



Introduction

This Sensor Simulator Probe is mainly used for simulation of the signals generated by different types of sensors in the vehicle. It can be used in all automobiles (12V/24V systems) with ECM / ECU either independently, or very often it is used together with a diagnostic scanner to distinguish faults whether that lies in the sensor itself or related to the connection (connector or wires) during troubleshooting phase. From the reading of Error codes on the diagnostic scanner, faults are recognized, as the sensors data which is imitated at the same time by this probe were observed. Through the simulation of the sensor output signals, the ECM / ECU response as well as its efficiency can be estimated.

Typical Applications

1. Simulates vehicle sensors output signals of Crankshaft Position (CKP) sensor, Camshaft Position (CMP) sensor, ABS sensor, Wheel Speed (WSS) sensor, Coolant Temperature sensor, Lambda (O2) sensor, MAF, MAP, etc.
2. Imitates sensor's signals at different working modes of the engine. This is done by simulating the signals with this Sensor Simulator Probe without removing the sensor unit. During simulation process, the ECU's activities are monitored on the Live Data screen displayed by the Diagnostic Scanner. In this way, we can determine the real cause of the fault whether it lies in the cables connected to the ECU or at the sensor itself before any replacement of parts take place.

3. Simulates sensor signals of:
Resistance type: 100Ω ~ 20KΩ output

Voltage type: 0.1V ~ 7.0.0V DC at 150 mA output,
0.1V ~ 7.0V DC at maximum 3.0 Amp power feed

Frequency modulated type:
Sine wave: 1Hz ~ 10,000Hz fixed at 5V, 150mA output.

Square wave: 1Hz ~ 20,000Hz (adjustable 0.1V to 12.0V at 150mA output).
4. Simulates **Duty Cycle (%)** from 1% to 100% signals with adjustable voltage from 0 to 12V Positive (+) or Negative (-) supply at 150mA output.

ATTENTION!

When working with the probe on a vehicle with computerised engine controls, the following safety measures must always be adhered to:

1. **DO NOT** unplug any of the sensors or wiring connectors from the vehicle while the ignition key is on. This could increase the chances of an internal voltage spike within the electrical system which can damage any delicate electronic mechanisms. Make sure that the ignition is turned off before you start to disconnect or reconnect the sensors and connectors.
2. **DO NOT** make any ground or jumper connections amongst the sensor wires and any other electrical circuits on the vehicle. The only time that you should do this is if the repair manual instructs you to do so.
3. Ensure that you **CLEAR** the computer's fault code memory. Once you have serviced a vehicle, clear the code memory by removing the computer's power source fuse for around 10 seconds.
4. **OBSERVE** the normal safety procedures before you start to conduct any tests. When the engine is running you need to make sure that:
 - The transmission is in park or neutral depending on the type of the vehicle.
 - The handbrake is on and the wheels are chocked.
5. When working on the vehicle **DO NOT** stand right in front of the vehicle when the engine is running. Especially when working in a closed environment (indoors), ensure that there is an air vent where fumes can be released, stopping the collection of any poisonous carbon monoxide particles.

Carbon Monoxide is colourless and odourless, and can quickly spread unless there is a suitable and reliable vent source. Inhaling the gas can cause serious injuries and can potentially be fatal.

6. **AVOID** any contact with the drive belts, any high voltage plug wires and hot surfaces which are located under the bonnet, for health and safety reasons.

Safety Protection

The Sensor Simulator Probe has a variety of internal safe guards which are used to protect itself as well as any other electrical components within the vehicle's computer structure.

When using the Sensor Simulator Probe there is no risk of damage to the components in the vehicle or any other equipment that may be used as well. The entire product is tested to ensure that it is secured against any excess voltage and reverse polarity.

The Sensor Simulator Probe is protected from large voltage transients which is normally met in modern automotive and truck vehicles, as well as reverse polarity.

The Sensor Simulator Probe has an internal circuit which will limit the possibility to damage any components which are in the engine's computer system.

