

## **Disclaimer**

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make change at any time without notice.

## **Safety Precautions and Warnings**

To prevent personal injury or damage to vehicles and/or the NL102, please read this user's manual first carefully and observe the following safety precautions at a minimum whenever working on a vehicle:

- Always perform automotive testing in a safe environment.
- Do not attempt to operate or observe the tool while driving a vehicle. Operating or observing the tool will cause driver distraction and could cause a fatal accident.
- Wear safety eye protection that meets ANSI standards.
- Keep clothing, hair, hands, tools, test equipment, etc. away from all moving or hot engine parts.
- Operate the vehicle in a well-ventilated work area: Exhaust gases are poisonous.
- Put blocks in front of the drive wheels and never leave the vehicle unattended while running tests.
- Use extreme caution when working around the ignition coil, distributor cap, ignition wires and spark plugs. These components create hazardous voltages when the engine is running.
- Put the transmission in P (for A/T) or N (for M/T) and make sure the parking brake is engaged.
- Keep a fire extinguisher suitable for gasoline/chemical/ electrical fires nearby.
- Don't connect or disconnect any test equipment while the ignition is on or the engine is running.
- Keep the NL102 dry, clean, free from oil/water or grease. Use a mild detergent on a clean cloth to clean the outside of the NL102, when necessary.

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## 1. INTRODUCTION

The NL102 is specially developed for heavy duty vehicles, which supports all 10 modes of OBDII test (EVAP, O2 Sensor, I/M Readiness, MIL Status, VIN Info, and On-board monitors testing etc.) for a complete diagnosis and enables users to read DTCs, clear DTCs and view the datastream with a live color graphing. It covers a wide range of vehicles since it offers multiple data bus protocols, such as J1587 and J1939. It can be connected to PC through the USB cable for upgrade to keep updated with the latest software version.

*Notice: NL102 may automatically reset while being disturbed by strong static electricity. THIS IS A NORMAL REACTION.*

## 2. General Information

### On-Board Diagnostics (OBD) II

The first generation of On-Board Diagnostics (called OBD I) was developed by the California Air Resources Board (ARB) and implemented in 1988 to monitor some of the emission control components on vehicles. As technology evolved and the desire to improve the On-Board Diagnostic system increased, a new generation of On-Board Diagnostic system was developed. This second generation of On-Board Diagnostic regulations is called "OBD II".

The OBD II system is designed to monitor emission control systems and key engine components by performing either continuous or periodic tests of specific components and vehicle conditions. When a problem is detected, the OBD II system turns on a warning lamp (MIL) on the vehicle instrument panel to alert the driver typically by the phrase of "Check Engine" or "Service Engine Soon". The system will also store important information about the detected malfunction so that a technician can accurately find and fix the problem. Here below follow three pieces of such valuable information:

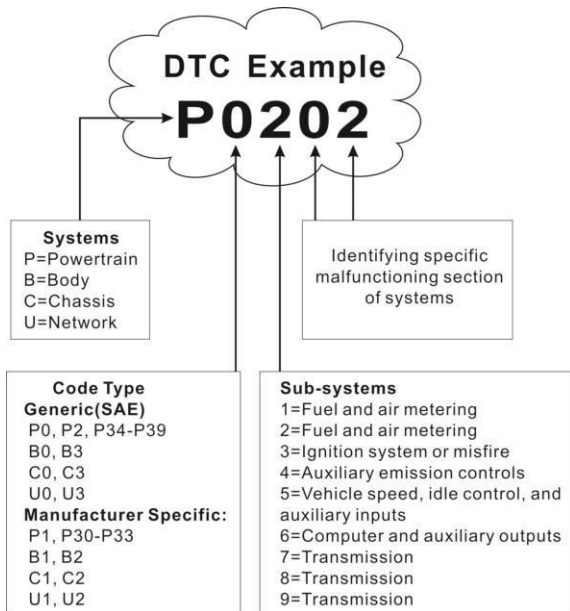
- 1) Whether the Malfunction Indicator Light (MIL) is commanded 'on' or 'off';
- 2) Which, if any, Diagnostic Trouble Codes (DTCs) are stored;
- 3) Readiness Monitor status.

## Diagnostic Trouble Codes (DTCs)

Diagnostic Trouble Codes (DTC) are codes that are stored by the on-board computer diagnostic system in response to a problem found in the vehicle. These codes identify a particular problem area and are intended to provide you with a guide as to where a fault might be occurring within a vehicle.

