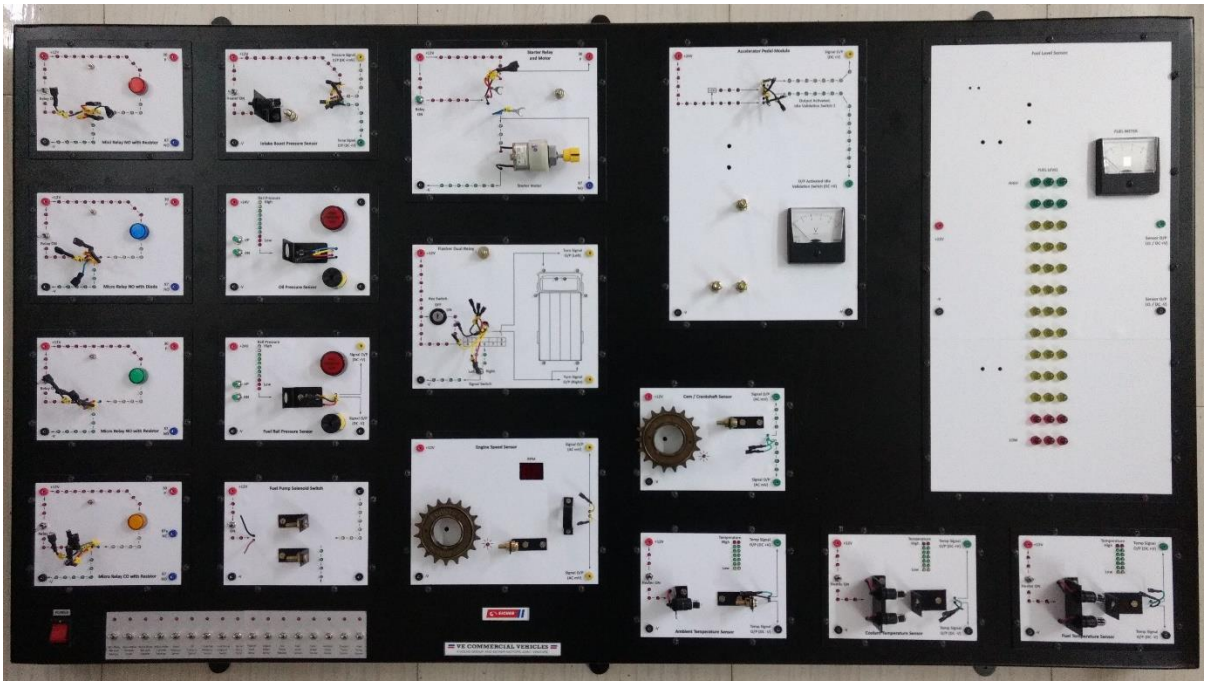
Display Board with LED based Demo-Kits

(Model: V03)



User Manual & Operating Instructions

- ✓ Safety Rules for Working with Demo-kits Board
- ✓ Start-up Guide
- ✓ Operating the Demo-kits Board
- ✓ Brief Theory of Sensors
- ✓ Resistance Measurement Test
- ✓ Understanding the Working of Sensors
- ✓ Troubleshooting

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Safety Rules for Working with Electrical Equipment

A safe work environment is not always enough to control all potential electrical hazards. You must be very cautious and work safely.

DO

- Do plug power equipment into wall receptacles with power switches in the OFF position.
- Do plug electrical equipment in OFF condition.
- Do unplug electrical equipment by grasping the plug and then pulling.
- Disconnect the power source before servicing or repairing electrical equipment.
- Stay away from exposed electrical parts unless you are a qualified worker.
- Keep the work area clean.
- Leave electrical repairs to qualified personnel.

DON'T

- Do not plug power equipment into wall receptacles with power switches in the ON position.
- Do not unplug electrical equipment in ON condition.
- Do not plug equipment into defective receptacles.
- Do not pull or jerk the cord to unplug the equipment.
- Do not touch equipment or electrical devices unless instructed to do so.
- Don't place cords near heat or water.
- Don't touch anything electric with wet hands.

Start-up Guide

Checking the Contents

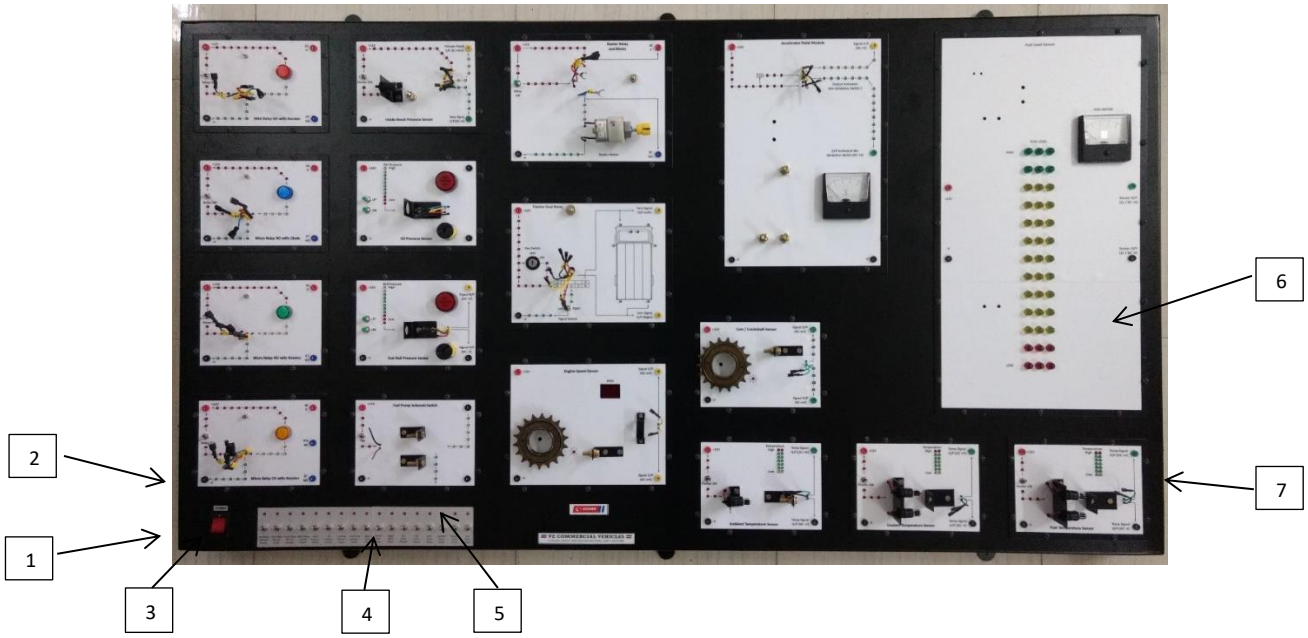
The total set consists following -

Sr. No.	Name	Make / Type	Quantity
1.	Display Board		1 unit
2.	Demo-kits (mounted on board)		
	➢ Mini Relay NO with Resistor	BGLI BGR210 or Equivalent	1 unit
	➢ Micro Relay NO with Diode	BGLI BGR203 or Equivalent	1 unit
	➢ Micro Relay NO with Resistor	BGLI BGR202 or Equivalent	1 unit
	➢ Micro Relay CO with Resistor	BGLI BCR202 or Equivalent	1 unit
	➢ Intake Boost Pressure Sensor		1 unit
	➢ Oil Pressure Sensor	21634021 / 10R-002202	1 unit
	➢ Fuel Rail Pressure Sensor		1 unit
	➢ Fuel Pump Solenoid Switch		1 unit
	➢ Starter Relay (HCV)	BGLI BGR255 or Equivalent	1 unit
	➢ Flasher Duel Relay	BGLI BGF136 or Equivalent	1 unit
	➢ Engine Speed Sensor		1 unit
	➢ Accelerator Pedal Module	Williams 400467 or Equivalent	1 unit
	➢ Fuel Level Sensor	L = 390mm	1 unit
	➢ Cam (Phase) Sensor / Crankshaft Sensor		1 unit
	➢ Ambient Temperature Sensor	NTC type	1 unit
	➢ Coolant Temperature Sensor	NTC type	1 unit
	➢ Fuel Temperature Sensor	NTC type	1 unit
3.	Connecting Cables (In Poly Bag)		
	➢ Power cable/cord	3 pin	1 pc
	➢ PVC pipe	1 meter long	1 pc

Operating the Demo-kits Board

Overview

Front view



1 > Mains Inlet Socket
2 > Mains Fuse
3 > Mains ON Switch with Indicator
4 > Power Supply Switches of Demo-kits
5 > Power ON Indicator of Demo-kits
6 > Demo-kits
7 > Display Board

Operating the Demo-kits Board

- Demo-kits Board is Plug-N-Play type.
- Ensure proper Earth at Mains supply point.
- Insert Mains cords' female pin in Board & other end (3-pin plug) to 230V Mains supply point.
- Ensure all Power supply switches of Demo-kits are at OFF position.
- Switch ON Mains supply.
- Mains ON indicator will glow.
- Now Board is ready to use.
- Demo-kits will function when power supply is applied to it by its particular switch.

Brief Theory of Sensors

Relay

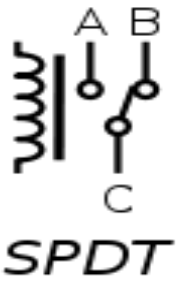
A relay is an electromagnetic device and it functions as an electronically operated switch. Most of relays are operated electro-magnetically. When current flows through coil, electromagnetic field is generated, this attracts the armature which in turn opens or closes the electrical contacts.

A common type of relay is having a normally open (N/O) and a normally closed (N/C) contact.
Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

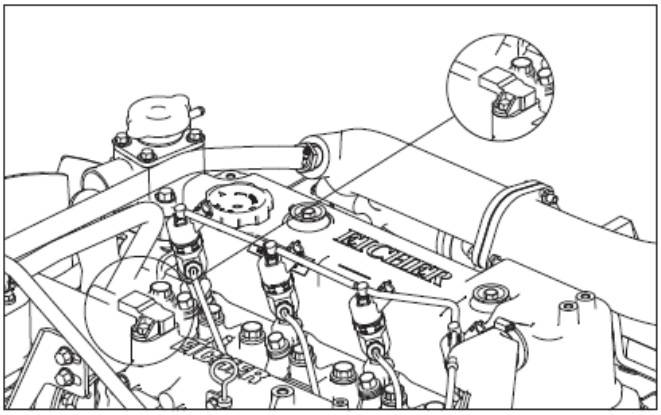
Simple electromagnetic relay consists of a coil of wire surrounding a soft iron core, an iron yoke, a movable iron armature, and one or more sets of contacts.

