This test is used to detect incorrect input and output signals to/from the various control systems. An fault is recorded if a signal deviates from its pre-programmed standard value. The fault is recorded until it is deleted manually or the power supply is interrupted.

- Up to five faults can be recorded each time Running is executed.
- Each primary fault can lead to a number of secondary faults.
- The Multi-Tester plus/pro stores all faults (primary and secondary) temporarily and offers an assessment of which is the primary fault. This is important in order to carry out repair work. Fault information is saved and displayed.
- The same fault cannot be recorded twice in succession.
- Order of priority of fault registration:
  1. Power supply
  2. Frame connections to the control system
  3. Sensor signals which affect the basic functions of the engine
  4. Other signals

Warning! If the display is to be read whilst driving the test should be performed by two people.

Monitor test

```
 RUNNING TEST
>MONITOR TEST      <
 SPECIAL TEST
      ↑/↓/ENTER
```

```
FAULT DETECTION
IN MONITOR TEST?

      YES/NO
```

```
#23  TEMP.     2.30 V
#24  GROUND    OK
#25  HALL      PULSE
IDLE           T
```

```
#23  TEMP      2.30 V
#24  GROUND    OK
#25  HALL      PULSE
IDLE           T  F
```

```
#3   LAMBDA    OK
F4   GROUND    1.25 V
#5   BATT      12.0 V
IDLE           T  F
```

```
 TOTAL NUMBER OF
 FAULTS:      (1–5)

      HELP/EXIT
```

1. Monitor test
Select MONITOR TEST in the test choice menu.

2. Fault detection in Monitor test
Here you can select whether or not fault detection is run while in Monitor test. If you press YES, Running searches for faults while Monitor displays the values. If you press NO, START ENGINE shows. I you press ENTER, the list of signals is shown without the engine being started.

3. Test underway
A small **T** character flashes on the status row which indicates that the test is underway.

4. Fault detected
If an fault is detected, the unit emits a tone as well as a small **F** on the status row.

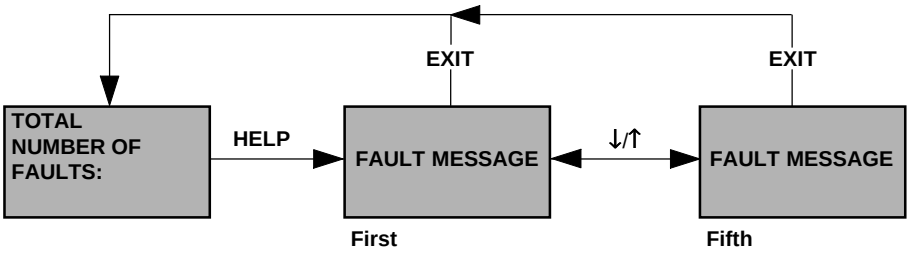
5. To inspect faults
If you press → the unit proceeds directly to the faulty signal. A small **F** character is displayed before the relevant pin number. If you select ← the unit proceeds to the beginning of the list of signals.

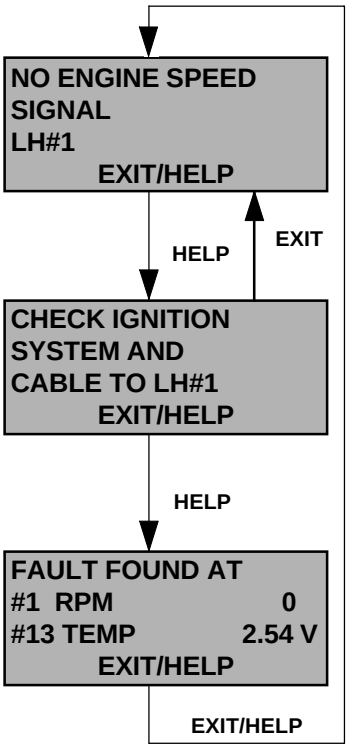
You can also press HELP to display which fault has been detected in simple text. If the engine is switched off, when Monitor is re-started, you must begin from stage 1 of this section.

Fault messages

Each fault has the following information associated with it:

- Fault message
- Help message
- Status message





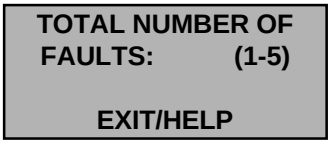
Example fault message for an LH control system.

Example help message.

Example status message.

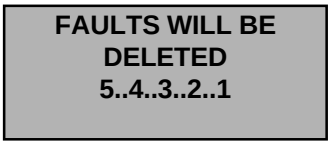
Display engine speed and voltage from coolant temperature sensor.