### OBDII DTC

OBD II Diagnostic Trouble Codes consist of a five-digit alphanumeric code. The first character, a letter, identifies which control system sets the code. The second character, a number, 0-3; other three characters, a hex character, 0-9 or A-F provide additional information on where the DTC originated and the operating conditions that caused it to set. Here below is an example to illustrate the structure of the digits:



## **DTCs for J1587/J1708 and J1939**

This section explains the basic elements of fault codes for J1587/J1708 and J1939 data bus protocols, how to view these codes on NL102, and what they mean. Each fault code on NL102 contain three distinct pieces of information, as described below.

J1587/J1708 fault codes consist of the following, in this order:

- Subsystem Identifier (SID) – Indicates what function on the ECU has failed.
- Failure Mode Indicator (FMI) – Indicates in what way the function failed.
- Occurrence (OC) – Indicates the occurrence times of fault codes.

J1939 fault codes consist of the following, in this order:

- Suspect Parameter Number (SPN) – Indicates what function on the ECU has failed.
- Failure Mode Indicator (FMI) – Indicates in what way the function failed.
- Occurrence (OC) – Indicates the occurrence times of fault codes.

## **2.3 J1708/J1587/J1939**

SAE J1708, SAE J1587 and SAE J1939 are automotive diagnostic protocol standard developed by the Society of Automotive Engineers (SAE).

### **SAE J1708**

SAE J1708 is a standard used for serial communications between ECUs on a heavy duty vehicle and also between a computer and the vehicle. With respect to Open System Interconnection model (OSI), J1708 defines the physical layer. Common higher layer protocols that operate on top of J1708 are SAE J1587 and SAE J1922.

### **SAE J1587**

SAE J1587 is an automotive diagnostic protocol standard developed by the Society of Automotive Engineers (SAE) for heavy-duty and most medium-duty vehicles built after 1985. The J1587 protocol uses different diagnostic connectors. Up to 1995, individual OEMs used their own connectors. From 1996 to 2001, the 6-pin Deutsch-connector was standard. Beginning in 2001, most OEMs converted to the 9-pin Deutsch. Some OEMs still use the 6-pin Deutsch. It has mostly been used for US made vehicles, and also by Volvo.

SAE J1708 makes up the physical and data link layers while SAE J1587 makes up the transport and application layers with respect to the OSI model. SAE J1587 is used in conjunction with SAE J1708 for automobile communication.

### **SAE J1939**

SAE J1939 is the vehicle bus standard used for communication and diagnostics among vehicle components, originally by the car and heavy duty truck industry in the United States.

SAE J1939 is used in the commercial vehicle area for communication throughout the vehicle. With a different physical layer it is used between the tractor and trailer. This is specified in ISO 11992.

SAE J1939 can be considered the replacement for the older SAE J1708 and SAE J1587 specifications.

SAE J1939 has been adopted widely by diesel engine manufacturers. One driving force behind this is the increasing adoption of the engine Electronic Control Unit (ECU), which provides one method of controlling exhaust gas emissions within US and European standards. Consequently, SAE J1939 can now be found in a range of diesel-powered applications: vehicles (on- and off-road), marine propulsion, power generation and industrial pumping.

Applications of J1939 now include off-highway, truck, bus, and even some passenger car applications.

## **2.4 OBD II Definitions**

**Powertrain Control Module (PCM)** -- OBD II terminology for the on-board computer that controls engine and drive train.

**Malfunction Indicator Light (MIL)** -- Malfunction Indicator Light (Service Engine Soon, Check Engine) is a term used for the light on the instrument panel. It is to alert the driver and/or the repair technician that there is a problem with one or more of vehicle's systems and may cause emissions to exceed federal standards. If the MIL illuminates with a steady light, it indicates that a problem has been detected and the vehicle should be serviced as soon as possible. Under certain conditions, the dashboard light will blink or flash. This indicates a severe problem and flashing is intended to discourage vehicle operation. The vehicle onboard diagnostic system cannot turn the MIL off until the necessary

repairs are completed or the condition no longer exists.

**DTC** -- Diagnostic Trouble Codes (DTC) that identifies which section of the emission control system has malfunctioned.

**Enabling Criteria** -- Also termed Enabling Conditions. They are the vehicle-specific events or conditions that must occur within the engine before the various monitors will set, or run. Some monitors require the vehicle to follow a prescribed "drive cycle" routine as part of the enabling criteria. Drive cycles vary among vehicles and for each monitor in any particular vehicle. Please refer to the vehicle's factory service manual for specific enabling procedures.

