قسم الهندسة الميكانيكية

هندسة السيارات

ملحق رقم (1) لمشروع تخرج

تصميم نماذج تعليمية متطورة في مجال هندسة السيارات التي تعمل بالديزل وعمل دراسة نموذجية لمشاغل السيارات

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Palestine Polytechnic University
College Of Engineering and Technology
Department Of Mechanical Engineering
Diesel Fuel Injection System

Common Rail Diesel Injection Model

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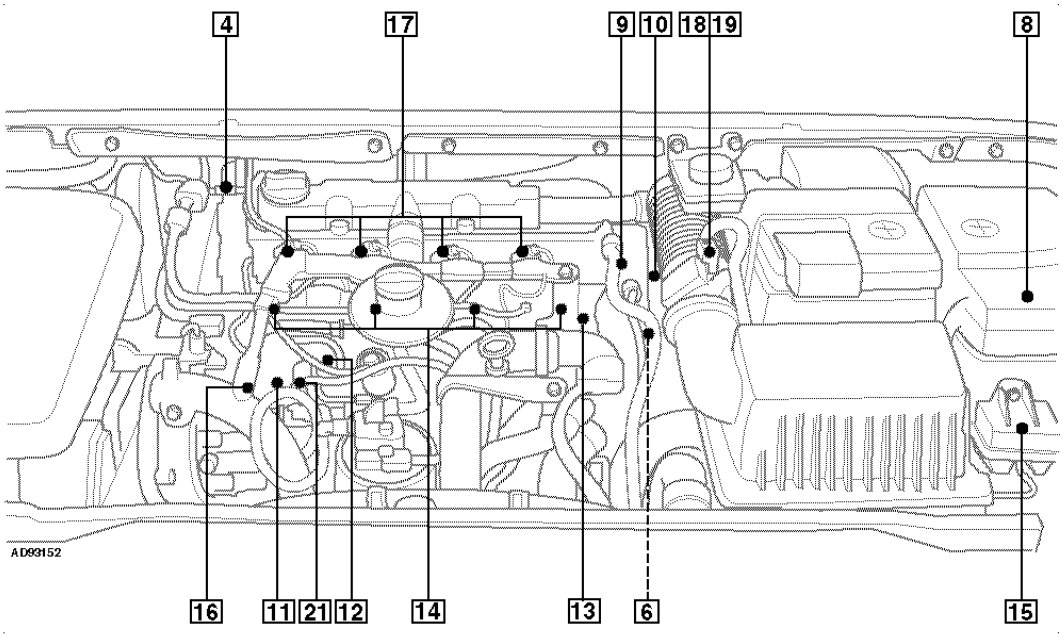
CITROËN