To delete recorded faults

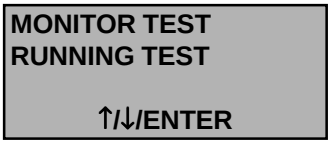


1. Start
To delete faults, start from this point.

2. To delete faults
Depress the EXIT key for at least 5 seconds. If EXIT is not pressed within 3 seconds the unit returns to the FAULT DETECTED message automatically.

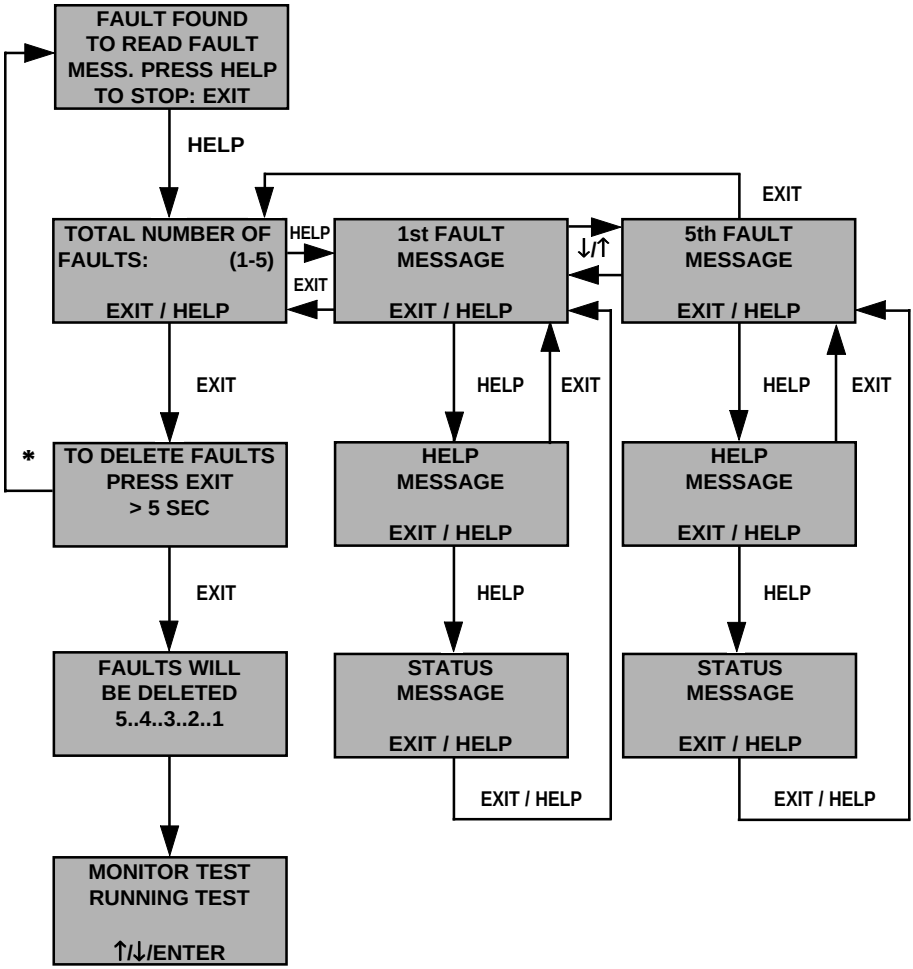


3. Delete faults.
All faults and all snapshots are deleted simultaneously.



4. Exit delete
When all faults have been deleted, the instrument returns to the “Choice of test” menu.

Fault detected



*** Occurs automatically after 3 seconds**

Snapshots (Multi-Tester pro only)

Automatic snapshots
When the Multi-Tester pro finds a fault, all the values in the monitor list are saved automatically as a snapshot. The Multi-Tester pro can store up to five snapshots. The number of snapshots stored is shown at the bottom of the display.

Certain parameters are displayed as mean values. Faults may be reported on the basis of instantaneous values, with the result that autosnap may not always display a faulty value even if the Multi-Tester pro indicates a fault on a particular signal.

Manual snapshots
Press ENTER to create a manual snapshot. Up to five manual snapshots can be stored. Here too, the number of snapshots stored is shown at the bottom of the display.

Viewing snapshots
To view snapshots, press EXIT, then HELP. Then move the cursor to VIEW SNAPSHOT with ↑/↓ and press ENTER. The manual snapshots appear first. The number of the current snapshot is shown at the bottom of the display. To view the next snapshot press →. Press EXIT to quit.