The Sensor Simulator Probe can be used for the following:

1. Adjust the input from practically all engine sensors, which includes variable voltages and voltage generating. This creates a faster way to find the sensors which are faulty or at risk of being damaged.
2. Adjust various sensor inputs to help specify a variety of engine operating modes, checking the computer's output reaction. As a result, this will recognise any problems within the computer as well as the output actuators, solenoids and other control devices.

The Sensor Simulator Probe is able to be used on any aged or imported vehicle with a computerised engine control system. Scan tools which are plugged into the vehicle's internal computer are used to recognise the fault codes and read data stream where needed, however, they will only read out the data and not put any information into the system.

The Sensor Simulator Probe is more beneficial than standard scan tools as it will adjust various sensor inputs, allowing you to verify if the sensor's signal is getting through to the computer or not. As a result, the computer should be reading the correct data and making the appropriate responses.

Basic Sensory Theory

Computerised Engine Controls Sensors are designed to monitor various conditions which could affect a vehicles performance. These signals which come from the various sensors are used by a computer to allow the control of the fuel mixture, ignition timing, idle speed, operation of the EGR valve, canister purge control valve and other emission functions, the lockup of the torque converter in the automatic transmission and the shifting of the gears in late model automatic vehicles. A problem in any of the system's important sensors can result in a range of driveability issues. These issues can include; hard starting, poor idle, intermittent fault, stalling, excessive idle speed, excessive tailpipe emissions, improper shifting or torque converter build-up.

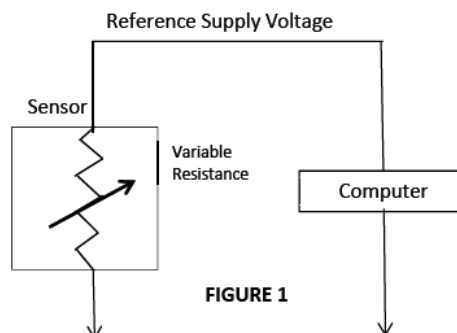
The Sensor Simulator Probe allows you to input voltage to both the sensor and directly to the computer. This should allow you to determine whether the sensor is working properly or if the computer is receiving the sensor signal.

Types of Sensor:

There are a variety of different sensors within an engine which are categorised into the following categories;

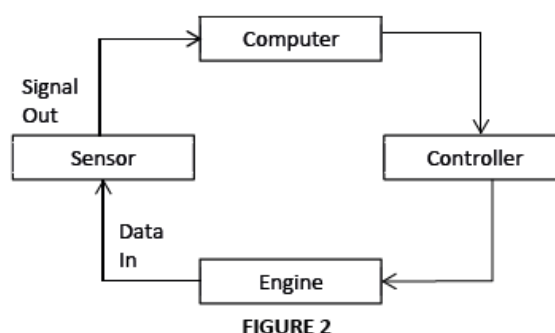
1. Variable Resistance Sensors

These types of sensors are often called '2-WIRE' sensors. This is because the sensors are usually connected by two wires to the computer; a voltage supply wire and a signal return wire. These sensors include; coolant temperature (CTS) sensors, manifold air temperature (MAT) sensors and outside air temperature (OAT) sensors.



2. Variable Voltage Sensors

These types of sensors are often called '3-WIRE' sensors. This is because the sensors use 3 wires to connect to a computer; a voltage supply wire (normally 3 volts), a signal return wire and a ground wire. These sensors include; throttle position (TPS) sensors, manifold absolute pressure (MAP) sensors, barometric pressure (BARO) sensors and some mass airflow (MAF) sensors.



Signal output (variable voltage)

An oxygen sensor will also produce a variable voltage signal, however; this is different from other sensors in this category because an oxygen sensor will generate its own voltage (similar to a battery).

The voltage which is created by the sensor will depend on the amount of oxygen within the exhaust. This means that the lower the oxygen level within the exhaust, the higher the output voltage will be.