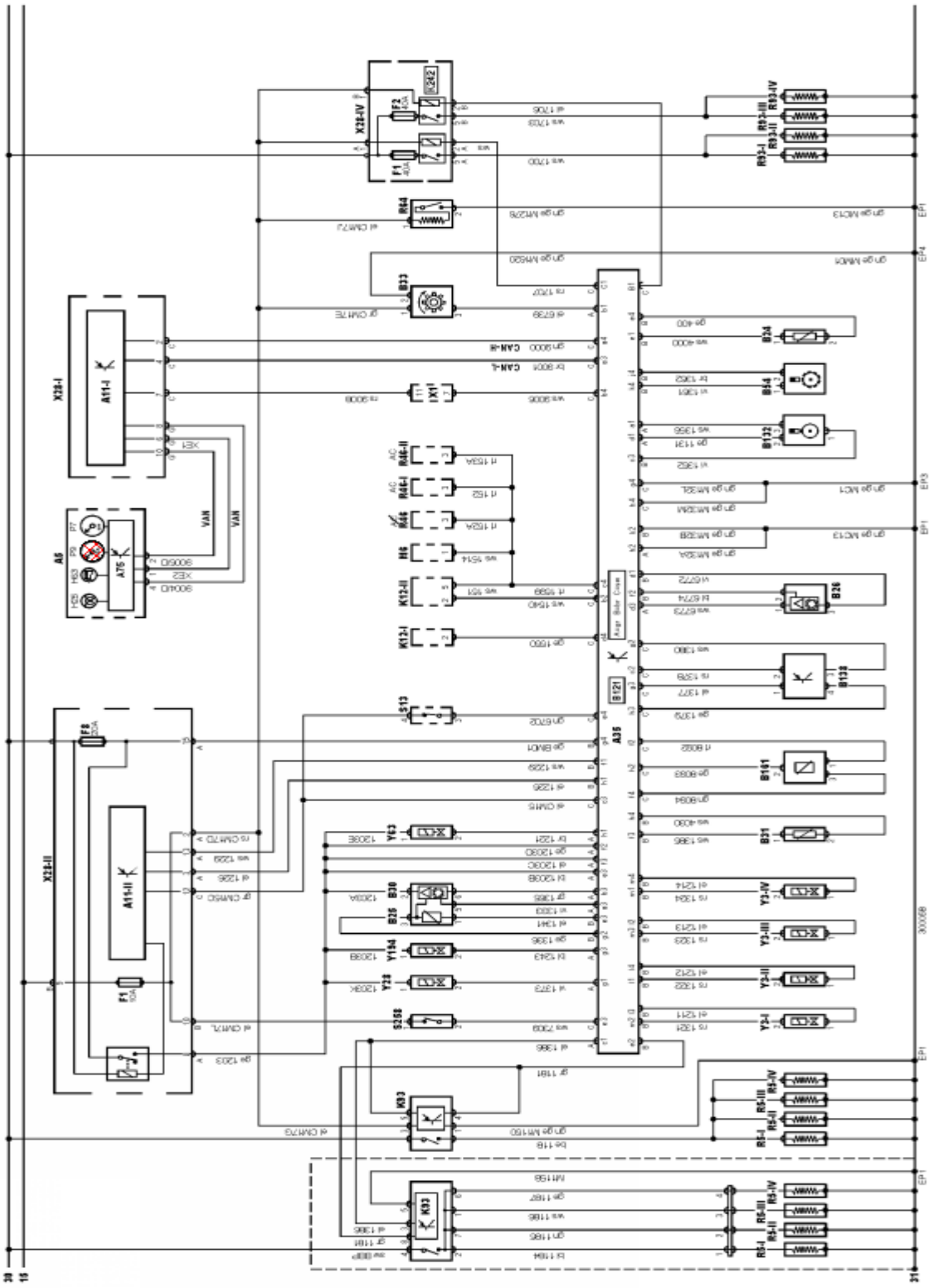
Technical specification **CITROEN Berlingo II 2.0 HDi 2007**

Model:	Berlingo 2.0 HDi
Engine code:	RHY
Tuned for:	Siemens
Year:	2007
Car engine:	1997 ccm (121,25 cubic inches)
Car engine type:	Inline, 4 cyl
Car valves per cylinder:	2
Car max power:	90.00 PS (65,67 kW or 88,56 HP) at 4000 Rev. per min.
Car compression:	18.0:1
Car fuel:	Diesel
Car transmission:	Manual, 6-speed
VIN COOD::	VF7GJRHYB6J00265
RPON°:	10039

Diesel Fuel Injection System



1 Accelerator pedal position (APP) sensor - above pedal
2 Barometric pressure (BARO) sensor - in ECM
3 Brake pedal position (BPP) switch - above pedal
4 Camshaft position (CMP) sensor
5 Clutch pedal position (CPP) switch - above pedal
6 Crankshaft position (CKP) sensor
7 Data link connector (DLC) - near steering column, under trim panel
8 Engine control module (ECM)
9 Engine coolant temperature (ECT) sensor
10 Exhaust gas recirculation (EGR) solenoid
11 Fuel pressure regulator control solenoid
12 Fuel pressure sensor
13 Fuel temperature sensor
14 Glow plugs
15 Glow plug timer relay
16 High pressure fuel pump
17 Injectors
18 Intake air temperature (IAT) sensor - in MAF sensor
19 Mass air flow (MAF) sensor
20 Vehicle speed sensor (VSS) - transmission
21 3rd piston cut-off solenoid



Engine System type:	Experiment name:	Experiment #:
Common Rail system	pre-heating system	1

1.1 pre-heating system

❖ **Objectives :**

- **Recognize to components of the system.**
- **Learning how check this components.**
- **Learning skill uses different device.**

Fig1.1

❖ **Process of measurement:** measure the resistance.

❖ **Equipment needed**: Digital ohmmeter.