To delete manual snapshots, move the cursor to DELETE SNAPSHOT with ↓. Press ENTER, then YES.

Running test

General

This test is used to detect incorrect input and output signals to/from the various control systems. An fault is recorded if a signal deviates from its pre-programmed standard value. The fault is recorded until it is deleted manually or the power supply is interrupted.

- Up to five faults can be recorded each time Running is executed.
- Each primary fault can lead to a number of secondary faults.
- The Multi-Tester plus/pro stores all faults (primary and secondary) temporarily and offers an assessment of which is the primary fault. This is important in order to carry out repair work. Fault information is saved and displayed.
- The same fault cannot be recorded twice in succession.
- Automatic test restart when the engine is restarted (appropriate for long-term tests).
- Signal values cannot be studied.
- Order of priority of fault registration:
  1. Power supply
  2. Frame connections to the control system
  3. Sensor signals which affect the basic functions of the engine
  4. Other signals

Warning! If the display is to be read whilst driving the test should be performed by two people.

An fault can be recorded the moment Running starts. The Multi-Tester plus/pro emits a beep and the letter **F** is displayed when an fault is detected. Instructions for retrieving the fault from memory together with a description of fault, help and status messages are described in the “Fault messages” section.

Edit

Edit can be used to turn off the error diagnosis for signals which for some reason are not connected to the interface. This may accur if you are testing a different year model of the car than the one that was available when developing the program for the actual control system.

At the start all signals are switched on. When the operator answers the introductory questions, Multi-Tester plus/pro shuts out non-relevant signals.

Error diagnosis for other signals can be switched on and off. Press ENTER to change the signal's status. When you press HELP, more information on the actual signal is displayed.

All changes will be erased when the Multi-Tester plus/pro is disconnected from power.

Note
If error diagnosis is disconnected, this can lead to other errors being reported. For example, if error diagnosis for a main ground or power supply is disconnected, then signals that depend on them can be reported as faulty.

Special Tests

Special tests allows detailed study of certain signals.

The following functions are provided for Special Tests.

Graphical display (Multi-Tester pro only)

- All signals that are presented in the form of voltage (V) in Monitor mode are displayed graphically.
- Press ↑/↓ to reach the required signal and press ENTER.
- To see all functions press HELP. To return, press any key.

  The timebase of the X-axis is shown bottom right on the display. It is marked with a black square. To reduce/increase the timebase, press ←/→. The shortest timebase is 2 seconds and the longest is 1024 seconds.

  The amount above the Y-axis indicates the scaling. Pressing F3 toggles the highlight between the scale factor and the offset bottom left on the display. Depending on which is highlighted, the setting is changed by pressing ↑/↓. The minimum and maximum values for the scaling are 200 mV and 15 000 mV, and for the offset 0 V and 14 V.

  The offset moves the curve in the Y-direction.

- Min/max is displayed top right on the display and applies to the curve currently displayed. When a snapshot has been taken, min/max is replaced by new values.

Snapshot (Multi Tester pro only)

There are two ways of taking a snapshot in graphical mode:

- Press F1. Curve drawing stops. Press ENTER to take a snapshot. To return, press F1 or F2.
- Press F2. A new curve is drawn to the end of the X-axis, where it stops. Press ENTER to take a snapshot. To return, press F1 or F2.

To view snapshots, press EXIT twice, then press HELP. Move the cursor to VIEW GRAPHS with ↑/↓ and press ENTER. The current snapshot and the number of snapshots stored are shown at the top of the display. Press → to view the next snapshot. Press EXIT to quit.

To delete graphical snapshots, move the cursor to ERASE GRAPHS with ↓. Press ENTER, then YES.

The program for the LE/LE2/LU system includes the following special tests:

>LOADSENSOR

Load signal
Displays the signal voltage from the air mass meter or air flow sensor and the minimum and maximum values.

>AIRTEMP.

Air temperature
Displays the signal voltage from the air temperature sensor and the minimum and maximum values.

>BATTERY

Battery
Displays the battery voltage and the minimum and maximum values.

>COOLANT TEMP.

Coolant temperature
Displays the signal voltage from the coolant temperature sensor and the minimum and maximum values.

>LAMBDASENSOR

Lambdasensor
Displays signal voltage from the lambdasensor and the minimum and maximum values.

>INTEGRATOR

Integrator
Displays signal voltage for the integrator and the minimum and maximum values.