The sensor's output voltage will range from around 0.1V (lean) to 1.0V (rich). The sensor might have between one to three wires connecting it to the computer depending on whether it is heated or not.

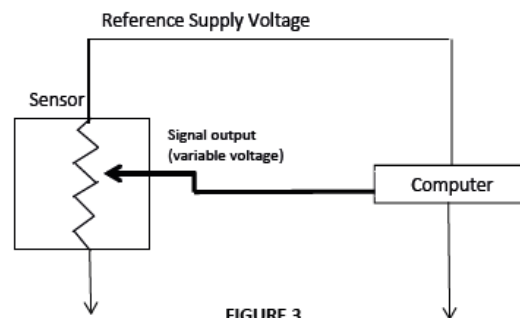


FIGURE 3

Pressure sensors (variable voltage)

These sensors get their 5V supply from the ECU. The sensors output voltage varies from 0V to 5V back to the ECU with low voltage indicates low pressure or vice versa. While the engine is in idle mode at normal working conditions, the voltage output should be around 2.5V.

3. Frequency Modulated Output

Most automobiles today have these types of sensors such as Hall Effect sensors, Crankshaft sensors, Camshaft sensors, Wheel Speed sensors, etc. There are some car models having these types of output signals as well on their Manifold Absolute Pressure (MAP) and / or Hot film Mass Air Flow (HFM) sensors.

4. Duty Cycle (%) controlled Output

This output is mainly use in the Clutchless or Electronically Controlled Variable Displacement Compressor (EVDC) air condition system to control the operation of its solenoid valve.

How to operate Sensor Simulator Probe:

Voltage output simulation:

1. Firstly, make sure that the vehicle's ignition is turned off and all the sensors are disconnected from the wiring connection. Make sure you refer to the Vehicle Service Manual's electrical wiring diagram to ensure that you have the correct sensor voltages.
2. Set the Sensor Simulator Probe to create the desired sensor voltage using the process as described below. The Sensor Simulator Probe will automatically turn on as soon as it is connected to the vehicle's battery and the wakeup screen will appear (Fig. 4 below).



Fig.4

3. To operate the Sensor Simulator Probe you connect the positive and negative clamps to the battery terminals on either 12V or 24V vehicles. The LCD display will light up.
4. When the unit is powered ON, it will always start from main menu display screen (Fig. 5).

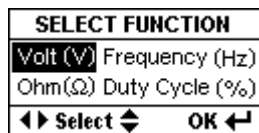


Fig.5



Fig.6

Here when select **Volt** mode, it will display the main menu (Fig. 6 above). Select **Test Volt** if need to measure voltage (Fig. 7 below). It can test up to **70V DC** maximum.

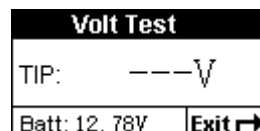


Fig. 7

If need to **Simulate Volt**, then select by ▼ key and confirm with OK ↵ key, the display will change to Fig. 8 below:

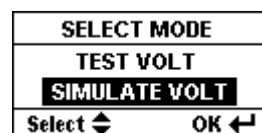


Fig. 8



Fig. 9

This warning (Fig. 9 above) reminds us that we should always check the polarity connections before simulating the volts output. Having wrong polarity can cause damage to the circuits or the ECM / ECU.

Having confirmed the polarity connections are correct, proceed by pressing OK ↵ key again will get into the selection menu (Fig. 10).

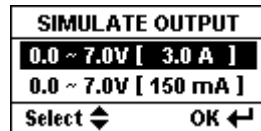


Fig. 10

Here there are two selections:

- 1) 0 ~ 7.0V @ 3.0A (Power Drive Feed up to 3 Amps maximum Output)
- 2) 0 ~ 7.0V @ 150 mA (Volt Signal Feed - save for direct input to ECM/ECU)

To confirm the selection, press ↵ OK key again will enter into the simulation mode (Fig. 11 & 12 below).