4-point Relay

5-point Relay



Boost pressure sensor



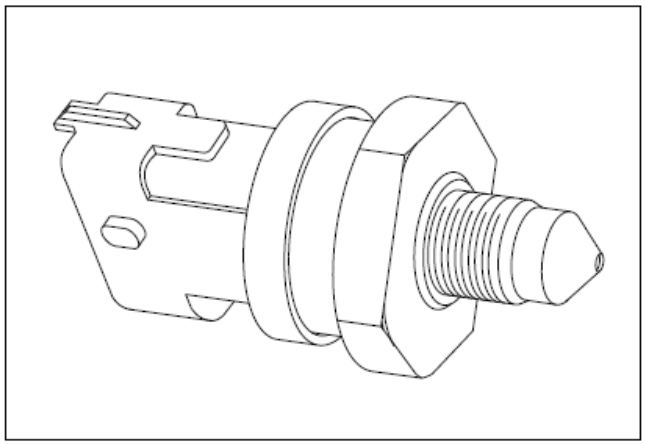
- It is mounted on Inlet Manifold.
- It senses the engine air intake pressure & temperature with Turbocharger.
- It gives Voltage output proportional to air intake to ECU.
- It is used for determining the fueling qty with respect to air intake pressure

Measuring principle :

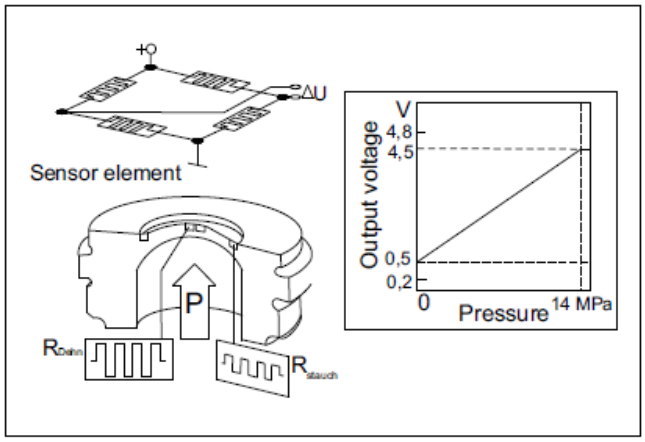
The boost pressure Sensor element consists of silicon diaphragm, which contains Several Piezo resistive Semiconductors. The boost pressure acts on the diaphragm causes change in electrical resistance in Circuit thus change in output voltage. Which goes to ECU as a signal.

Rail pressure sensor (High pressure)

- Sensor is mounted to one end of the rail for sensing the rail pressure
- Sensor supplied with 5V by the ECU
- Signal voltage from the sensor is converted to rail pressure by the ECU
- Rail pressure control is disabled incase of sensor failure
- Able to sense 0 – 1800 bar pressure



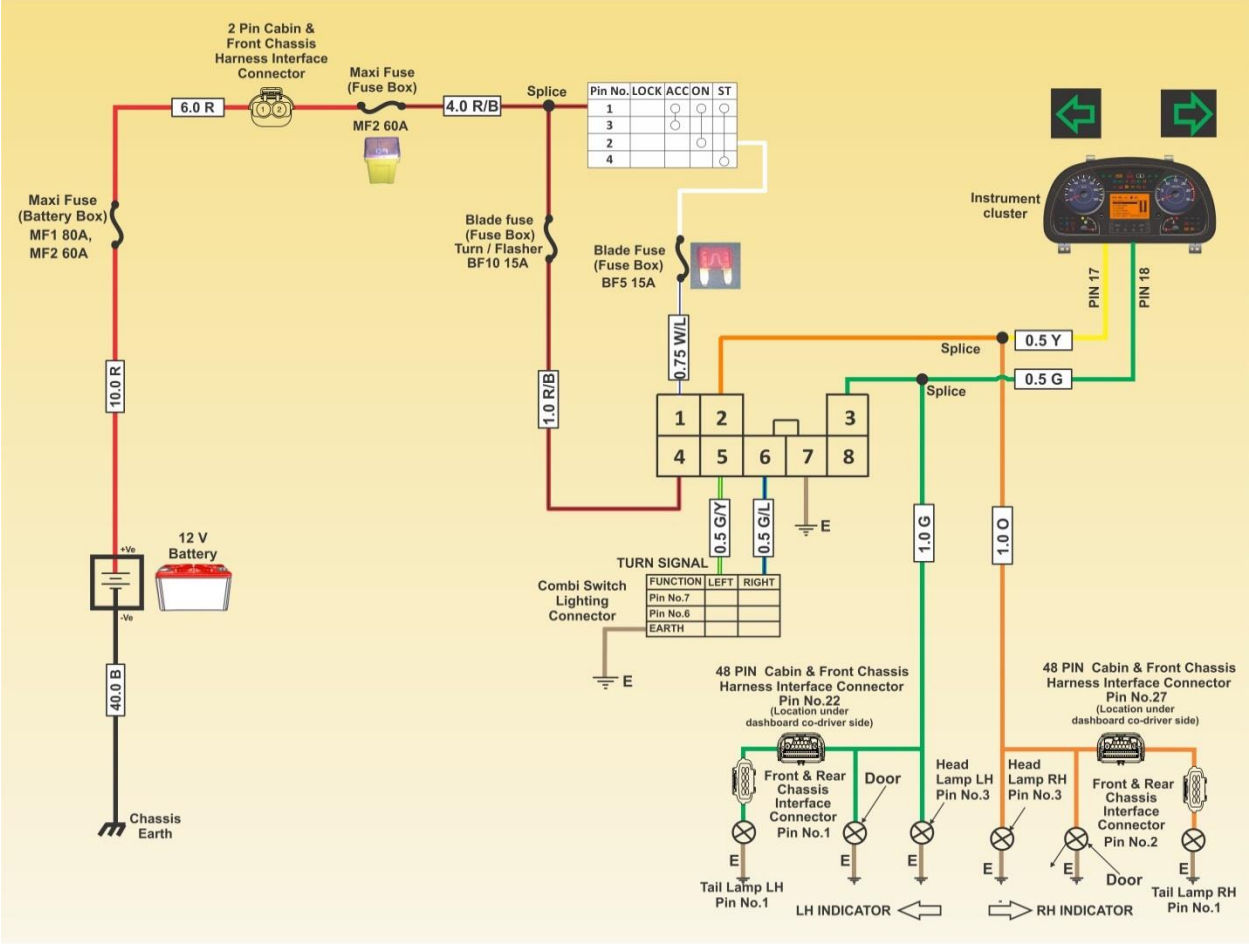
Measuring Principle



Note :

1 Do not dismounted Rail Pressure sensor and Pressure Relief Valve from the Rail.

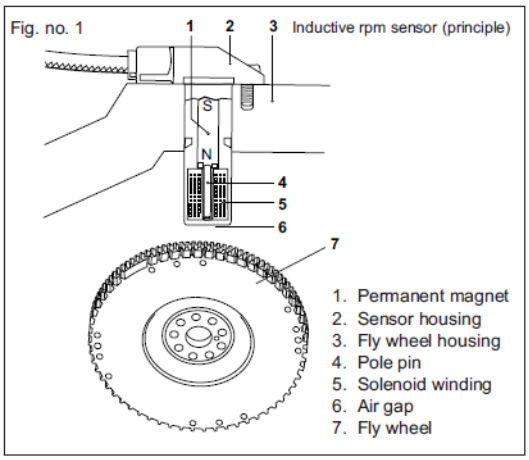
Flasher Dual Relay

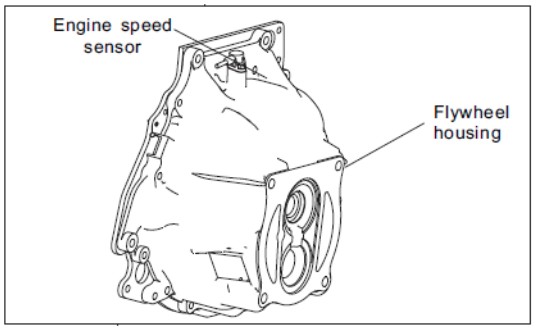


Engine Speed Sensor

Its a Inductive type sensor fitted on the flywheel housing, Electric pulses are generated when the formed slot(serial no. 7 of fig. no.1) on the flywheel pass thro the sensor axis(as shown in the fig.No.1) Flywheel outer face has 60 equally spaced teeth machined. Two teeth, near tdc of no. 1 or 4, is deliberately missed. The sensor identifies the missing teeth & locates the TDC and the ECU calculates the speed.

Engine speed sensor after sensing the signals gives it to ECU. Signal received from Engine speed sensor helps ECU to Calculate the position of the cylinder.

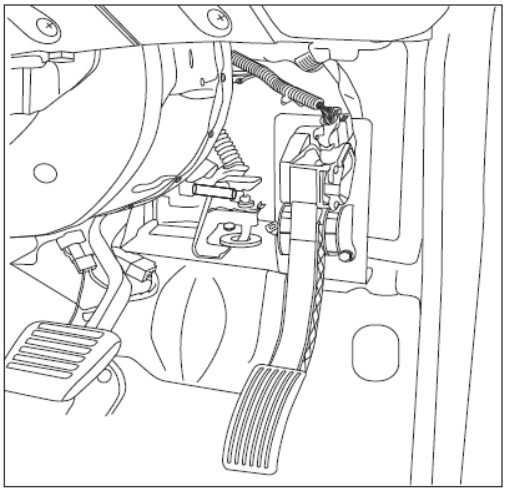




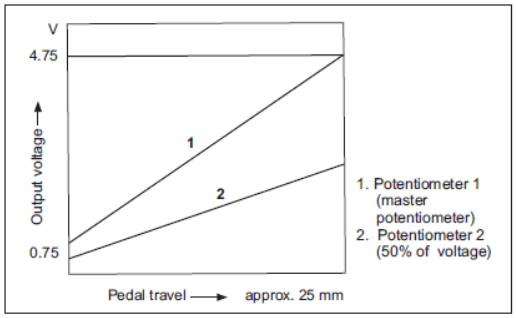
Note :

1. **Ensure no damage Happens to flywheel sensing teeth during servicing.**
2. **Whenever servicing refitment of sensor replace the sensor Oring.**
   (Eicher Part No. .....)
   (Bosch Part No.....)
3. **Maintain air gap between flywheel and sensor (0.7 to 1.4 mm)**

Accelerator pedal sensor



- It is complete accelerator Pedal module mounted in cabin at accelerator position.
- It is for sensing the vehicle accelerator pedal position.
- It works on variable resistance potentiometer principle whose resistance changes with pedal pressing / position.(Out put voltage changes with respect to pedal travel as shown in below fig.) The out put voltage signal goes to ECU.
- It has two potentiometers so that if one potentiometer fails it takes input from other potentiometers & vehicle performs normally. If both fails it goes to limp home mode.
- It gives the driver demand signal to ECU in terms of variable resistance and ECU adjust fueling accordingly.
- Important Sensor for the proper functioning of the vehicle.
- Driver's commands are mapped into the ECU.
- Injection quantity, rail pressure & timing are varied according to the driver's commands.