>IDLE SWITCHTEST

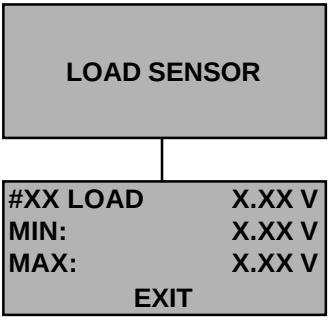
Idle switch test
Tests the throttle switch.

Load signal

This test demonstrates the signal voltage of the air mass meter or air flow sensor.

The test displays the actual value together with the minimum and maximum values recorded.

This test will continue until EXIT is pressed or until the engine is turned off.

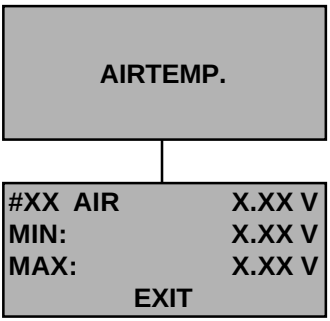


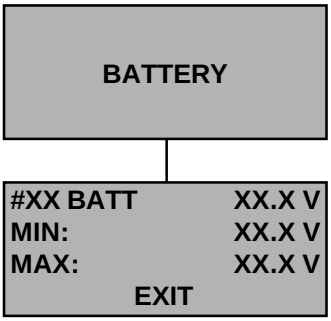
Air temperature

This test demonstrates the signal voltage of the air temperature sensor.

The test displays the actual value together with the minimum and maximum values recorded.

This test will continue until EXIT is pressed or until the engine is turned off.



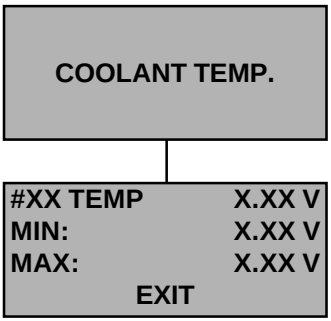


Battery

This test demonstrates the voltage level of the car's battery.

The test displays the actual value together with the minimum and maximum values recorded. This enables the battery voltage during for example the starting phase to be measured.

This test will continue until EXIT is pressed or until the engine is turned off.



Coolant temperature

This test demonstrates the signal voltage of the coolant temperature sensor.

The test displays the actual value together with the minimum and maximum values recorded.

This test will continue until EXIT is pressed or until the engine is turned off.

Lambdasensor

This test demonstrates the signal voltage of the lambdasensor.

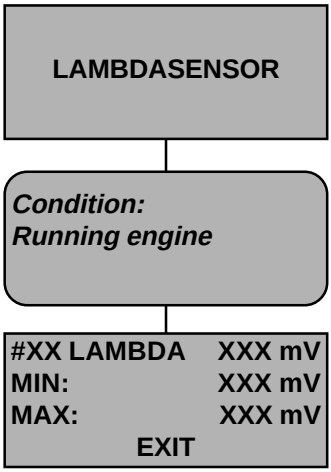
The test displays the actual value together with the minimum and maximum values recorded. This makes it possible to check that the sensor is working and swings between extreme positions 0 and 1 V approx.

Starting conditions for this test:

- The engine has to be running.

  If not, you will be asked to start it.

This test will continue until EXIT is pressed or until the engine is turned off.



Integrator

This test demonstrates the signal voltage of the integrator.

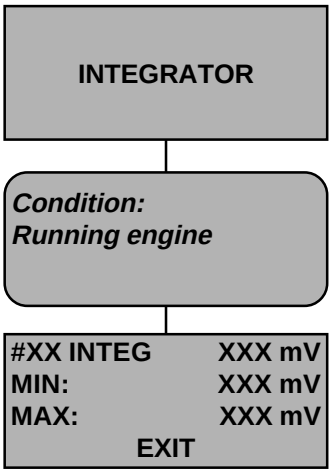
The test displays the actual value together with the minimum and maximum values recorded.