❖ **Steps**

1) Make sure the ignition switch off
2) remove *Glow plug timer relay* ; Fig1.1.
3) put Digital ohmmeter on Lower scale.
4) in the ***test Board*** Glow plug socket's,
   (red socket and black socket for each plug)
   put red probe of Digital ohmmeter in red socket of plug 1,
   and black probe of Digital ohmmeter in black socket of plug 1.
5) Read the resistance value measured, And recorded in the table 1.1.
6) Do again the step 4 and 5 for each plug's.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	pre-heating system	1

Table 1.1

#	Glow plug	Typical value	Measured value	Notice (good/bad)
1	Plug 1	0.4 Ω		
2	Plug 2	0.4 Ω		
3	Plug 3	0.4 Ω		
4	Plug 4	0.4 Ω		

**Note: test and Typical values at 20 °

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Common Rail Injectors test	2

1.2 Fuel System

❖ **Objectives :**

- **Recognize to component and sensors of the system.**
- **Learning how check this component.**
- **Notice the change of value when change engine operating.**
- **Learning skill uses different device.**

1.2.1 Injectors

Note: piezo type injectors fitted, resistance cannot be checked

❖ **Process of measurement:** Extract the signal injector, Fig 1.3.
❖ **Equipment needed**: Oscilloscope (Sun LS2000), Fig 1.2.

Fig1.2

Fig1.3

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Common Rail Injectors test	2

❖ Steps

1) Make sure of the engine is ready to run.
2) Start the engine.
3) Engine in idle mode.
4) in the ***test Board*** Injectors socket's,
   (red socket and black socket for each Injectors) put red probe of Oscilloscope in red socket
   of Injector 1, and black probe of Oscilloscope
   in black socket of Injector 1.
5) See the waveform of Injector 1 signal.
6) Do again the step 3 and 4 for each Injectors.
7) Compare this signal's with standard signal's, Fig 1.4.

Table 1.2

#	Waveform of	**Status** (good/pad)
1	Injector 1	
2	Injector 2	
3	Injector 3	
4	Injector 4	

Fig1.4

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Fuel Temperature Sensor test	3

1.2.2 Fuel Temperature Sensor

- **Process of measurement:** measure the resistance.
- **Equipment needed**: Digital ohmmeter.

Fig1.5: Fuel Temperature Sensor

- **Steps**

1) Make sure the ignition switch off.
2) Remove the wires connection between (1 & 2), and (3 & 4) on the ***test Board*** .
3) Connect Digital Ohmmeter on socket 2 & 4.
4) Measure the resistance value of the sensor at different temperatures as in table 1.3.

Table 1.3

#	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	2 & 4	25 °c	2392 Ω		
2	2 & 4	40 °c	1236 Ω		
3	2 & 4	60 °c	557 Ω		
4	2 & 4	80 °c	273 Ω		
5	2 & 4	100 °c	144 Ω		

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Fuel Pressure Regulator Control Solenoid test	4

1.2.3 Fuel Pressure Regulator Control Solenoid , Fig 1.6.

➢ First Test

- ❖ **Process of measurement:** measure the resistance.
- ❖ **Equipment needed**: Digital ohmmeter.

Fig1.6: Fuel Pressure Regulator

- ❖ **Steps**

1) Make sure the ignition switch off.
2) Remove the wires connection between (5 & 6), and (7& 8) on the ***test Board*** .
3) Connect Digital Ohmmeter on socket 6 & 8.
4) Measure the resistance value of the Pressure regulator solenoid.

Table 1.4

#	object	socket	Typical value	Measured value	Notice (good/bad)
1	Pressure Regulator	6 & 8	2-3 Ω		

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Fuel Pressure Regulator Control Solenoid test	4

1.2.3 Fuel Pressure Regulator Control Solenoid .

➢ Second Test

- ❖ **Process of measurement:** Extract the signal ***Pressure Regulator***.
- ❖ **Equipment needed**: Oscilloscope (Sun LS2000), Fig 1.7.

Fig1.7

- ❖ **Steps**

1) Make sure of the engine is ready to run.
2) Reconnect the wires connection between (5 & 6), and (7& 8) on the ***test Board*** .
3) connect the Oscilloscope probe on socket (6 & 8) on the ***test Board*** .
4) Start the engine.
5) Engine in idle mode.
6) See the waveform of ***Pressure Regulator*** signal.
7) Compare this signal's with standard signal's, Fig 1.8.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Fuel Pressure Regulator Control Solenoid test	4