**OBD II Drive Cycle** -- A specific mode of vehicle operation that provides conditions required to set all the readiness monitors applicable to the vehicle to the "ready" condition. The purpose of completing an OBD II drive cycle is to force the vehicle to run its onboard diagnostics. Some form of a drive cycle needs to be performed after DTCs have been erased from the PCM's memory or after the battery has been disconnected. Running through a vehicle's complete drive cycle will "set" the readiness monitors so that future faults can be detected. Drive cycles vary depending on the vehicle and the monitor that needs to be reset. For vehicle specific drive cycle, consult the service manual.

**Freeze Frame Data** -- When an emissions related fault occurs, the OBD II system not only sets a code but also records a snapshot of the vehicle operating parameters to help in identifying the problem. This set of values is referred to as Freeze Frame Data and may include important engine parameters such as engine RPM, vehicle speed, air flow, engine load, fuel pressure, fuel trim value, engine coolant temperature, ignition timing advance, or closed loop status.

**Fuel Trim (FT)** - Feedback adjustments to the base fuel schedule. Short-term fuel trim refers to dynamic or instantaneous adjustments. Long-term fuel trim refers to much more gradual adjustments to the fuel calibration schedule than short-term trim adjustments. These long-term adjustments compensate for vehicle differences and gradual changes that occur over time.

### 3. Product Descriptions

#### Outline



Figure 3-1

No.	Name	Descriptions
①	<b>OBD II Cable</b>	Connects the NL102 to the vehicle's Data Link Connector (DLC).
②	<b>LCD display</b>	Indicates test results.
③	<b>ESC button</b>	Confirms a selection (or action) from menu list.
⑤/⑧	<b>▲ / ▼ button</b>	Move cursor up or down for selection.
④/⑨	<b>► / ◀ button</b>	Move cursor right or left for selection; Or turn page up or down when more than one page is displayed.
⑥	<b>USB port</b>	Connects to computer to update online.
⑩	<b>OK button</b>	Returns to previous menu.



⑦	<b>? button</b>	Help of live data
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## Specifications

- Screen: 2.8" TFT 262K true color, 320\*240 QVGA LCD display
- Input voltage range: 8~32V
- Operating current: <100mA@12V (Typical)
- Power consumption: < 1.2W (Typical)
- Operating temperature: 32°F~122°F / 0°C~50°C
- Storage temperature: -4°F~158°F / -20°C ~70°C @ RH60%
- Outline dimension: 4.7\*3.2\*1.0' / 121\*82\*26 mm LWH
- Weight : < 17.6 oz (500g)

## Accessories

- User's Manual -- Instructions on tool operations
- 6 PIN DLC adaptor
- 9 PIN DLC adaptor
- USB cable -- Connect to a computer for upgrading online

## Power supply

The power of the NL102 is provided via the vehicle's Data Link Connector (DLC). Follow the steps below to power it up:

1. Find DLC on heavy duty vehicle:

The DLC is the connector where diagnostic code readers interface with the vehicle's on-board computer and usually located in the driver's cab.

A plastic DLC cover may be found for some vehicles and you need to remove it before plugging the 6 pin or 9 pin DLC diagnostic adaptor. If it cannot be found, refer to the vehicle's service manual for the location.

2. Plug one end of 6 pin or 9 pin DLC diagnostic adaptor into the included OBD II 16 pin connector, and connect the other end to the heavy duty vehicle's DLC.

## **Battery Monitor**

The power of the NL101 supply by the vehicle's battery, If using the tool too long time, the energy of battery will reduce and the voltage is down. The NL100 give two levels warning :

✓**Level 1: The voltage of battery is less than 11.8V, show you: The voltage of battery is less ,The engine will start difficultly, Please start engine over to 1500 rpm and charge the battery.**

✓**Level 2: The voltage of battery is less than 10.8V, show you: The voltage of battery is less ,Please stop the testing and check the battery.**

## 4. Connections & General Operations

### Connections

1. Turn the ignition off.
2. Locate the heavy duty vehicle's DLC.
3. Select the desired diagnostic adaptor according to your vehicle's DLC.
4. Plug one end of 6pin or 9pin DLC diagnostic adaptor into the included OBD II 16 pin connector, and connect the other end to the heavy duty truck's DLC.
5. Turn the ignition on. Engine can be off or running.
6. After finishing, the system will enter the main menu interface, as shown in Figure 4-1.