Diagnostic lamp

Diagnostic lamp is mounted on dash board.

It will glow in case of any improper functioning of any system. It will help operator to understand problem in CRS system to take necessary action. 3

Note :

1) **APM 1.1 Type sensor Applicable for E483 BSIII (VP37) & CRS BSIV**
2) **Dont give direct battery supply to sensor pins**

CAM (Phase) sensor

It is mounted on cyl Block on exhaust side (At feed pump position).

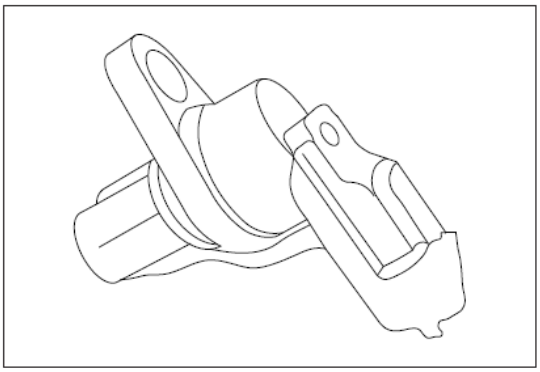
It Gives Voltage output pulse on occurrence of Teeth on cam shaft.

It is used to give feedback signal to ECU for correct timing.

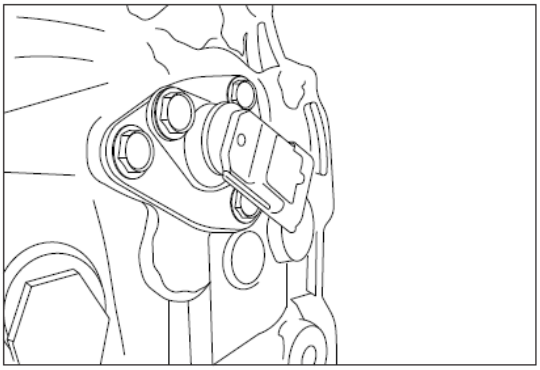
The sensor helps in quick starting (as compared to crankshaft sensor) due to single rotation of camshaft per power stroke.

Functional Principle

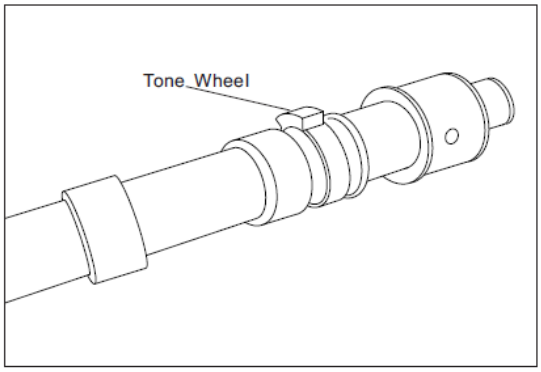
- Sensor generates electrical signal from the camshaft tone wheel
- Used along with the crankshaft sensor to detect the TDC position of the cylinders
- The tone wheel varies the magnetic field of the sensor resulting in the generation of output voltage



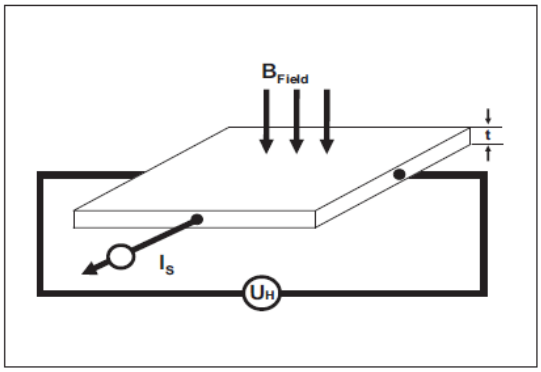
CAM Sensor Mounting Position on Engine Cylinder block RH Side.



Cam shaft with Tone Wheel for sensing correct timing by Cam Sensor.



Hall Effect Principle

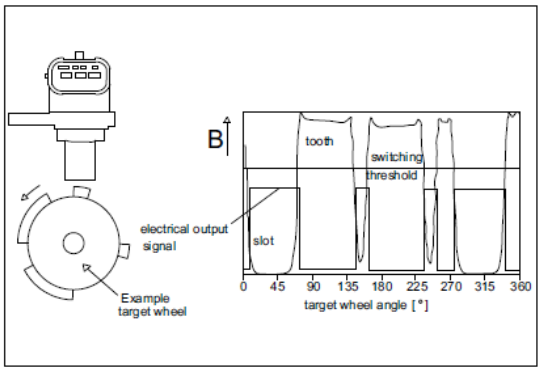


$$U_H = R_H \times \frac{I_s \times B_{field}}{t}$$

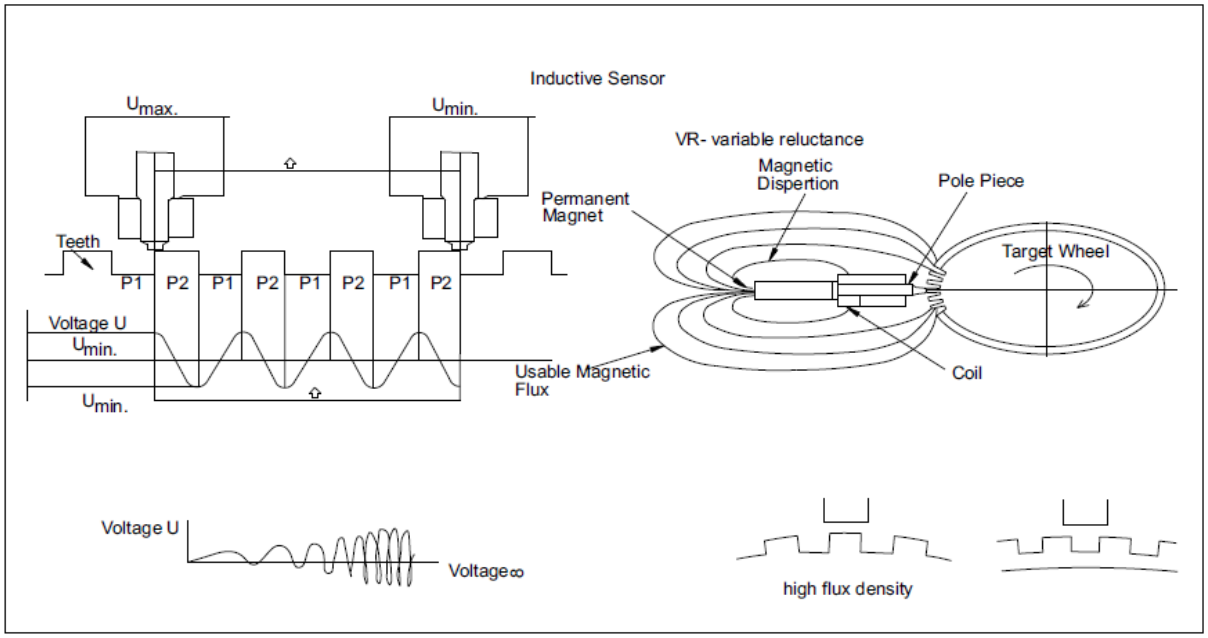
U_H = Hall voltage
R_H = Hall constant
I_S = Supply current
B_{field} = Magnetic Induction
t = Thickness of the Hall element

Operating Principle :

Is the generation of a potential difference (the Hall voltage) across and electrical conductor, transverse to an electric current in the conductor and a magnetic field perpendicular to the current



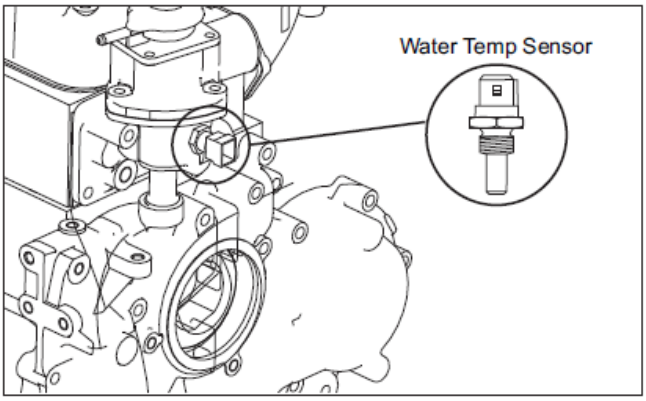
Crankshaft sensor



Engine speed is sensed by the ECU through this sensor

- Sensor generates sinusoidal voltage signal from the tone wheel mounted next to the flywheel
- The sinusoidal voltage is converted to speed signal by the ECU

Water Temp Sensor



Water Temperature sensor is mounted on thermostat housing. Its a Negative temperature co-efficient (NTC - Resistance decrease as temperature increase As shown in the graph of fig. 2) type Sensor. It senses the Coolant temperature in Engine for detecting Cold & Hot Condition of Engine. After sensing the temperature of coolant it gives signal to ECU.