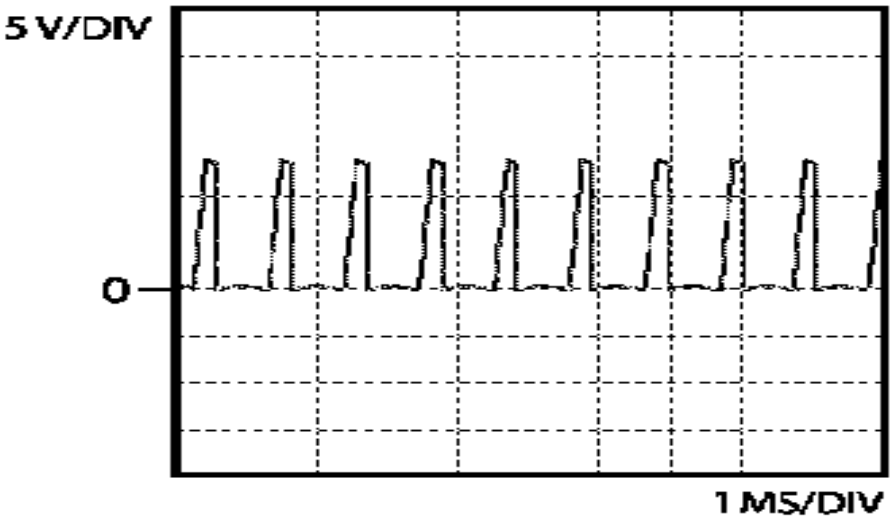


Fig 1.8: Fuel Pressure Regulator– Idle.

Table 1.5

#	Waveform of	**Status** (good/pad)
1	***Pressure Regulator***	

- ## Questions

1. can check the Pressure Regulator By Digital voltmeter? How?
2. What happens to the Waveform when the engine speed increase?
3. If the Pressure Regulator failure, what affects the engine?

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Fuel Pressure Sensor test	5

1.2.4 Fuel Pressure Sensor , Fig 1.9.

❖ **Process of measurement:** Measuring the voltage.

❖ **Equipment needed**: Digital voltmeter.

Fig1.9 :Fuel Pressure Sensor.

❖ **Steps**

1) Make sure of the engine is ready to run.
2) Start the engine.
3) Engine in idle mode.
4) connect the **Digital voltmeter** probe on socket (9 & 10) on the ***test Board*** .
5) Read the voltage value measured, And recorded in the table 1.6.
6) Increase the Engine speed at 3000 RPM.
7) Read the voltage value measured, And recorded in the table 1.6.
8) Compare Measured value with Typical value.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Fuel Pressure Sensor test	5

Table 1.6

#	object	socket	Typical value	Measured value	Notice (good/bad)
1	Fuel Pressure Sensor	9 & 10	1.3 v		
2	Fuel Pressure Sensor	9 & 10	1.7 v		

- ## Questions

1. can check the Fuel Pressure Sensor By Other devices? How?
2. If the Fuel Pressure Sensor, what affects the engine?

Engine System type:	Experiment name:	Experiment #:
Common Rail system	3rd Piston Cut-off Solenoid	6

1.2.5 3rd Piston Cut-off Solenoid.

- **Process of measurement:** measure the resistance.
- **Equipment needed**: Digital ohmmeter.

- **Steps**

1) Make sure the ignition switch off.
2) Remove the wires connection between (11 & 12), and (13& 14) on the ***test Board*** .
3) Connect Digital Ohmmeter on socket 12& 14.
4) Measure the resistance value of the 3rd Piston Cut-off Solenoid.

Table 1.7

#	object	socket	Typical value	Measured value	Notice (good/bad)
1	3rd Piston Cut-off Solenoid	12 & 14	25-50 Ω		

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Mass Air Flow (MAF) Sensor test	7

1.3 Intake System

- **Objectives :**
  - **Recognize to components and sensors of the system.**
  - **Learning how check this components.**
  - **Notice the change of value when change engine operating.**
  - **Learning skill uses different device.**

1.3.1 Mass Air Flow (MAF) Sensor , Fig 1.10.

Fig1.10_: (MAF) Sensor

- **Process of measurement:** Measuring the voltage.
- **Equipment needed**: Digital voltmeter.

- **Steps**
  1) Extracted the Typical values to check **MAF** sensor from Autodata program, And recorded in the table 1.8.
  2) Make sure of the engine is ready to run.
  3) Ignition switch on.
  4) connect the **Digital voltmeter** probe on socket (38 & 39) on the ***test Board*** .
  5) Read the voltage value measured, And recorded in the table 1.8.
  6) Start the engine.
  7) Engine in idle mode.
  8) Read the voltage value measured, And recorded in the table 1.8.
  9) Compare Measured value with Typical value.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Mass Air Flow (MAF) Sensor test	7

Table 1.6

#	object	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	MAF	38 & 39	Ignition On			
2	MAF	38 & 39	Engine idling			

- By using Oscilloscope device connect the Oscilloscope probe on socket (6 & 8) on the ***test Board*** , when engine is running, see the waveform in engine idling and when Increase engine speed.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Intake Air Temperature (IAT) Sensor test	8

1.3.2 Intake Air Temperature (IAT) Sensor

- **Process of measurement:** measure the resistance.
- **Equipment needed**: Digital ohmmeter.