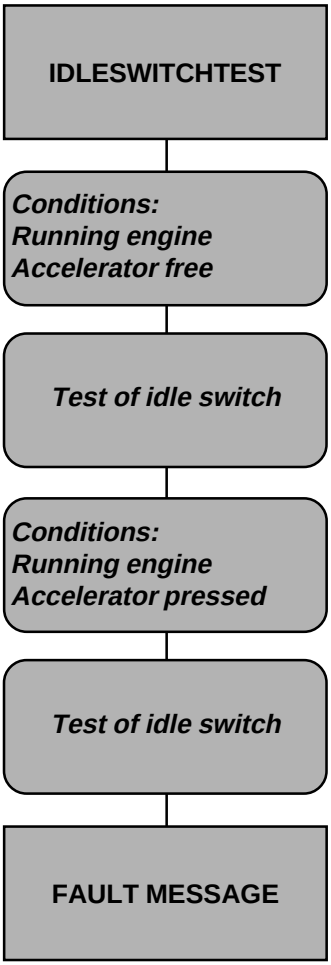
Starting condition for this test:

- The engine should be running.

  If not, you will be asked to start it.

This test will continue until EXIT is pressed or until the engine is turned off.





Idle switch

This test checks that the idle switch is functioning.

Starting conditions for the test:

- The engine should be running.

  If not, you will be asked to start it.

When the engine is started the idle switch will be checked for a few seconds. If necessary, you will be asked to release the accelerator. Then you will have to press down the accelerator for about 4 seconds, thus to open the idle switch.

After all the signals are controlled, the text NO FAULTS FOUND appears on the display or if any faults are located then FAULTS EXIST will appear.

Trouble-Shooting Procedure

General

Many faults can be detected by using the Multi-Tester plus/pro (with the appropriate software cassette) only. As an additional aid, each software cassette has a dedicated troubleshooting manual.

However, when troubleshooting, the following points should be observed:

- Faults of intermittent character, e.g. faulty switch contacts, are often difficult to observe in the workshop. In such cases, those components which are considered potential causes of the fault should be swapped out, each in turn, followed on each occasion with a test drive with the Multi-Tester plus/pro connected.
- **NB:** the fault rate for control units is relatively low. More likely causes of failure are harness connectors, cabling, sensors or switches.
- Whenever resistance or voltage supply measurements are being taken at the harness connector by the control unit, the Autodiagnos Break-out Box (A0201/A0202) and associated Break-out Box adapter should be used to avoid destroying the harness connector's sheathing. This is to ensure good electrical contact and to avoid damage to or a short circuit across the harness connector's sheathing.

The troubleshooting manuals include two chapters important to trouble-shooting.

The *Fault Tracing* chapter includes a brief signal description for each pin and three columns (the pin number means the number in the control unit's harness connector). The three columns enumerate the quantities to be checked by the various tests. In the rightmost column the corresponding section in the *Locating Faults* chapter is also included (see figure below).

Pin 1 Control signal to ignition coil

MONITOR	SPECIAL	RUNNING
"#1 RPM"	Not tested.	Continuous pulse check. See chapter Locating Faults ➧1

In the *Locating Faults* chapter, the working procedure for locating faults is included.

Fault Tracing

Pin 1 Control signal to ignition coil (terminal 1)

MONITOR	SPECIAL	RUNNING
"#1 RPM"	Not tested.	Continuous pulse check. See chapter Locating Faults ➧1

Pin 2 Signal from idle switch

MONITOR	SPECIAL	RUNNING
"IDLE" (Status)	Idleswitchtest: continuous test of signal level. Desired value at idle: 0 V	Not tested. Desired value at: – full load 12 V – idle 0 V See chapter Locating Faults ➧2

Pin 3 Signal from full load switch

MONITOR	SPECIAL	RUNNING
"FULL LOAD" (Status)	Not tested.	Not tested. Desired value at: – full load 0 V – idle 12 V See chapter Locating Faults ➧3

Pin 5 Ground

MONITOR	SPECIAL	RUNNING
"#5 GROUND" (OK/ERR)	Not tested.	Continuous check of ground level. Desired value: 0 V See chapter Locating Faults ➧4

Pin 7 Signal from air flow meter

MONITOR	SPECIAL	RUNNING
"#7 LOAD" (V)	Loadsensor: display of signal variation.	Continuous check of signal level. Desired values for Min: 0.8 V Max: 10.5 V See chapter Locating Faults ➧5

Pin 8 Signal from air temperature sensor

MONITOR	SPECIAL	RUNNING
"#8 I-AIR" (V)	Airtemp.: display of power variation.	Continuous check of signal level. Desired value at 20°C: 2.2-2.7 Ω See chapter Locating Faults ➧6

Pin 9 Power supply from main relay

MONITOR	SPECIAL	RUNNING
"#9 POWER" (V)	Not tested.	Continuous check of voltage level. Desired value: 12–14 V See chapter Locating Faults ➧7