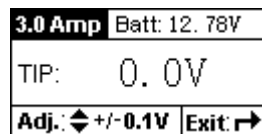


Fig. 11

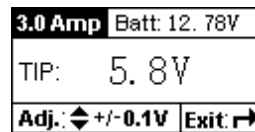


Fig. 12

From the above example selection of 0 ~ 7.0V simulation @ 3.0 Amp output, the Voltage output can be adjusted from 0.1V to 7.0V having an adjustment Resolution of 0.1V with every pressing of ▲key for increasing or ▼key for decreasing the voltage output during simulation. If you need to exit, press EXIT ↵ key will return to the main Menu (Fig. 5 above).

NOTE:

Once you have set the required voltage, (before connecting to the circuit please ensure you check the voltage of that circuit by using the vehicles wiring diagram) momentarily push the switch to activate the voltage to the tip. The output will be positive voltage only.

Caution: *You are responsible for the voltage that you have set.*

If you have your scanner scope connected you should then be able to see the reading on your scope, which should display the same voltage that has been activated. If the voltage is lower than selected then you have a potential voltage loss.

Resistance simulation:

- While the menu display screen (Fig. 5 above) select [Ohm Ω] Fig. 13 by pressing \blacktriangledown key once and then press OK \blacktriangleleft key will enter into the Resistance simulation menu (Fig. 14) below.

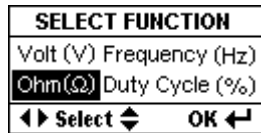


Fig.13

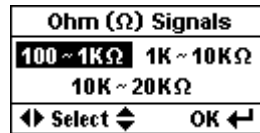


Fig.14

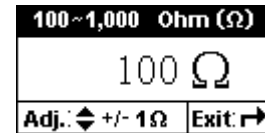


Fig.15

From the Menus, there are three selection ranges (100 ~ 1K Ω , 1K Ω ~ 10K Ω and 10K ~ 20K Ω) Once selected, press OK \blacktriangleleft key will enter into Resistance (Ω) simulation mode (Example Fig. 15 above).

Adjustable Ohm Range Simulation:

- [100 to 1,000 Ohms]** having adjustment resolutions of **1 Ohm** with every pressing of either \blacktriangle key for increasing or \blacktriangledown key for decreasing while changing the ohm values.
- [1,000 to 10,000 Ohms]** having adjustment resolutions of **10 Ohms** with every pressing of either \blacktriangle key for increasing or \blacktriangledown key for decreasing while changing the ohm values.
- [10,000 to 20,000 Ohms]** having adjustment resolutions of **50 Ohms** with every pressing of either \blacktriangle key for increasing or \blacktriangledown key for decreasing while changing the ohm values.

Pressing EXIT \blacktriangleright key will return back to the main Menu (Fig. 5 above).

Sine Wave Frequency simulation:

- While on the menu display screen (Fig.5 above) select [Frequency (Hz)] as Fig. 16 below by pressing \blacktriangleright key once and then press OK \blacktriangleleft key will enter into the Frequency simulation selection menu (Fig.17) below. Here the highlighted display is on Sine Wave icon. Press OK \blacktriangleleft key again will enter into Sine wave simulation mode (Fig. 18 below).

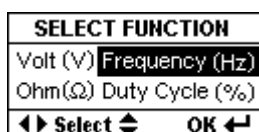


Fig.16

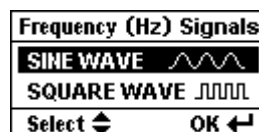


Fig.17

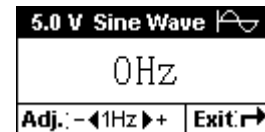


Fig.18

This Sine Wave Frequency can be adjusted with the scale of 1Hz from the range of **1Hz to 0,000 Hz fixed at 5.0 Volts peak to peak**. The Hz value indication will change when pressing either ► key to increase its value or ◀ key to decrease its value.

To Exit, pressing EXIT ↵ key will return back to the main Menu Fig. 5 above.