- **Steps**

1) Make sure the ignition switch off.
2) Remove the wires connection between (40& 41), and (42 & 43) on the ***test Board*** .
3) Connect Digital Ohmmeter on socket 41 & 43.
4) Measure the resistance value of the sensor at different temperatures as in table 1.7.

Table 1.7

#	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	41 & 43	15 °c	2874-3300 Ω		
2	41 & 43	20°c	2346-2672 Ω		
3	41 & 43	25°c	1928-2174 Ω		
4	41 & 43	30 °c	1585-1787 Ω		
5	41 & 43	40°c	1089-1225 Ω		

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Engine coolant Temperature (ECT) Sensor test	9

1.4 Engine Sensors

❖ **Objectives :**

- **Recognize to components and sensors of the system.**
- **Learning how check this components.**
- **Notice the change of value when change engine operating.**
- **Learning skill uses different device.**

1.4.1 Engine coolant Temperature (ECT) Sensor, Fig 1.11.

❖ **Process of measurement:** measure the resistance.

❖ **Equipment needed**: Digital ohmmeter.

Fig1.11_: (ECT) Sensor

Steps

1) Make sure the ignition switch off.
2) Remove the wires connection between (15& 16), and (17& 18) on the ***test Board*** .
3) Connect Digital Ohmmeter on socket 16 & 18.
4) Measure the resistance value of the sensor at different temperatures as in table 1.8.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Engine coolant Temperature (ECT) Sensor test	9

Table 1.8

#	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	16 & 18	20 °c	6080-6400 Ω		
2	16 & 18	30 °c	3930-4210 Ω		
3	16 & 18	40°c	2600-2710 Ω		
4	16 & 18	60°c	1220-1270 Ω		
5	16 & 18	80°c	620-636 Ω		

- ## Questions

1. What type of ECT sensor?
2. What is the effect of ECT sensor on the performance of the engine?
3. In the event of sensor failure, what is the value imposed by the ECU?

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Crankshaft Position (CKP) Sensor test	10

1.4.2 Crankshaft Position (CKP) Sensor. Fig 1.12.

➢ First Test

- ❖ **Process of measurement:** measure the resistance.
- ❖ **Equipment needed**: Digital ohmmeter.

Fig1.12: CKP sensor

- ❖ **Steps**

1) Extracted the Typical values to check **CKP** sensor from Autodata program, And recorded in the table 1.9.
2) Make sure the ignition switch off.
3) Remove the wires connection between (19 & 20), and (21& 22) on the ***test Board*** .
4) Connect Digital Ohmmeter on socket 20 & 22.
5) Measure the resistance value of the **CKP** sensor.

Table 1.9

#	object	socket	Typical value	Measured value	Notice (good/bad)
1	CKP	20 & 22			

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Crankshaft Position (CKP) Sensor test	11

1.4.2 Crankshaft Position (CKP) Sensor.

➢ Second Test

❖ **Process of measurement:** Extract the signal ***CKP sensor***.

❖ **Equipment needed**: Oscilloscope (Sun LS2000).

❖ Steps

1) Make sure of the engine is ready to run.
2) Reconnect the wires connection between (19 & 20), and (21 & 22) on the ***test Board*** .
3) connect the Oscilloscope probe on socket (20 & 22) on the ***test Board*** .
4) Start the engine.
5) Engine in idle mode.
6) See the waveform of ***CKP sensor*** signal.
7) Compare this signal with standard signal, Fig 1.13

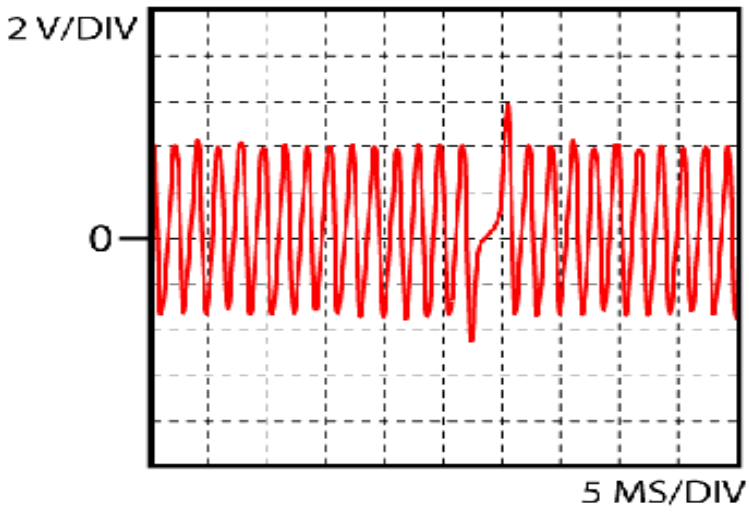


Fig 1.13: Woveform of CKP sensor -idle

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Crankshaft Position (CKP) Sensor test	11