Accuracy of sensor is ± 2 °C

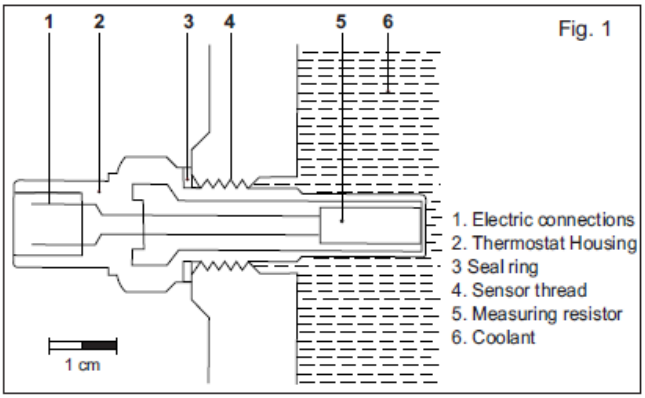
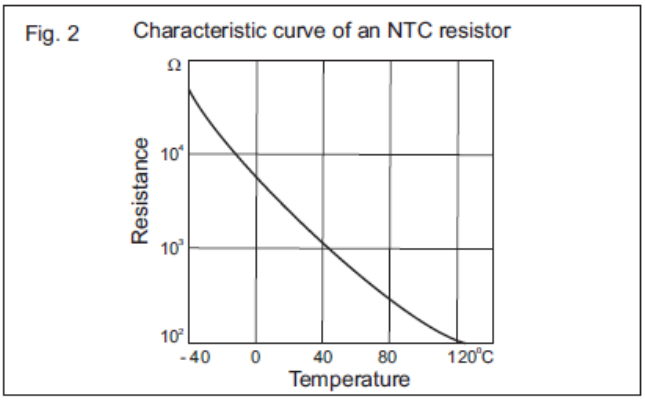
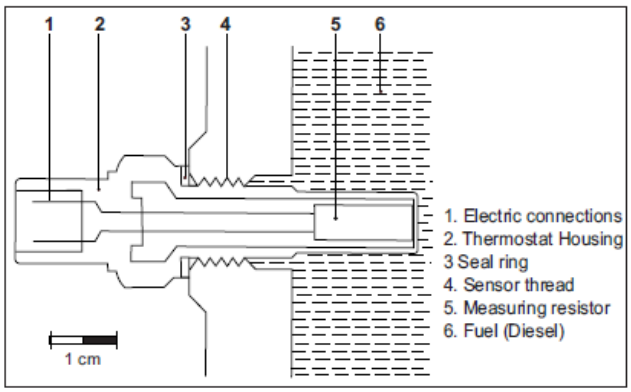


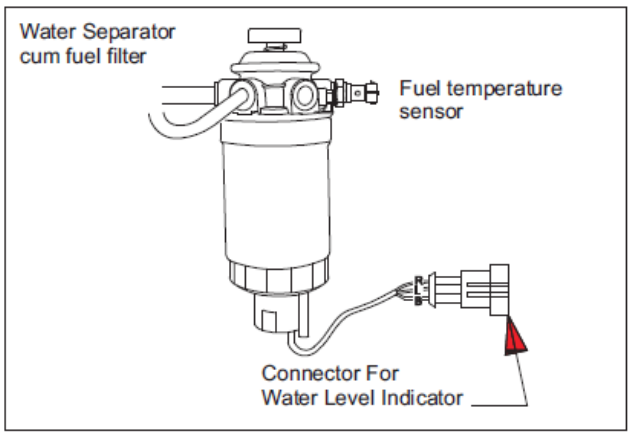
Fig. 1



Fuel Temperature Sensor

Fuel Temperature sensor is mounted in the water separator cum fuel filter unit. It measure fuel temperature for density correction. Its a Negative temperature co-efficient (NTC - Resistance decrease as temperature increase type Sensor.





Note :

1. **Do not dismount the fuel temperature sensor from the filter body**
2. **Use spl. tool to remove filter element.**

Resistance Measurement

All checks described below are performed using Digital Multi meter (DMM). The actual values are measured between corresponding terminals and compared with the specified rated (Nominal) values.

Resistance measurement of individual sensor –

Sr. No.	Check	Sensor End	Rated value
1	Cam (Phase) sensor / Crankshaft sensor	1 and 2 (as shown in figure 5)	835Ω / 882Ω
2	Boost Pressure sensor -a) Pressure sensor b) Air temperature sensor	 4 and 1 (as shown in figure 4) 2 and 1 (as shown in figure 4)	 60Ω at Open Air 1.6kΩ at Room Temp.

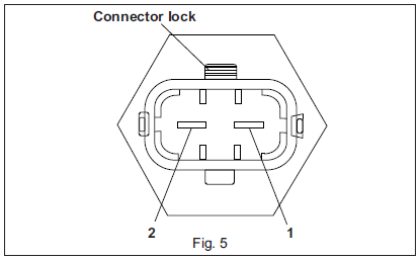


Fig. 5

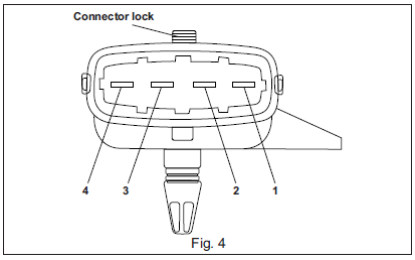


Fig. 4

Water Temperature sensor values(Tabulation)

Water temperature in °C	Resistance in KΩ with tolerance of ± 1 °C	
	From (R_{min}) KΩ	To(R_{max}) KΩ
-40	38.313	52.926
-30	22.307	30.194
-20	13.402	17.718
-10	8.244	10.661
0	5.227	6.623
10	3.390	4.217
20	2.262	2.760
25	1.870	2.260
30	1.553	1.866
40	1.080	1.277
50	0.771	0.900
60	0.555	0.639
70	0.408	0.465
80	0.304	0.342
90	0.230	0.257
100	0.178	0.196
110	0.136	0.152
120	0.106	0.119
130	0.084	0.095
140	0.067	0.076

Fuel Temperature sensor values(Tabulation)

Temperature in °C	Resistance in KΩ with tolerance of ± 1 °C	
	From	To
20	2.315	2.649
40	1.118	1.231
60	0.573	0.618
80	0.313	0.332
100	0.182	0.191

Precautions

Following precautions must be observed before working on Demo-kits to ensure proper functioning of sensors & other parts and also to avoid short-circuit and Electrical damage.

A 12V or 24V DC supply is available at each Demo-kit terminal. Working with this low voltage supply is very safe and it does not cause a shock. This DC supply is used to power the Sensors, Relays & other circuitry.

Do not apply this supply to output terminals of Demo-kits unless otherwise specified. Doing this, will damage the sensor & electronic circuitry.

Also do not short circuit the DC supply terminals which may cause damage to SMPS units.

Fuel solenoid switch consumes heavy current to operate and also heats up early. So do not keep it ON for more than 1 minute.

Understanding the working of Sensors

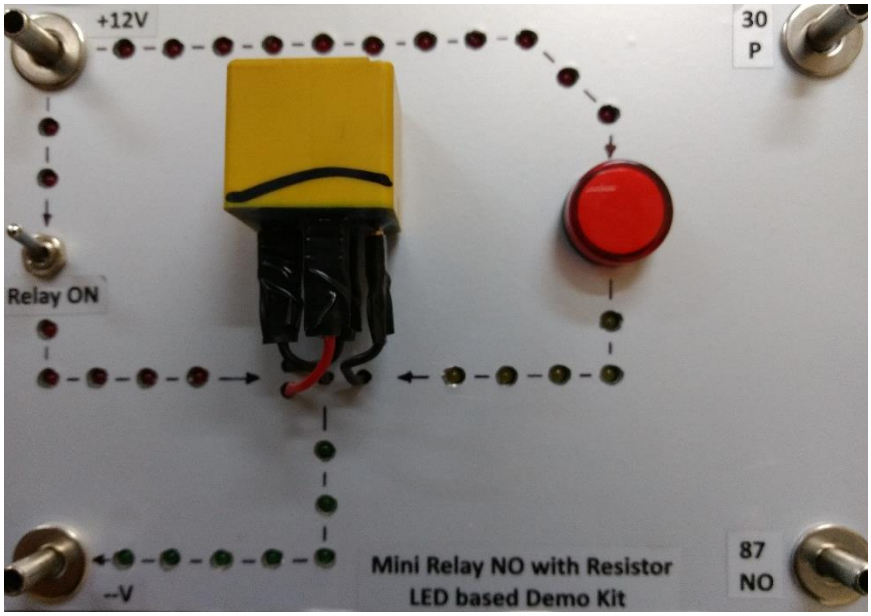
Preparation
To operate / function the Demo-kits, a DC power supply is provided through individual On/Off switches at Bottom-left corner. A LED indicator is also provided to indicate presence of power.

A digital multi-meter is recommended to measure the output parameters like Resistance, Voltage etc. of sensors & relays.

1. Mini Relay NO with Resistor Demo-kit

Red LED – indicates flow of supply voltage / current from +12V to relay coil & lamp
Yellow LED – indicates flow of supply voltage / current from lamp to relay contact
Green LED – indicates flow of supply voltage / current from relay contact to –V

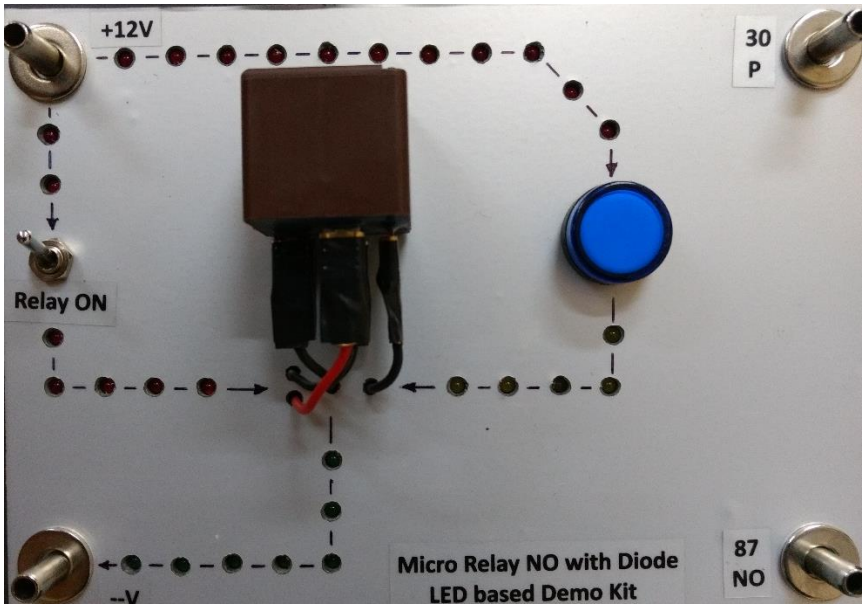
- Connect multi-meter red probe to 30 (P) terminal.
- Connect multi-meter common/-V/GND black probe to 87 (NO) terminal.
- Select multi-meter range as continuity.
- Multi-meter will show no continuity as relay contacts are open.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Also Yellow LED will start glowing one by one.
- Now switch ON relay.
- Red LED will start glowing one by one and at the end relay will be ON.
- Multi-meter will show continuity as relay contacts are closed.
- Green LED will start glowing one by one and at the end lamp will glow.