Pin 10 Signal from coolant temperature sensor

MONITOR	SPECIAL	RUNNING
"#10 TEMP" (V)	Coolant temp.: display of power variation.	Continuous check of signal level. Desired value when engine at operating temperature: 0.3 V See chapter Locating Faults ➧8

Pin 12 Control signal to injection valves

MONITOR	SPECIAL	RUNNING
"#12 INJ" (ms)	Not tested.	Continuous pulse check. See chapter Locating Faults 9

Pin 13 Ground

MONITOR	SPECIAL	RUNNING
"#13 GROUND" (OK/ERR)	Not tested.	Continuous check of ground level. Desired value: 0 V See chapter Locating Faults 4

Pin 15 Control signal to ignition coil (only Citroën)

MONITOR	SPECIAL	RUNNING
"#15 RPM"	Not tested.	Continuous pulse check. See chapter Locating Faults 1

Pin 20 Signal from lambdasensor

MONITOR	SPECIAL	RUNNING
"#20 LAMBDA" (mV)	Lambdasensor: display of power variation.	Check of power variation. Conditions: – engine at operating temperature – not idling or under full load – engine speed < 2.500 rpm. See chapter Locating Faults 10

Pin 22 Integrator voltage, signal (only LU)

MONITOR	SPECIAL	RUNNING
"#22 INTEG" (V)	Ingerator: display of power variation.	Not tested. Used only to adjust lambda correction. Se kapitel fellokalisering 11

Pin 24 Control signal to injection valves

MONITOR	SPECIAL	RUNNING
"#24 INJ" (ms)	Not tested.	Continuous pulse check. See chapter Locating Faults 9

Pin 25 Ground

MONITOR	SPECIAL	RUNNING
"#25 GROUND" (OK/ERR)	Not tested.	Continuous check of ground level. Desired value: 0 V See chapter Locating Faults 4

Locating Faults

1

Check of ignition pulse (terminal 1) from LE/LE2/LU, pin 1 and 15 (only Citroën)

This is an input signal to the control unit from the ignition system.
There are several possible causes of an absent signal:

- Discontinuity in the wiring or connectors.
- Defective or absent main input signal to the system, such as:
  - Ground connection
  - Voltage supply
- Faulty control unit, although this is most unlikely as the failure rate for control units is very low.

1. Turn on the ignition and check if there is battery voltage for the ignition coil at pin 15 (+).

   Possible cause of fault: Ignition switch or cable to ignition coil (terminal 15).

2. Start or turn over the engine and check pulses are being received at the ignition coil, pin 1 (–) with a test lamp.

   Possible cause of fault: Circuit-breaker (possibly ignition amplifier), ignition coil or wiring on primary side.

3. Turn off the ignition and disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020201) to the car's wiring harness only. Do not reconnect the control unit.

4. Measure the resistance of the cable between the Break-out Box, pin 1 and 15 and ignition coil. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.

2

Check of signal from the idle switch to LE/LE2/LU, pin 2

This is an input signal to the control unit from the throttle switch.
The idle switch closes when the throttle is closed completely.

1. Disconnect the connector from the DC motor and the idle switch, then measure the resistance between the connector's terminals 2 and the battery's positive pole (+) when the throttle is:
   – completely closed (switch closed). Desired value: 0 Ω
   – opened slightly (switch opened). Desired value: > 100 kΩ

   Possible cause of fault: The trim of the idle switch. If adjustment is not possible, replace the idle switch.
2. Measure the resistance between the connector, pin 2 and ground. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.
3. Disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020211) to the car's wiring harness only. Do not reconnect the control unit.
4. Measure the resistance of the cable between the Break-out Box, pin 2 and idle switch. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.

3

Check of signal from the full load switch to LE/LE2/LU, pin 3

This is an input signal to the control unit from the throttle switch.
The full load switch closes when the throttle is opened fully.

1. Disconnect the connector from the full load switch and measure the resistance between the terminals when the throttle is:
   – completely closed (switch opened). Desired value: > 100 kΩ
   – opened slightly (switch opened). Desired value: > 100 kΩ
   – opened fully (switch closed). Desired value: 0 Ω

   Possible cause of fault: The trim of the full load switch. If adjustment not possible, replace full load switch.
2. Measure the voltage between the connector's two terminals. Desired value: 12–14 V

   Possible cause of fault: Wiring or connectors.

3. Turn off the ignition and disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020201) to the car's wiring harness only. Do not reconnect the control unit.
4. Measure the resistance of the cable between the Break-out Box, pin 3 and full load switch. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.