8) Increase the Engine speed at 3000 RPM.
9) See the waveform of ***CKP sensor*** signal.
10) Compare this signal with signal at idle.
11) Fill the following table 1.10

Table 1.10

#	object	socket	Condition	Voltage (peak to peak)	Notice (good/bad)
1	CKP	20 & 22	Idling		
2	CKP	20 & 22	3000 RPM		

Questions

1. What happens to the Waveform when the engine speed increase?
2. If the **CKP** sensor failure, what affects the engine?
3. Locate the sensor on the engine
4. What type of **CKP** sensor?

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Camshaft Position (CMP) Sensor test	12

1.4.3 Camshaft Position (CMP) Sensor.

- **Process of measurement:** Measuring the voltage.
- **Equipment needed**: Digital voltmeter.

➢ First Test

❖ Steps

1) Extracted the Typical values to check **CMP** sensor from Autodata program, And recorded in the table 1.12.
2) Make sure of the engine is ready to run.
3) Start the engine.
4) Engine in idle mode.
5) connect the **Digital voltmeter** probe on socket (24 & 26) on the ***test Board*** .
6) Read the voltage value measured, And recorded in the table 1.12.
7) Compare Measured value with Typical value.
8) Increase the Engine speed at 3000 RPM.
9) Read the voltage value measured, And recorded in the table 1.12.

Table 1.112

#	object	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	CMP	24 & 26	Idling			
2	CMP	24& 26	3000 RPM			

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Camshaft Position (CMP) Sensor test	12

1.4.3 Camshaft Position (CMP) Sensor.

➢ Second Test

❖ **Process of measurement:** Extract the signal ***CMP sensor***.

❖ **Equipment needed**: Oscilloscope (Sun LS2000).

❖ Steps

1) Make sure of the engine is ready to run.
2) Reconnect the wires connection between (23 & 24), and (25 & 26) on the ***test Board*** .
3) connect the Oscilloscope probe on socket (27 & 26) on the ***test Board*** .
4) Start the engine.
5) Engine in idle mode.
6) See the waveform of ***CMP sensor*** signal.
7) Compare this signal with standard signal, Fig 1.14

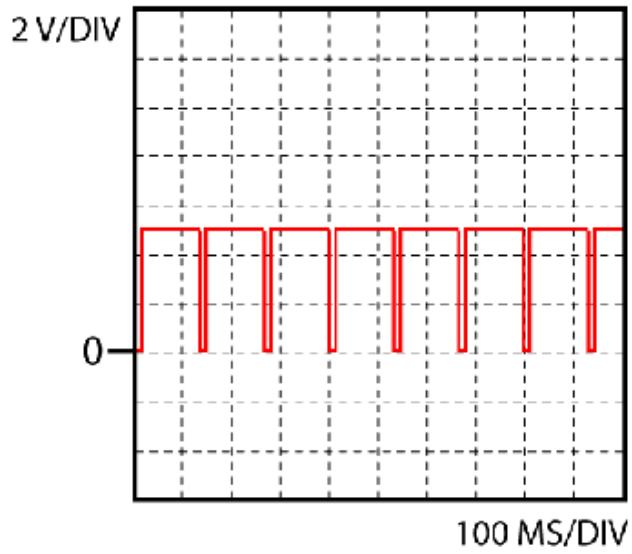


Fig:1.14 woveform of **CMP** signal_ idlilig

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Camshaft Position (CMP) Sensor test	12

8) Increase the Engine speed at 3000 RPM.
9) See the waveform of ***CMP sensor*** signal.
10) Compare this signal with signal at idle.
11) Fill the following table 1.13

Table 1.13

#	object	socket	Condition	Voltage (peak to peak)	Notice (good/bad)
1	CMP	27 & 26	Idling		
2	CMP	27 & 26	3000 RPM		

Questions

1. What happens to the Waveform when the engine speed increase?
2. If the **CMP** sensor failure, what affects the engine?
3. Locate the sensor on the engine
4. What type of **CMP** sensor?

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Exhaust Gas Recirculation EGR test	13

1.5 Emission Control System

❖ **Objectives :**

- **Recognize to component and sensors of the system.**
- **Learning how check this component.**
- **Notice the change of value when change engine operating.**
- **Learning skill uses different device.**

Exhaust Gas Recirculation (EGR), Fig 1.15.