Square Wave Frequency simulation:

- To access into this simulation mode, while on the display (Fig. 17 above), press ▼ key will move the highlighted bar to Square Wave icon (Fig. 19 below).

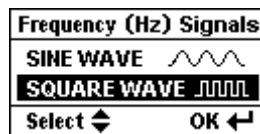


Fig.19

Now press OK ↵ key will enter into the selection of **Positive (+)** supply volt or Negative (-) supply volt as shown (Fig. 20). For example, if Positive (+) Volt is selected then confirmed by pressing OK ↵ key will get access into the + Volt Range selection display (Fig. 21 below).

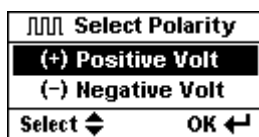


Fig. 20

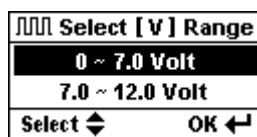


Fig. 21

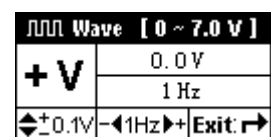


Fig. 22

Here, there are two ranges (0~7V and 7~ 12.0V) that can be selected. For example, if [0 ~ 7.0 Volt] range is selected and pressing OK ↵ key will confirm with the screen changed to the display with **+V** sign to indicate it is the positive supply (Fig. 22 shown above).

The same goes for **Negative (-)** Volts supply if it is selected then the display will have the **-V** sign to indicate that it is the negative supply as example (Fig.23,24 & 225 shown below).

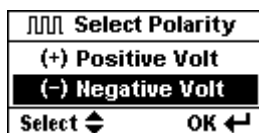


Fig. 23

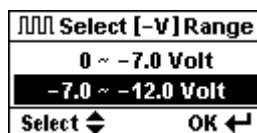


Fig. 24

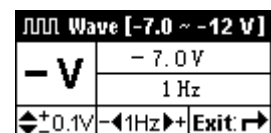


Fig. 25

The Frequency Volts can be adjusted by pressing ▲ or ▼ key with 0.1V resolution for 0~7.0V range and 0.5V resolution for 7.0V ~ 12.0V range while its frequency is adjusted by pressing ◀ or ► key with 1Hz resolution each step.

To quit, pressing EXIT → key will return back to the main Menu (Fig.15 above).

Duty Cycle (%) simulation:

- To activate Duty Cycle (%) simulation, on Menu display (Fig. 26 below) select [Duty Cycle (%)] and press OK ↵ key will access into the selection of Positive (+) Volt supply or Negative (-) Volt supply menu (Fig. 27 below).

SELECT FUNCTION	
Volt (V)	Frequency (Hz)
Ohm(Ω)	Duty Cycle (%)
◀▶ Select	OK ↵

Fig. 26

Select Polarity	
(+) Positive Volt	
(-) Negative Volt	
Select	OK ↵

Fig. 27

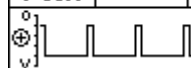
D. Cycle	10%	±1% ◀▶
+ Volt	1V	±1V ◀▶
		Exit →

Fig. 28

For example, Positive (+) Volt supply was selected, pressing OK ↵ key will access into the simulation display (Fig. 27 & 28 above).

Likewise, if Negative (-) Volt supply was selected, the display will be shown as (Fig. 29 & 30 below).

Select Polarity	
(+) Positive Volt	
(-) Negative Volt	
Select	OK ↵

Fig. 29

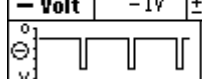
D. Cycle	10%	±1% ◀▶
- Volt	-1V	±1V ◀▶
		Exit →

Fig. 30

The Duty Cycle (%) can be adjusted with the scale of 1% from the range of 1% to 100% and the Voltage can be adjusted: V+ or V- for 0 ~ 12.0V ranges when pressing either ▶ key to increase its value or ◀ key to decrease its value whereas the Frequency is fixed at **650Hz**.