2. Micro Relay NO with Diode Demo-kit

Red LED – indicates flow of supply voltage / current from +12V to relay coil & lamp
Yellow LED – indicates flow of supply voltage / current from lamp to relay contact
Green LED – indicates flow of supply voltage / current from relay contact to –V

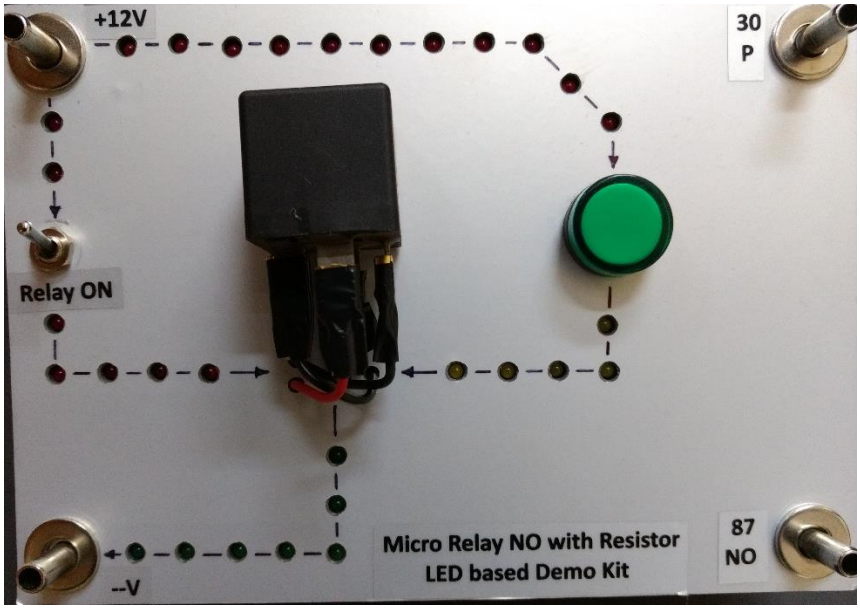
- Connect multi-meter red probe to 30 (P) terminal.
- Connect multi-meter common/-V/GND black probe to 87 (NO) terminal.
- Select multi-meter range as continuity.
- Multi-meter will show no continuity as relay contacts are open.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Also Yellow LED will start glowing one by one.
- Now switch ON relay.
- Red LED will start glowing one by one and at the end relay will be ON.
- Multi-meter will show continuity as relay contacts are closed.
- Green LED will start glowing one by one and at the end lamp will glow.



3. Micro Relay NO with Resistor Demo-kit

Red LED – indicates flow of supply voltage / current from +12V to relay coil & lamp
Yellow LED – indicates flow of supply voltage / current from lamp to relay contact
Green LED – indicates flow of supply voltage / current from relay contact to –V

- Connect multi-meter red probe to 30 (P) terminal.
- Connect multi-meter common/-V/GND black probe to 87 (NO) terminal.
- Select multi-meter range as continuity.
- Multi-meter will show no continuity as relay contacts are open.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Also Yellow LED will start glowing one by one.
- Now switch ON relay.
- Red LED will start glowing one by one and at the end relay will be ON.
- Multi-meter will show continuity as relay contacts are closed.
- Green LED will start glowing one by one and at the end lamp will glow.



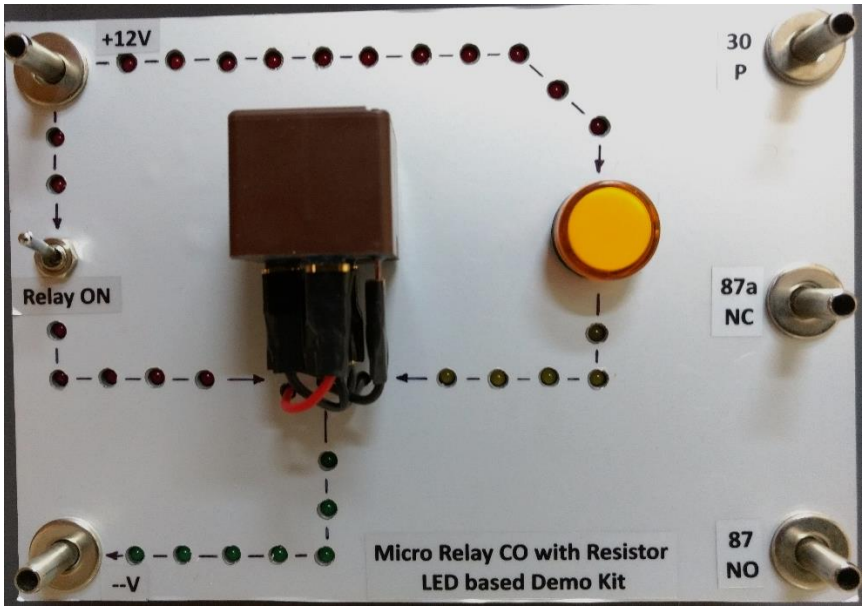
4. Micro Relay CO with Resistor Demo-kit

Red LED – indicates flow of supply voltage / current from +12V to relay coil & lamp
Yellow LED – indicates flow of supply voltage / current from lamp to relay contact
Green LED – indicates flow of supply voltage / current from relay contact to –V

Checking of Relay conatcts NO+NC using multi-meter before relay is energised.
- Select multi-meter range as continuity.
- Connect multi-meter red probe to 30 (P) terminal.
- Connect multi-meter common/-V/GND black probe to 87a (NC) terminal.
- Multi-meter will show continuity as relay contacts are closed.
- Now connect multi-meter common/-V/GND black probe to 87 (NO) terminal.
- Multi-meter will show no continuity as relay contacts are open.

- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Also Yellow LED will start glowing one by one.
- Now switch ON relay.
- Red LED will start glowing one by one and at the end relay will be ON.
- Green LED will start glowing one by one and at the end lamp will glow.

Checking of Relay conatcts NO+NC using multi-meter after relay is energised.
- Select multi-meter range as continuity.
- Connect multi-meter red probe to 30 (P) terminal.
- Connect multi-meter common/-V/GND black probe to 87a (NC) terminal.
- Multi-meter will show no continuity as relay contacts are open.
- Now connect multi-meter common/-V/GND black probe to 87 (NO) terminal.
- Multi-meter will show continuity as relay contacts are closed.



5. Boost Pressure Sensor Demo-kit

Red LED – indicates flow of supply voltage / current
Yellow LED – indicates Pressure signal output voltage & blinks if pressure varies
Green LED – indicates Temperature signal output voltage & blinks if temperature varies

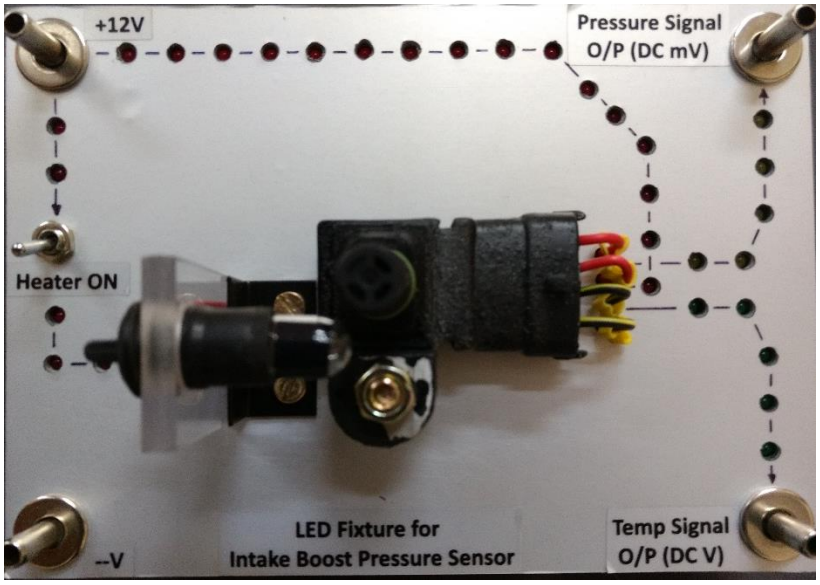
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- After this, Yellow & Green LED will start glowing one by one.

a) To measure Pressure signal o/p -
- Connect multi-meter red probe to Pressure signal o/p terminal of sensor demo kit.
- Connect multi-meter common/-V/GND black probe to --V terminal of sensor demo kit.
- Select multi-meter range as 2000mV/2V DC.
- In ideal state, multi-meter reads around 887mV/0.887V for room pressure.
- Yellow LED glows constant as Pressure is constant.
- To create more pressure, insert pipe in sensor & blow air at other end of pipe.
- Now multi-meter reading increases, as pressure increases.
- Yellow LED blinks as pressure increases.
  Blinking speed is fixed / constant and is not proportional to pressure.

Note –
Green LED may blink when pressure is applied as flow of air increases the sensor temperature.

b) To measure Temperature signal o/p -
- Connect multi-meter red probe to Temperature signal o/p terminal of sensor demo kit.
- Connect multi-meter common/-V/GND black probe to --V terminal of sensor demo kit.
- Select multi-meter range as 20V DC.
- In ideal state, multi-meter reads around 2.55V for room temperature.
- Green LED glows constant as temperature is constant.
- To increase temperature, switch ON heater.
- Red LED will start glowing one by one and at end bulb will glow.
- Now multi-meter reading decreases, as temperature increases.
- Yellow LED blinks as temperature varies.
  Blinking speed is fixed / constant and is not proportional to temperature.