Figure 4-1

Function Items	Descriptions
<b>OBDII/EOBD</b>	Diagnose your car.
<b>HD OBD</b>	Diagnose your heavy-duty truck.
<b>DTC Lookup</b>	The description of trouble code
<b>Review Data</b>	Review the stored data
<b>Setup</b>	To configure the system date and time and turn on / off the beeper.

**CAUTION:** Don't connect or disconnect any test equipment with ignition on or engine running.

## DTC Lookup

The **DTC Lookup** function is used to search for definitions of DTCs stored in the DTC library and for code breaker information.

1. From **Main Screen** (Figure 4.1), use the ▲ / ▼ scroll button and ► / ◀ scroll button to select **DTC Lookup** and press the [OK] button.
2. From **DTC Lookup** screen, use the ► / ◀ button to move to the desired character, use the ▲ / ▼ button to change selected digit/character and press the [OK] button to confirm.
3. View the DTC definition on screen. When DTC definition covers more than one screen, use the LEFT/RIGHT button or UP/DOWN button to view additional information on previous/next screens.

## Review Data

The Review Data function allows viewing of data from last test recorded by the scan tool, including the codes, live data, I/M etc.

## Setup

Select [Tool Setup] in the main menu and press [OK], the system will enter the system setup screen:

- 1) **Beeper:** Turn ON/OFF the Beeper. Once Beeper is set to ON, the voice will come when starting and press the key.
- 2) **Language:** Configure the system language to your preference.
- 3) **Unit system setting:** Set the measurement unit system.

## 5. Diagnose

In Figure 4-1, press **[OK]** to scan the protocols of heavy-duty trucks and OBDII vehicles, a screen similar to figure 5-1 will appear:

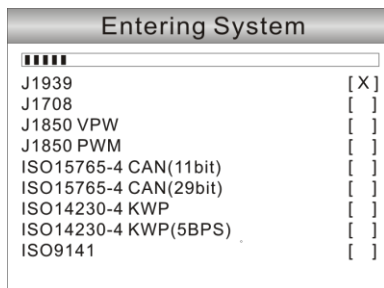


Figure 5-1

If a vehicle equipped with OBDII is tested, the system will enter the function selection screen once scanning has finished successfully.

Monitor Status	
MIL Status	Off
DTCs in this ECU	108
Readiness Completed	5
Readiness Not Completed	2
Readiness Not Supported	3
Datastream Supported	119
Ignition	Spark
Protocol Type	CAN

Figure 5-2

Press **[OK]** to enter the system selection screen. For detailed operations, please refer to **Chapter 5.2 "OBDII Diagnosing"**.

If a heavy-duty truck is diagnosed, the system will continue scanning the protocols the truck supports and then enter the system selection screen. See figure 5-3.

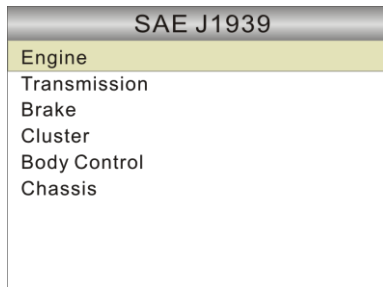


Figure 5-3

For detailed operations, please refer to **Chapter 5.1 “HD OBD Diagnosing”**. If scanning failure occurs, the system will enter the screen as shown in Figure 5-4:

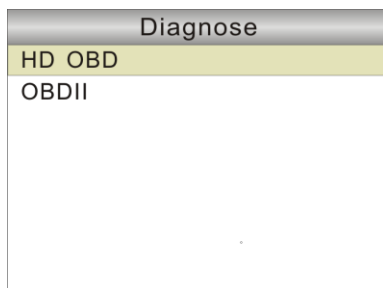


Figure 5-4

In this case, follow the diagnosis flowchart shown as below to proceed:

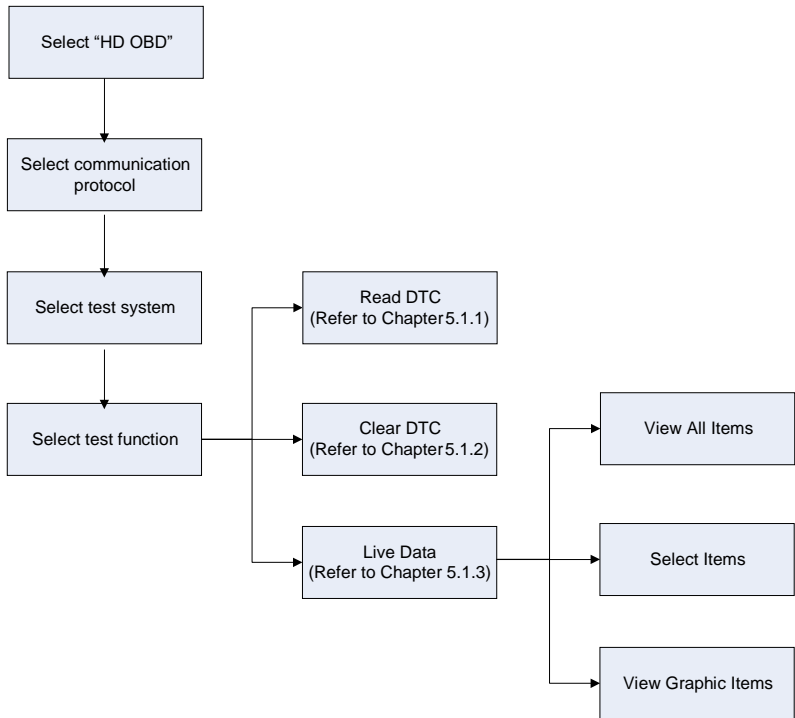


Figure 5-5

### HD OBD Diagnosing

In Figure 5-3, use ▲ / ▼ button to select the desired system and press [OK] to enter:

Engine
Read DTC
Clear DTC
Live Data

Figure 5-6

### Read DTC

This option is used to read the current activated or historical activated trouble codes.

Generally, there are three elements for one J1939 DTC (See Figure 5-7):

- Suspect Parameter Number (SPN) – Indicates what function on the ECU has failed.
- Failure Mode Indicator (FMI) – Indicates in what way the function failed.
- Occurrence (OC) – Indicates the occurrence times of the current DTC.

Read DTC		
SPN0100	Occurrence Count= 1	1/8
FMI= 4	Voltage Below Normal, Or Shorted Lower Source	
SPN 100 Engine Oil Pressure		

Further descriptions on current DTC

Indicates there are total 8 codes and SPN0100 is the first code to display.

Figure 5-7

Whereas, if we choose [J1587/1708], the fault code includes:

- Subsystem Identifier (SID) – Indicates what function on the ECU has failed.
- Failure Mode Indicator (FMI) – Indicates in what way the function failed.
- Occurrence (OC) – Indicates the occurrence times of the current DTC.



Press ► / ◀ to view the next or previous trouble code; press [ESC] to exit and return to the function screen.

### Clear DTC

This option allows you to clear the existing or historic trouble codes.

**Note:** After clearing, you should retrieve trouble codes once more or turn ignition on and retrieve codes again. If there are still some trouble codes in the system, please troubleshoot the code using a factory diagnosis guide, then clear the code and recheck.

### Live Data

This option enables you to read the real-time data stream in character or graphic form.

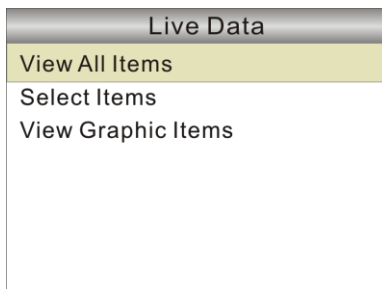


Figure 5-8

- A. **View All Items:** To view all data stream items.
- B. **Select Items:** Select the desired data stream items, and then press [ESC] to read the value of the selected items.
- C. **View Graphic Items:** Select the desired data stream item and press [ESC] to display it in live graphic form. (Note: Max. 1 item is supported.)

### OBDII Diagnosing

Press [OK] in Figure 5-2, a screen similar to Figure 5-9 will appear:

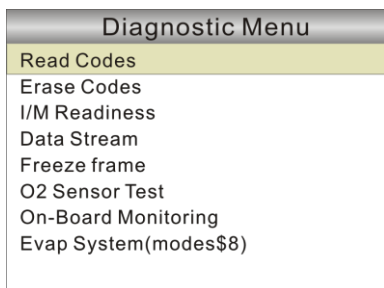


Figure 5-9

### Read Codes

This option is used to read the current, pending or permanent trouble codes. If the trouble code is found, the system will display the detailed description of the trouble code:

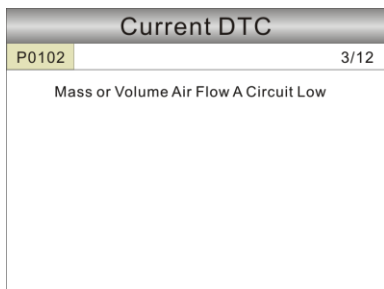


Figure 5-10

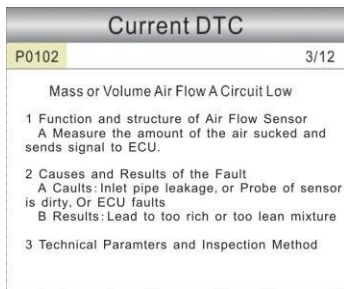


Figure 5-11

In Figure 5-10, 3/12 indicates there are total 12 codes and P0102 is the third code to display.

If the DTC is defined by the manufacturer, a screen similar to Figure 5-11 will appear. In this case, press **[OK]** to select the manufacturer from the list and the screen will show the detailed content of the trouble code.

**Some DTC have the tips guide, it is the next page of Figure 5-11. It shows the structures of sensor, the cause and Results of Fault and give you the parameters and inspection method.**

## Erase Codes

It is used to clear all existing trouble codes.

### Notes:

- *Before performing this function, make sure to retrieve and record the trouble codes.*
- *After clearing, you should retrieve trouble codes once more or turn ignition on and retrieve codes again. If there are still some trouble codes in the system, please troubleshoot the code using a factory diagnosis guide, then clear the code and recheck.*

## I/M Readiness

I/M refers to Inspection and Maintenance that is legislated by the Government to meet federal clean-air standards. I/M Readiness indicates whether or not the various emissions-related systems on the vehicle are operating properly and are ready for Inspection and Maintenance testing.

The purpose of the I/M Readiness Monitor Status is to indicate which of the vehicle's Monitors have run and completed their diagnosis and testing, and which ones have not yet run and completed testing and diagnosis of their designated sections of the vehicle's emissions system.

The I/M Readiness Monitor Status function also can be used (after repair of a fault has been performed) to confirm that the repair has been performed correctly, and/or to check for Monitor Run Status.

**Note:** *N/A means not available on this vehicle; INC means incomplete or not ready and OK means Completed or Monitor Ok.*

## Data Stream

This item enables you to view all data stream items and the live waveform of all selected items. Some data stream have the help information, press the [?] .

## View Freeze Frame

When an emission-related fault occurs, certain vehicle conditions are recorded by the on-board computer. This information is referred to as freeze frame data. Freeze Data is a snapshot of the operating conditions at the time of an emission-related fault.

**Note:** *If DTCs were erased, Freeze Data may not be stored in vehicle memory*

*depending on vehicle.*

### **O2 sensor test**

The results of O2 sensor test are not live values but instead the results of the ECU's last O2 sensor test. For live O2 sensor readings, refer to any of the live sensor screens such as Graph Screen.

Not all test values are applicable to all vehicles. Therefore, the list generated will vary depending on vehicle. In addition, not all vehicles support the Oxygen Sensors screen.

### **On-board monitor test**

This function can be utilized to read the results of on-board diagnostic monitoring tests for specific components/systems.

### **Evap System**

The EVAP test function lets you initiate a leak test for the vehicle's EVAP system. NL102 does not perform the leak test, but signals to vehicle's on-board computer to initiate the test. Before using the system test function, refer to the vehicle's service repair manual to determine the procedures necessary to stop the test.

### **Vehicle Information**

This option allows you to view the relevant information of the vehicle, including VIN (Vehicle identification Number), CID (Calibration ID) and CVN (Calibration verification number).

## 6. FAQ

Here we list some frequently asked questions and answers relating to NL102.

**Question:** System halts when reading data stream. What is the reason?

**Answer:** It may be caused by a slackened connector. Please turn off the NL102, firmly connect the connector, and switch on it again.

**Question:** Screen of main unit flashes at engine ignition start.

**Answer:** Caused by electromagnetic disturbance and this is normal phenomenon.

**Question:** There is no response when communicating with on-board computer.

**Answer:** Please confirm the proper voltage of power supply and check if the throttle has been closed, the transmission is in the neutral position, and the water is in proper temperature.

**Question:** Why are there so many fault codes?

**Answer:** Usually, it's caused by poor connection or fault circuit grounding.

**Note:** All pictures illustrated here are for reference and demonstration purpose

*only and this User's Manual is subject to change without prior notice.*