Fig1.15: EGR

➢ **First Test**

❖ **Process of measurement:** measure the resistance.

❖ **Equipment needed**: Digital ohmmeter.

❖ **Steps**

1) Extracted the Typical values to check **EGR** valve from Autodata program, And recorded in the table 1.14.
2) Make sure the ignition switch off.
3) Remove the wires connection between (44 & 45), and (46& 47) on the ***test Board*** .
4) Connect Digital Ohmmeter on socket 45 & 47.
5) Measure the resistance value of the **EGR** valve .

Table 1.14

#	object	socket	Typical value	Measured value	Notice (good/bad)
1	CKP	20 & 22			

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Exhaust Gas Recirculation EGR test	13

1.5 Exhaust Gas Recirculation (EGR),

➢ Second Test

❖ **Process of measurement:** Measuring the voltage.

❖ **Equipment needed**: Digital voltmeter.

❖ **Steps**

1) Extracted the Typical values to check **EGR** valve from Autodata program, And recorded in the table 1.15.
2) Make sure of the engine is ready to run.
3) Ignition switch on.
4) connect the **Digital voltmeter** probe on socket (45 & 47) on the ***test Board*** .
5) Read the voltage value measured, And recorded in the table 1.15.
6) Compare Measured value with Typical value.

Table 1.15

#	object	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	**EGR**	45 & 47	Ignition On			

- By using Oscilloscope device connect the Oscilloscope probe on socket (45 & 47) on the ***test Board*** , when engine is running, see the waveform in engine idling and when Increase engine speed.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Control System test	14

1.6 Control System Fig:1.16.

❖ **Objectives :**

- **Learning how check this component.**
- **Notice the change of value when change engine operating.**
- **Learning skill uses different device.**

Fig1.16: ECU

➢ **First Test**

❖ **Process of measurement:** Measuring the voltage.

❖ **Equipment needed**: Digital voltmeter.

❖ **Steps**

1) Extracted the Typical values to check **ECU.** from Autodata program, And recorded in the table 1.16.
2) Use Digital voltmeter to check **ECU** As following table 1.16.

Table 1.16

#	object	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	**ECU**	**Bg4 & earth**	Ignition Off			
2	**ECU**	**Ae3 & earth**	Ignition On			
3	**ECU**	**Af2 & earth**	Ignition On			
4	**ECU**	**Af3 & earth**	Ignition On			
5	**ECU**	**Cc3 & earth**	Ignition On			

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Control System test	14

1.6 Control System

➢ Second Test

- ❖ **Process of measurement:** measure the resistance.
- ❖ **Equipment needed**: Digital ohmmeter.

❖ Steps

1) Make sure the ignition switch off.
2) Disconnect the positive battery cable
3) Remove the wires connection between (**Ah2** red & **Ah2 black**), (**Bk2** red & **Bk2 black**) ,(**Cg4** red & **Cg4 black**) , and (**Ch4** red & **Ch4black**) on the ***test Board*** .
4) Extracted the Typical values to check **ECU.** from Autodata program, And recorded in the table 1.17.
5) Use Digital ohmmeter to check **ECU** As following table 1.17.

Table 1.17

#	object	socket	Typical value	Measured value	Notice (good/bad)
1	**ECU**	**Ah2 black & earth**			
2	**ECU**	**Bk2 black & earth**			
3	**ECU**	**Cg4 black & earth**			
4	**ECU**	**Ch4 black & earth**			

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Accelerator Pedal Position (APP) Sensor test	15

1.7 Vehicle Sensors

❖ **Objectives :**

- **Recognize to components and sensors of the system.**
- **Learning how check this components.**
- **Notice the change of value when change engine operating.**
- **Learning skill uses different device.**

1.7.1 Accelerator Pedal Position (APP) Sensor.

❖ **Process of measurement:** Measure the resistance & Measuring the voltage.

❖ **Equipment needed**: Digital ohmmeter& Digital voltmeter.