Note –
Green LED will blink even if Heater/Bulb is switched off, till sensor temperature reaches to room temperature.

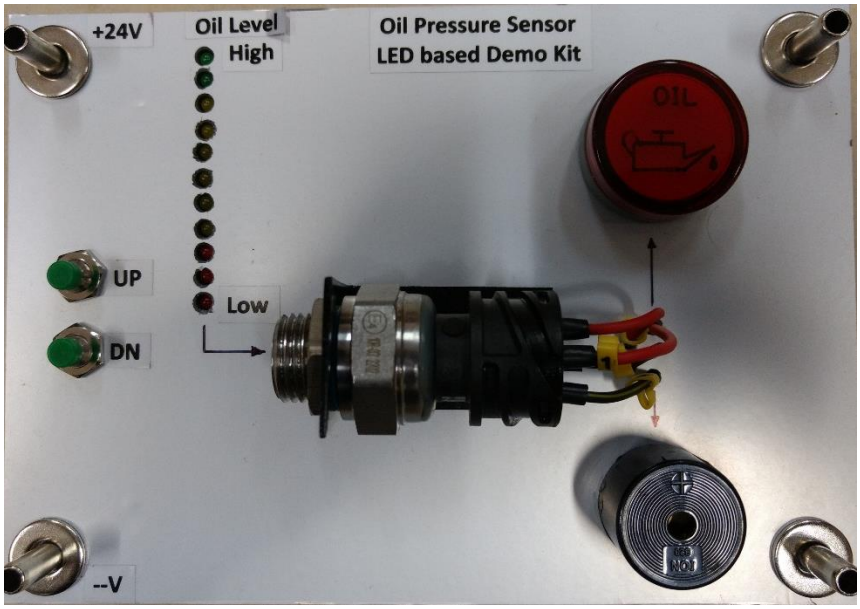


6. Oil Pressure Sensor Demo-kit

Oil Pressure LED bar graph – indicates engine oil pressure level as Low – Red LED
Normal – Yellow LED
High – Green LED
Warning lamp & Buzzer – indicates that engine oil pressure is low

- Switch ON toggle switch to apply 24V DC supply.
- Oil pressure bar graph LEDs will glow.
- Oil pressure can be varied (LEDs ON/OFF) by using UP / DN buttons.
- When oil pressure becomes low, warning lamp glows & buzzer sounds.

Note –
LED bar graph represents oil pressure for demo purpose only & does not vary actual pressure input to sensor.

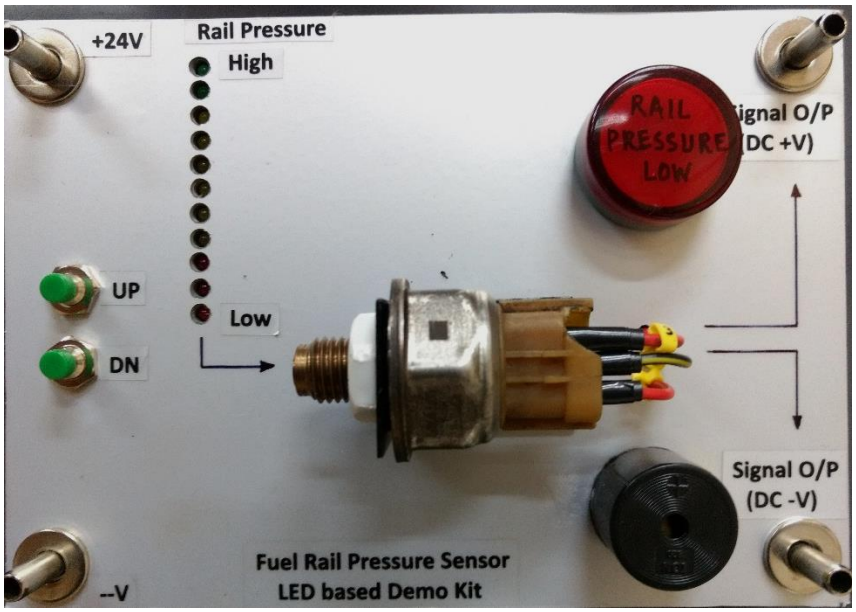


7. Fuel Rail Pressure Sensor Demo-kit

Rail Pressure LED bar graph – indicates fuel rail pressure level as Low – Red LED
Normal – Yellow LED
High – Green LED
Warning lamp & Buzzer – indicates that fuel rail pressure is low

- Connect multi-meter red probe to signal output (DC+V) terminal.
- Connect multi-meter common/-V/GND black probe to signal output (DC-V) terminal.
- Select multi-meter range as 20V DC.
- Switch ON toggle switch to apply 24V DC supply.
- Rail pressure bar graph LEDs will glow.
- Also multi-meter will read 0.65V
- Rail pressure can be varied (LEDs ON/OFF) by using UP / DN buttons.
- When rail pressure becomes low, warning lamp glows & buzzer sounds.

Note –
LED bar graph represents rail pressure for demo purpose only & does not vary actual pressure input to sensor.
So sensor output singal voltage remains constant & does not vary as per LED bar graph.

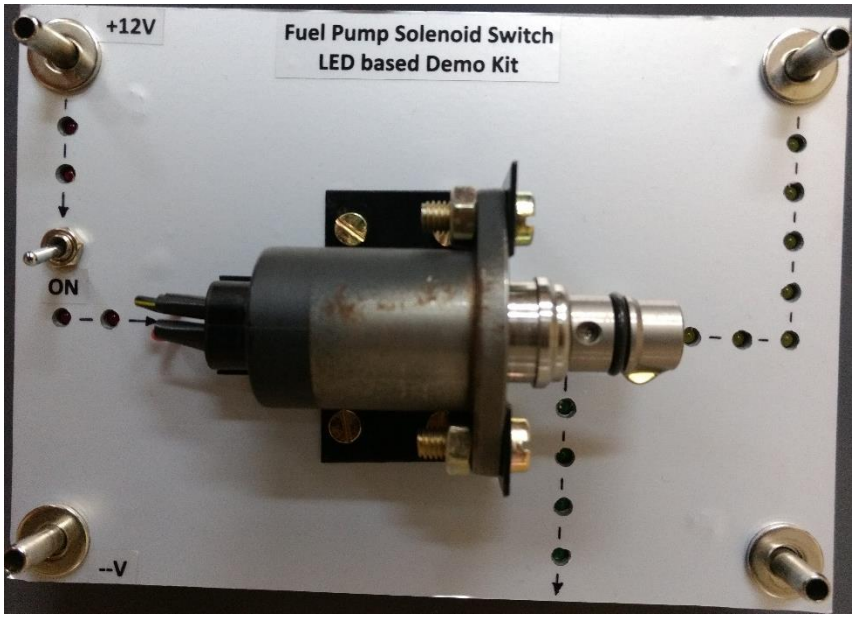


8. Fuel Pump Solenoid Switch Demo-kit

Red LED – indicates flow of supply voltage / current
Yellow LED – indicates incoming fuel to solenoid
Green LED – indicates outgoing fuel from solenoid

- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Also Yellow LED will start glowing one by one.
- Now switch ON solenoid switch.
- Red LED will start glowing one by one and at end solenoid will be ON.
- Green LED will glow, one at a time, to indicate flow of fuel.
- Green LED will stop glowing, if solenoid is switched OFF.

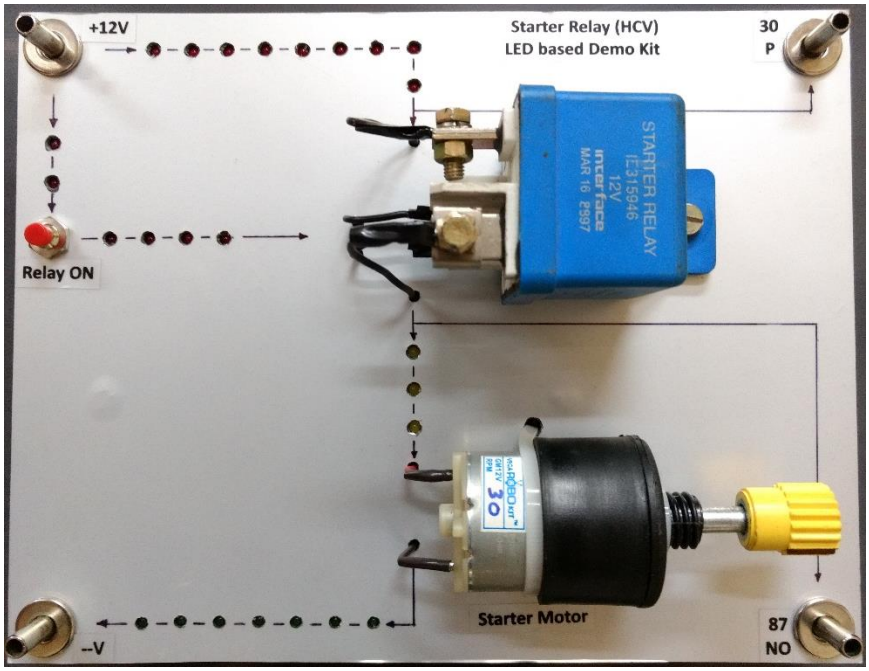
Note –
Do not keep this solenoid ON for more than 1 minute as it consumes heavy current & heats up rapidly.



9. Starter Relay (HCV) Demo-kit

Red LED – indicates flow of supply voltage / current from +12V to relay coil & contact
Yellow LED – indicates flow of supply voltage / current from relay contact to starter motor
Green LED – indicates flow of supply voltage / current from starter motor to –V

- Connect multi-meter red probe to 30 (P) terminal.
- Connect multi-meter common/-V/GND black probe to 87 (NO) terminal.
- Select multi-meter range as continuity.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Also multi-meter will show no continuity as relay contacts are open.
- Now press ON relay switch once.
- Red LED will start glowing one by one and at the end relay will be ON.
- And multi-meter will show continuity as relay contacts are closed.
- Then Yellow LED will start glowing one by one.
- Also Green LED will start glowing one by one and at the end motor will rotate.
- Motor will stop automatically after around 20 sec.