4

Check of ground connection to LE/LE2/LU, pin 5, 13 and 25

These contacts are the control unit's ground connection.

1. Disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020211) to the car's wiring harness only. Do not reconnect the control unit.
2. Measure the resistance between the Break-out Box, pin 5/13/25 and ground. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.

5

Check of signal from air flow meter to LE/LE2/LU, pin 7

This is an input signal to the control unit from the air flow meter. The signal indicates engine load.

1. Disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020211) to the car's wiring harness only. Do not reconnect the control unit.
2. Measure the resistance of the cable between the Break-out Box, pin 7 and air flow meter, pin 7. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.
3. Measure the resistance of the cable between the Break-out Box, pin 5 and air flow meter. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.
4. Measure the resistance between the Break-out Box, pin 5 and 9. Desired value: 300 Ω

   Possible cause of fault: Wiring, connectors or air flow meter.

Continued

5. Measure the resistance between the Break-out Box, pin 5 and 7.
   Desired value: 250 Ω

   Possible cause of fault: Wiring, connectors or air flow meter.
6. Connect the Break-out Box and the 25-pin adapter between the car's wiring harness and the control unit.
7. Turn on the ignition and measure the voltage at the Break-out Box, pin 9.
   Desired value: 12–14 V

   Possible cause of fault: Wiring, connectors or control unit.

6

Check of signal from air temperature sensor to LE/LE2/LU, pin 8

This is an input signal to the control unit from the air temperature sensor (type NTC with a negative temperature coefficient).

1. Disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020211) to the car's wiring harness only. Do not reconnect the control unit.
2. Measure the resistance of the cable between the Break-out Box, pin 8 and the air temperature sensor, (see workshop manual).
   Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.
3. Measure the resistance of the cable between the Break-out Box, pin 5 and air temperature sensor. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.
4. Measure the resistance between the Break-out Box, pin 8 and 5.
   Desired values:

air temperature	**resistance (kΩ)**
± 0°C	6
+ 20°C	2.2–2.7

   Possible cause of fault: Air temperature sensor.
6. Connect the Break-out Box and the 25-pin adapter between the car's wiring harness and the control unit.
7. Turn on the ignition and measure the voltage at the Break-out Box, pin 9.
   Desired value: 12–14 V

   Possible cause of fault: Wiring, connectors or control unit.

7

Check of power supply from main relay to LE/LE2/LU, pin 9

1. Turn on the ignition and measure the voltage between main relay, terminal 30 and ground (see workshop manual). Desired value: 12–14 V

   Possible cause of fault: Wiring or connectors.

2. Measure the voltage at the main relay, terminal 86 and ground. Desired value: 12–14 V

   Possible cause of fault: Wiring, connectors or ignition switch.

3. Turn off the ignition and disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020201) to the car's wiring harness only. Do not reconnect the control unit.

4. Measure the resistance of the cable between the Break-out Box, pin 9 and main relay, pin 87. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.

5. Connect the Break-out Box and the 25-pin adapter between the car's wiring harness and the control unit.

6. Turn on the ignition and measure the voltage between the Break-out Box, pin 9 and pin 5. Desired value: 12–14 V

   Possible cause of fault: Main relay.

8

Check of signal from coolant temperature sensor to LE/LE2/LU, pin 10

This is an input signal to the control unit from the coolant temperature sensor (type NTC with a negative temperature coefficient).

1. Disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020211) to the car's wiring harness only. Do not reconnect the control unit.

2. Measure the resistance of the cable between the Break-out Box, pin 10 and coolant temperature sensor (see workshop manual). Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.

3. Measure the resistance of the cable between the Break-out Box, pin 5 and coolant temperature sensor. Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.

Continued

4. Measure the resistance between the Break-out Box, pin 10 and 5.
   Desired values:

engine temperature	**resistance (Ω)**
– 10°C	8000–11000
+ 20°C	2000– 2900
+ 80°C	270– 380

   Possible cause of fault: Coolant temperature sensor.

9

Check of control signal to injection valves from LE/LE2/LU, pin 12 and 24

This is an output signal from the control unit to the injection valves which controls fuel metering.

1. Turn on the ignition and measure the power supply to the injection valves. Desired value: 12–14 V

   Possible cause of fault: Wiring, connectors or injection relay.

2. Check the opening pulse by measuring the voltage across the injection valves with a test lamp (measure from the rear of one of the connectors on any injector). At low rpm the lamp should flash; it should shine with even intensity at higher rpm.