❖ **Steps**

1) Make sure the ignition switch off.
2) Remove the wires connection between (28 & 29) on the ***test Board*** .
3) Connect Digital Ohmmeter on socket 29 & Earth.
4) Measure the resistance value, And recorded in the table 1.18.
5) Make sure of the engine is ready to run.
6) Ignition switch on.
7) Remove the wires connection between (30 & 31) on the ***test Board*** .
8) connect the **Digital voltmeter** probe on socket (31 & Earth) on the ***test Board*** .
9) Read the voltage value measured, And recorded in the table 1.18.
10) Compare Measured value with Typical value.
11) Reconnect the wires connection between (28 & 29), and (30 & 31) on the ***test Board*** .
12) connect the **Digital voltmeter** probe on socket (32 & 29) on the ***test Board*** .
13) make APPS in released mode.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Accelerator Pedal Position (APP) Sensor test	15

14) Read the voltage value measured, And recorded in the table 1.18.
15) Compare Measured value with Typical value.
16) make APPS in fully pressed mode.
17) Read the voltage value measured, And recorded in the table 1.18.
18) Compare Measured value with Typical value.
19) connect the **Digital voltmeter** probe on socket (33 & 29) on the ***test Board*** .
20) make APPS in released mode.
21) Read the voltage value measured, And recorded in the table 1.18.
22) Compare Measured value with Typical value.
23) make APPS in fully pressed mode.
24) Read the voltage value measured, And recorded in the table 1.18.
25) Compare Measured value with Typical value.

Table 1.18

#	object	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	**APPS**	29 & Earth	Switch off	0 Ω		
2	**APPS**	31 & Earth	Switch on	5 v		
3	**APPS**	32 & 29	Switch on & Pedal is released	0.4 v		
4	**APPS**	32 & 29	Switch on & Pedal is fully pressed	3.7 v		
5	**APPS**	33 & 29	Switch on & Pedal is released	0.2 v		
6	**APPS**	33 & 29	Switch on & Pedal is fully pressed	1.85 v		

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Vehicle Speed Sensors (VSS) test	16

1.7.2 Vehicle Speed Sensors (VSS).

- **Process of measurement:** Measure the resistance & Measuring the voltage.
- **Equipment needed**: Digital ohmmeter& Digital voltmeter.

- **Steps**
  1) Make sure the ignition switch off.
  2) Remove the wires connection between (34 & 35) on the ***test Board*** .
  3) Connect Digital Ohmmeter on socket 35 & Earth.
  4) Measure the resistance value, And recorded in the table 1.19.
  5) Reconnect the wires connection between (34 & 35), on the ***test Board*** .
  6) Make sure of the engine is ready to run.
  7) Ignition switch on.
  8) Remove the wires connection between (36 & 37) on the ***test Board*** .
  9) connect the **Digital voltmeter** probe on socket (37 & Earth) on the ***test Board*** .
  10) Read the voltage value measured, And recorded in the table 1.19.
  11) Compare Measured value with Typical value.

Table 1.19

#	object	socket	Condition	Typical value	Measured value	Notice (good/bad)
1	**VSS**	35 & Earth	Switch off	0 Ω		
2	**VSS**	37& Earth	Switch on	11-14 v		

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Diagnosis of engine	17

1.8 Diagnosis of engine

❖ **Objectives :**

- **Learning how extract the measure and typical value.**
- **Notice the change of value when change engine operating.**
- **Ability to describe condition of engine sensors and actuator.**
- **Learning skill uses different device.**

❖ **Equipment needed**: Digital ohmmeter, Digital voltmeter, Oscilloscope & **Lexia** Device, fig 1.17.

Fig1.17: Lexia Device

❖ Extract all the engine faults through the process of diagnosis Lexia device.
❖ Record of these faults.
❖ Analyzed these faults and mention the reasons.
❖ Then Extract readings of the engine and record in a table 1.20.

Engine System type:	Experiment name:	Experiment #:
Common Rail system	Diagnosis of engine	17

Table 1.20

#	Name of component	unit	Switch on	Idle speed	3000 RPM	Note
1	Engine speed					
2	Crankshaft-camshaft synchronizing					
3	Fuel pressure reference					
4	Fuel pressure measured					
5	Pressure regulator OCR					
6	Fuel flow regulator					
7	Output injected					
8	Injector flow correction, cylinder 1					
9	Injector flow correction, cylinder 2					
10	Injector flow correction, cylinder 3					
11	Injector flow correction, cylinder 4					
12	Injector voltage					
13	Air flow reference value					
14	Measured air flow					
15	EGR valve OCR					
16	EGR throttle electro valve OCR					
17	Pre-injection advance					
18	Main- injection advance					
19	Injection time					
20	Engine coolant temperature					
21	Fuel temperature					
22	Corrected air temperature					
23	Atmospheric pressure					
24	Battery voltage					
25	Sensor supply voltage					
26	Power relay control					
27	Ignition on voltage					
28	Status of the ECU					
29	Engine immobilizer programming status					

Palestine Polytechnic University
College Of Engineering and Technology
Department Of Mechanical Engineering
Diesel Fuel Injection System

Manual control panel

Specially just for teacher