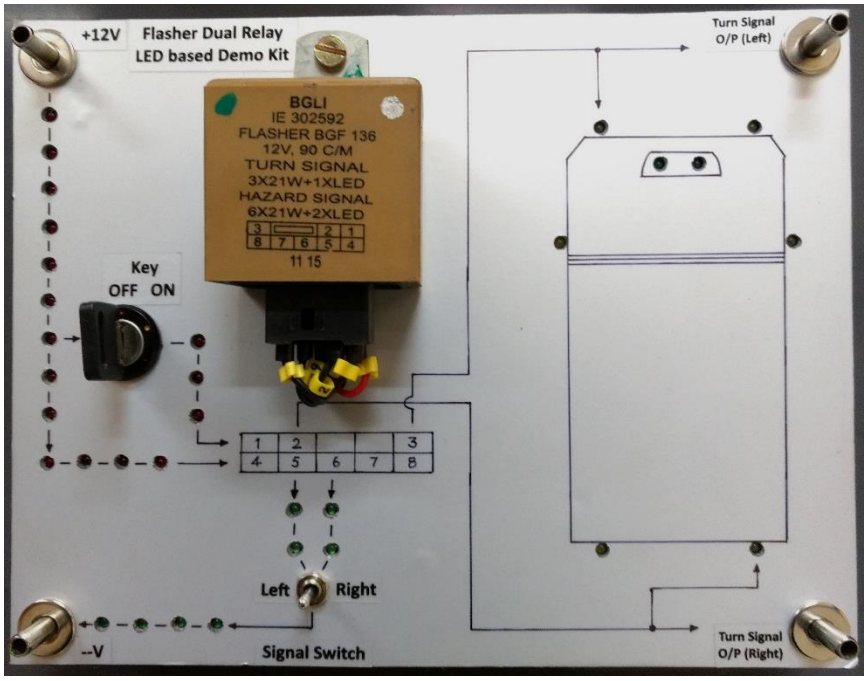


10. Flasher Duel Relay Demo-kit

Red LED – indicates flow of supply voltage / current from +12V to flasher relay unit
Green LED – indicates flow of supply voltage / current from flasher relay unit to –V
Yellow LED – indicates Turn signal

- Ensure key switch at OFF position & Signal switch at centre position.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Turn Key switch to ON position.
- Red LED will start glowing one by one.
- Move Signal switch to Left / Right.
- Green LED will start glowing one by one and at the end Left / Right yellow LEDs will flash.

Note –
Turn Signal voltage & frequency can be measured at output terminals.

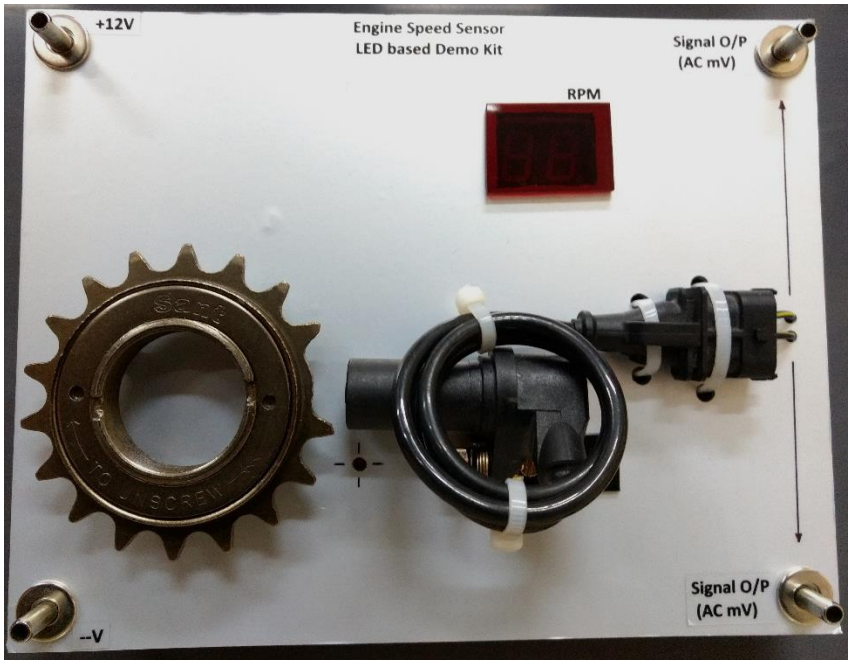


11. Engine Speed Sensor Demo-kit

Red LED – indicates variation in magnetic field

- Switch ON toggle switch to apply 12V DC supply.
- Connect multi-meter to signal o/p terminals of sensor demo kit.
- Being AC, multi-meter terminals can be connected in any polarity.
- Select multi-meter range as 2000mV/2V AC.
- In ideal state, multi-meter reads zero voltage and RPM display shows zero.
- Now rotate flywheel in either direction- Red LED blinks as flywheel rotates. Blinking speed is proportional to flywheel speed.
- Multi-meter will display the voltage generated by sensor. And also RPM meter will display the RPM.

Note –
RPM display is just indicative and may not match with actual RPM.

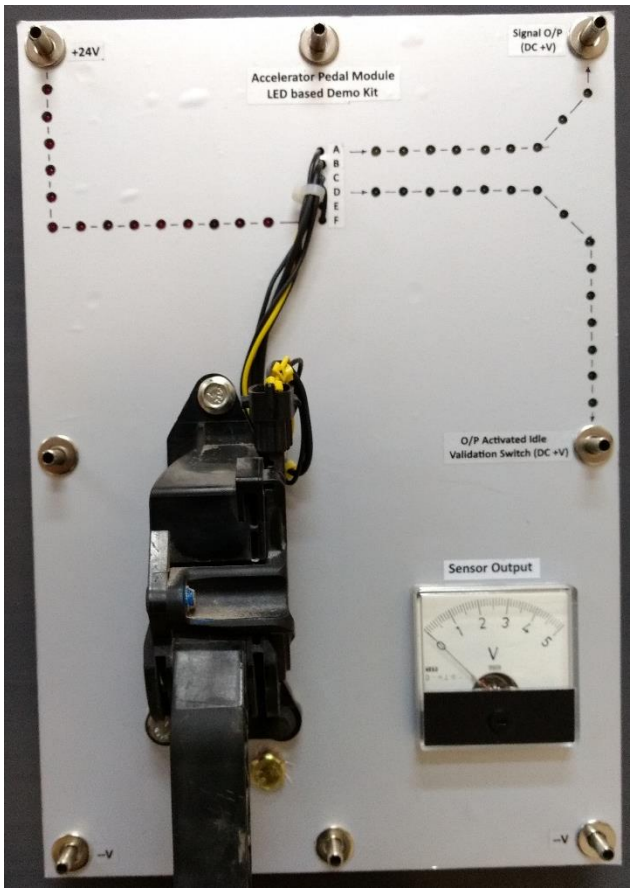


12. Accelerator Pedal Module Demo-kit

Red LED – indicates flow of supply voltage / current from +24V to Accelerator pedal module
Yellow LED – indicates flow of signal output
Green LED – indicates flow of output activated signal

- Switch ON toggle switch to apply 24V DC supply.
- Red LED will start glowing one by one.
- Yellow LED will start glowing one by one.
- Signal output meter will read 0.5V at rest position.
- Now press Accelerator pedal slowly.
- Green LED will glow at particular level of pedal position.

Note –
Both signals from Accelerator pedal module can be measured at output terminals w.r.t. Ground on multi-meter.
Signal output voltage will vary from 0.5V to 4.8V. (Use multi-meter range as 20V DC).
Output activated voltage is around 24V. (Use multi-meter range as 200V DC).

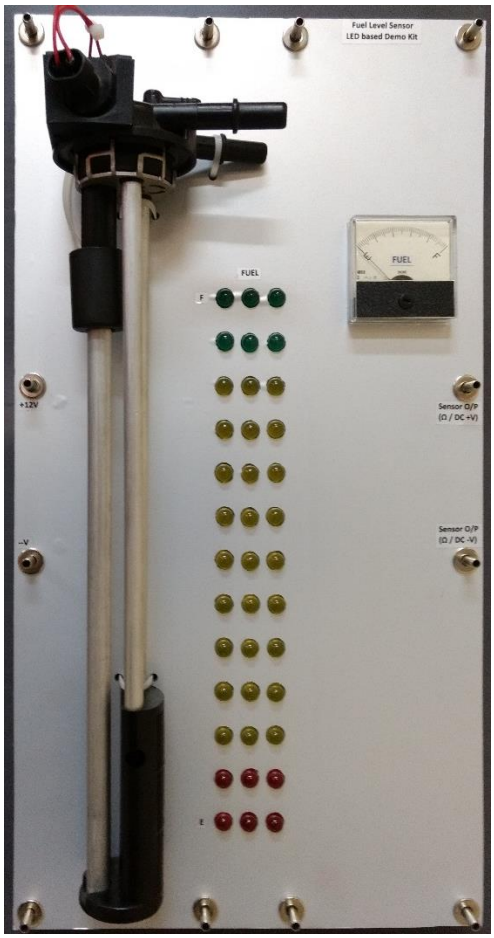


13. Fuel Level Sensor Demo-kit

Fuel meter – indicates level / percentage of fuel in fuel-tank
Fuel Level LED bar graph – indicates status of fuel level as Low – Red LED
Normal – Yellow LED
Full – Green LED

- Connect multi-meter red probe to sensor output terminal.
- Connect multi-meter common/-V/GND black probe to sensor output terminal.
- Select multi-meter range as 20V DC.
- Ensure sensor float at bottom / min level.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will glow which indicates minimum level.
- And fuel meter will show minimum reading.
- Also multi-meter will read 0.15V
- Now slowly move the sensor float in upward direction.
- Corresponding LEDs will glow & also fuel meter pointer will deflect more.
- At maximum / full level, all LEDs will glow & fuel meter will show 100%.
- Also multi-meter will read 0.95V