   If incorrect:

   – disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020201) between the car's wiring harness and the control unit.

3. Turn on the ignition and repeat corresponding measurement between the Break-out Box, pin 12 and 24 respectively and pin 9.

4. In the case of a suspected discontinuity between LE/LE2/LU, pin 12 and 24 respectively and the injector, make the following measurement:

   – turn off the ignition and disconnect the connector from the control unit. Measure the resistance between the Break-out Box, pin 12 and 24 respectively and the terminal on the injector's connector (see workshop manual). Desired value: 0 Ω

   Possible cause of fault: Wiring or connectors.

5. Measure the resistance across each individual injector with the injector connector terminal removed (i.e. directly on the injectors).
   Desired value: 16 Ω

   Possible cause of fault: Injector.

Note
The test is disconnected during fuel cut-off.

Injector failure can also have a mechanical cause (lining, etc.). Such faults are not registered by the Multi-Tester plus/pro. In such a case, a flow check must be carried out on each injector.

10

Check of signal from lambdasensor to LE/LE2/LU, pin 20

This is an input signal to the control unit from the lambdasensor. It is only found on cars fitted with catalytic converters and is used for the fine adjustment of the ratio of fuel to air to approx. 1:14.6 (by weight). This ratio is called lambda = 1.

The following test conditions must be met as the Multi-Tester plus/pro checks that the lambdasensor signal level lies between 0 and 1 V:

- Engine temperature must exceed +70°C.
- The engine must not be idling – some sensors cool down after long periods of idling and oscillation ceases.
- The engine must not be at full throttle – the sensor signal then becomes constant at approx. 1 V.
- Fuel cut-off should not be activated – the sensor signal then becomes constant at approx. 0 V.
- Engine speed below 2.500 rpm.

1. Check the sensor's pre-heating (if fitted) by measuring the voltage at the sensor connector while the engine is running. Desired value: 12–14 V
2. Check the resistance in the heating coil by disassembling the connector for the pre-heater and measuring the resistance. Desired value: 2–20 Ω

   Possible cause of fault: Lambdasensor.
3. Run the engine until it reaches operating temperature and maintain engine speed at approximately 2.500 rpm. Execute the LAMBDASENSOR special test and confirm that the lambdasensor signals fluctuate between 0 and 1 V. The signal should oscillate about once a second. Oscillations of longer duration indicate that the sensor may be polluted and should be replaced.
4. Turn off the ignition and disconnect the 25-pin connector from the control unit. Connect the Break-out Box (A0201/A0202) and the 25-pin adapter (A020201) to the car's wiring harness only. Do not reconnect the control unit.

Continued

5. Measure the resistance between the Break-out Box, pin 20 and ground. If the reading is approximately 0 Ω the sensor has short-circuited and is no longer functioning. Repeat the measurement at the sensor connector to determine whether the short circuit is in the sensor or the cable between the sensor and the control unit.

11

Check of integrator voltage, LE/LE2/LU, pin 22

This voltage is used solely to make basic settings of the lambda control at idle speed (only LU).

1. Run the engine until it reaches operating temperature and check the reading for “INTEGRATOR” in the special test at idle speed. Compare with the figure given in the workshop manual.
2. Adjust to correct setting using the CO screw on the air flow meter.

Note!

If adjustment fails to produce the correct setting look for an air leak on the inlet or exhaust side.

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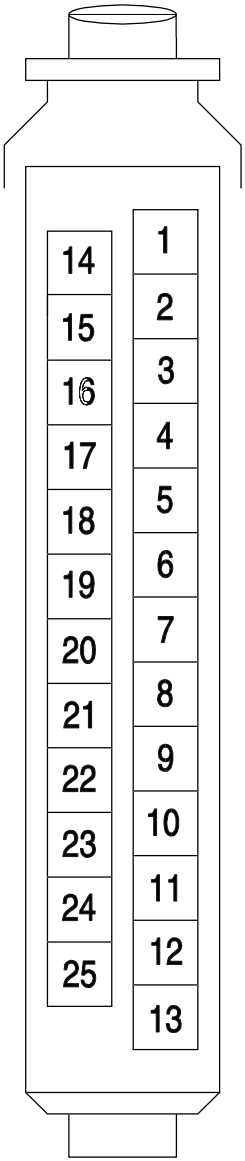
Note: The connector is viewed from below.

Wiring harness



Wiring Diagram

NOTE! This is an example of a wiring diagram for LE/LE2/LU-Jetronic. Check in the relevant workshop manual for the diagram of the car model you are working on.