The percentage (%) as well as the waveform indications will change dynamically when pressing either ▶ key to increase its value or ◀ key to decrease its value.

To quit, pressing EXIT → key will return back to the main Menu Fig. 31 below.

SELECT FUNCTION	
Volt (V)	Frequency (Hz)
Ohm(Ω)	Duty Cycle (%)
◀▶ Select	OK ↵

Fig. 31

Technical Specifications:

Operating Voltage	9V to 30V max
Display	LCD Screen (128 x 64 pixels)
Voltage measurement range	Up to 70V DC
Accuracy	+/-2% + 1 digit

Simulated Voltages:

0.2 Volt ~ 7.0 Volt Output Range:

Max. Output Current.....	3.0 Amps
Adjustment Resolution.....	0.1V
Accuracy.....	+/- 2%

0.0 Volt ~ 7.0 Volt Output Range:

Max. Output Current.....	150mA
Adjustment Resolution.....	0.1V
Accuracy.....	+/- 2%

Simulated Resistances Output:

100Ω to 1000Ω Range.....	Adj. Resolution 1Ω
1000Ω to 10000Ω Range.....	Adj. Resolution 10Ω
10000Ω to 20000Ω Range.....	Adj. Resolution 50Ω
Accuracy.....	+/- 7%

Simulated Sine Wave Fixed @ 5.0V Output:

Max. Output Current.....	150mA
Adjustment Range.....	3Hz to 10K Hz
Adjustment Resolution.....	1Hz
Accuracy.....	+/- 3%

Simulated Square Waves:

Positive (+) Voltages:

Output Range: [0.0 V to + 7.0 V]

Max. Output Current.....	150mA
Adjustment Resolution.....	0.1V
Accuracy.....	+/- 3%

Output Range: [+ 7.0 V to +12.0 V]

Max. Output Current.....	150mA
Adjustment Resolution.....	0.5V
Accuracy.....	+/- 3%

Negative (-) Voltages:

Output Range: [0.0 V to - 7.0 V]

Max. Output Current.....	150mA
Adjustment Resolution.....	- 0.1V
Accuracy.....	+/- 3%

Output Range: [- 7.0 V to -12.0 V]

Max. Output Current.....150mA
Adjustment Resolution.....- 0.5V
Accuracy..... +/- 3%

Frequency (Hz) Adjustment Range (Both Polarity) .1Hz to 20K Hz

Adjustment Resolution.....1Hz

Simulated Duty Cycles Fixed @ 650 Hz Output:

Positive (+) Voltages:

Output Range: [0.0V to + 12V]

Max. Output Current.....150mA
Adjustment Resolution.....1V
Accuracy..... +/- 3%

Negative (-) Voltages:

Output Range: [0.0V to - 12V]

Max. Output Current.....150mA
Adjustment Resolution..... 1V
Accuracy..... +/- 3%

Duty Cycle (%) Adjustment Range (Both Polarity) ...1% to 100%

Adjustment Resolution.....1%

Built-in Safety features:

Short circuit Protection.....Self-Recovery - 3.0 Amps PTC fuse
Inverse Polarity Protection..... No power on reverse polarity.
Working Temperature.....0°C (32°F) ~ 50°C (122°F)
Working Humidity.....10% ~ 80 %
Approvals.....CE, ROHS

Product Warranty

The Sensor Simulator Probe comes with a one-year warranty and undergoes strict quality control for testing workmanship, function and safety before leaving the factory.

From the date of purchase, we will warranty/repair Sensor Simulator Probe against defects in parts and workmanship.

All repairs due to misuse or tampering with will incur a charge. All warranty units must be accompanied by a copy of the original sale receipt.

This warranty doesn't apply to products which have been:

1. Altered.
2. Improperly installed, maintained or repaired.
3. Damaged by accident, negligence or misuse.

THIS WARRANTY EXCLUDES ALL INCIDENTAL OR CONSEQUENTIAL DAMAGES AS A RESULT OF MISUSE