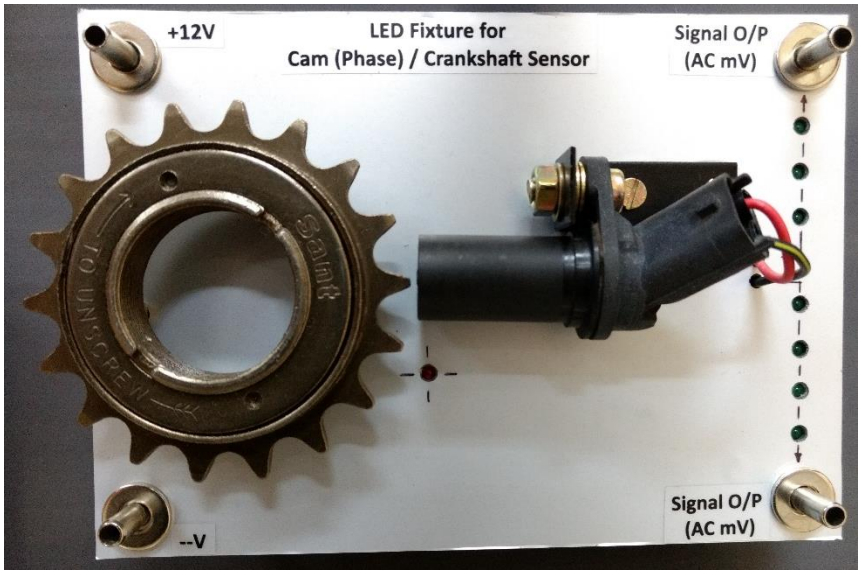
Note –
If 12V DC supply is not connected, sensor resistance can be measured on multi-meter (ohm range) at sensor output teminals as Low level – 232 ohm
Full level – 33 ohm



14. Cam (Phase) Sensor / Crankshaft Sensor Demo-kit

Red LED – indicates variation in magnetic field
Green LED – indicates generation of output voltage

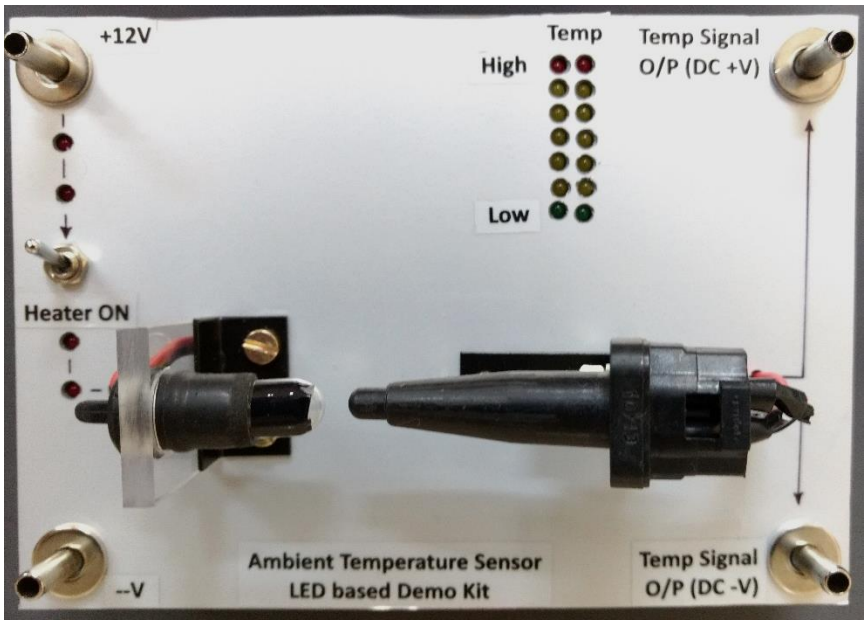
- Switch ON toggle switch to apply 12V DC supply.
- Connect multi-meter to signal o/p terminals of sensor demo kit.
- Being AC, multi-meter terminals can be connected in any polarity.
- Select multi-meter range as 2000mV/2V AC.
- In ideal state, multi-meter reads zero voltage and all LEDs are off.
- Now rotate flywheel in either direction, multi-meter will display voltage.
- Red LED blinks as flywheel rotates.
  Blinking speed is proportional to flywheel speed.
- Green LED blinks when output signal is generated.
  Blinking speed is fixed / constant and is not proportional to signal output voltage.



15. Ambient Temperature Sensor Demo-kit

Red LED – indicates flow of supply voltage / current
Temp LED bar graph – indicates status of temperature as Low – Green LED
Normal – Yellow LED
High – Red LED

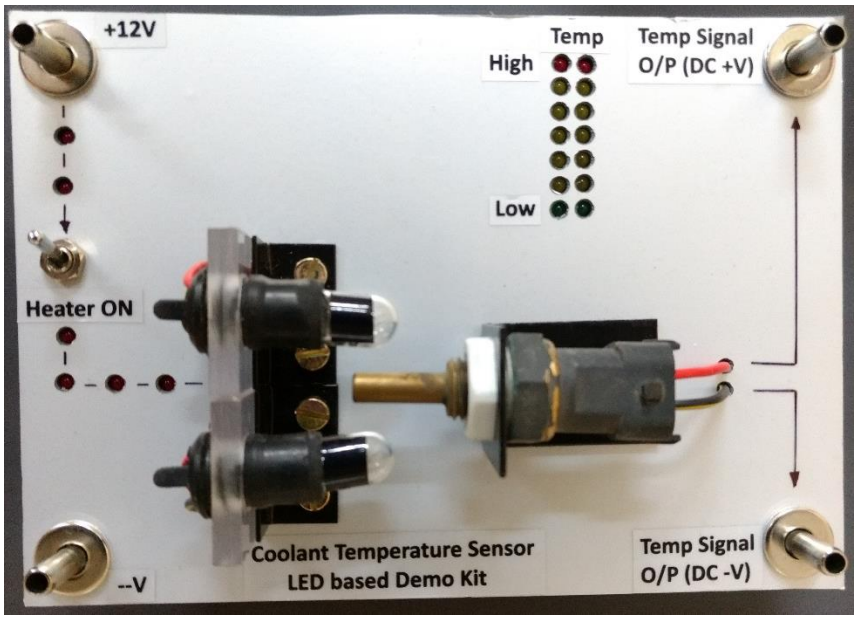
- Connect multi-meter red probe to Temperature signal o/p (DC+V) terminal.
- Connect multi-meter common/-V/GND black probe to Temperature signal o/p (DC--V) terminal.
- Select multi-meter range as 20V DC.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Temp LED bar graph will indicates status of temperature.
- And multi-meter reads around 2.70V for room temperature.
- To increase temperature, switch ON heater.
- Red LED will start glowing one by one and at end bulb will glow.
- After few seconds, LEDs on bar graph will start glowing.
- Also multi-meter reading decreases, as temperature increases.



16. Coolant Temperature Sensor Demo-kit

Red LED – indicates flow of supply voltage / current
Temp LED bar graph – indicates status of temperature as Low – Green LED
Normal – Yellow LED
High – Red LED

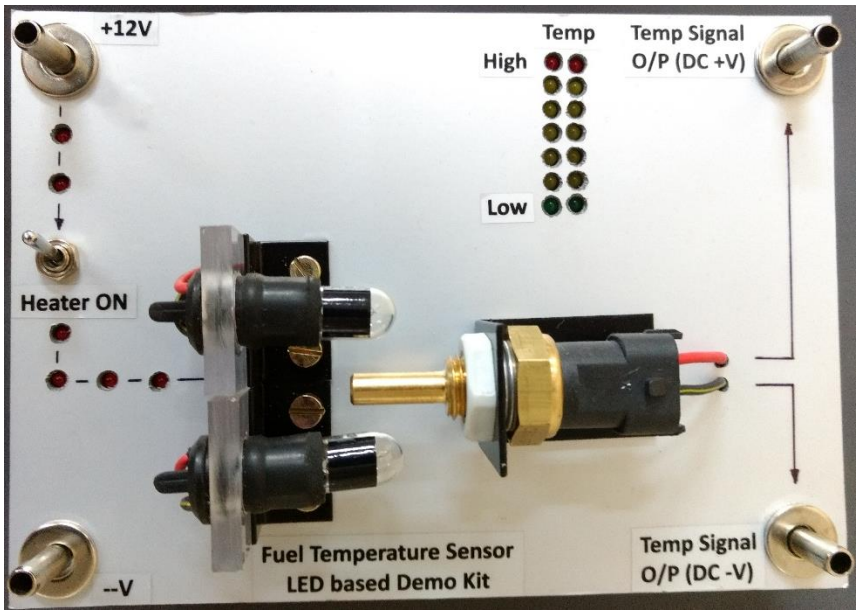
- Connect multi-meter red probe to Temperature signal o/p (DC+V) terminal.
- Connect multi-meter common/-V/GND black probe to Temperature signal o/p (DC--V) terminal.
- Select multi-meter range as 20V DC.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Temp LED bar graph will indicates status of temperature.
- And multi-meter reads around 2.70V for room temperature.
- To increase temperature, switch ON heater.
- Red LED will start glowing one by one and at end bulb will glow.
- After few seconds, LEDs on bar graph will start glowing.
- Also multi-meter reading decreases, as temperature increases.



17. Fuel Temperature Sensor Demo-kit

Red LED – indicates flow of supply voltage / current
Temp LED bar graph – indicates status of temperature as Low – Green LED
Normal – Yellow LED
High – Red LED

- Connect multi-meter red probe to Temperature signal o/p (DC+V) terminal.
- Connect multi-meter common/-V/GND black probe to Temperature signal o/p (DC--V) terminal.
- Select multi-meter range as 20V DC.
- Switch ON toggle switch to apply 12V DC supply.
- Red LED will start glowing one by one.
- Temp LED bar graph will indicates status of temperature.
- And multi-meter reads around 2.70V for room temperature.
- To increase temperature, switch ON heater.
- Red LED will start glowing one by one and at end bulb will glow.
- After few seconds, LEDs on bar graph will start glowing.
- Also multi-meter reading decreases, as temperature increases.



Troubleshooting

If sensor does not work properly, then perform voltage measurement to locate the fault. All checks described below are performed using Digital Multi meter (DMM). The actual values are measured between corresponding terminals and accordingly fault is located.

Voltage measurement of sensor on fixture –

Sr. No.	Sensor Fixture	Check	Observed value	Sensor Fault
1	Cam (Phase) sensor / Crankshaft sensor	Signal o/p	zero voltage	Open / short
2	Boost Pressure sensor	Pressure signal o/p and –V Temp. signal o/p and --V	-a) 11.2V b) 0V -a) 4.7V b) 0V	Pressure terminal (4) is open Pressure terminal (4) is short to -V NTC terminal (2) is open NTC terminal (2) is short to -V