

HANDBOOK AND TECH GUIDE:

KICK-START YOUR FUNCTIONAL TESTING PROJECT TODAY!

Hardware in Loop (HIL) | Model in Loop (MIL) | Software in Loop (SIL)



*A Handbook on
Functional Testing*

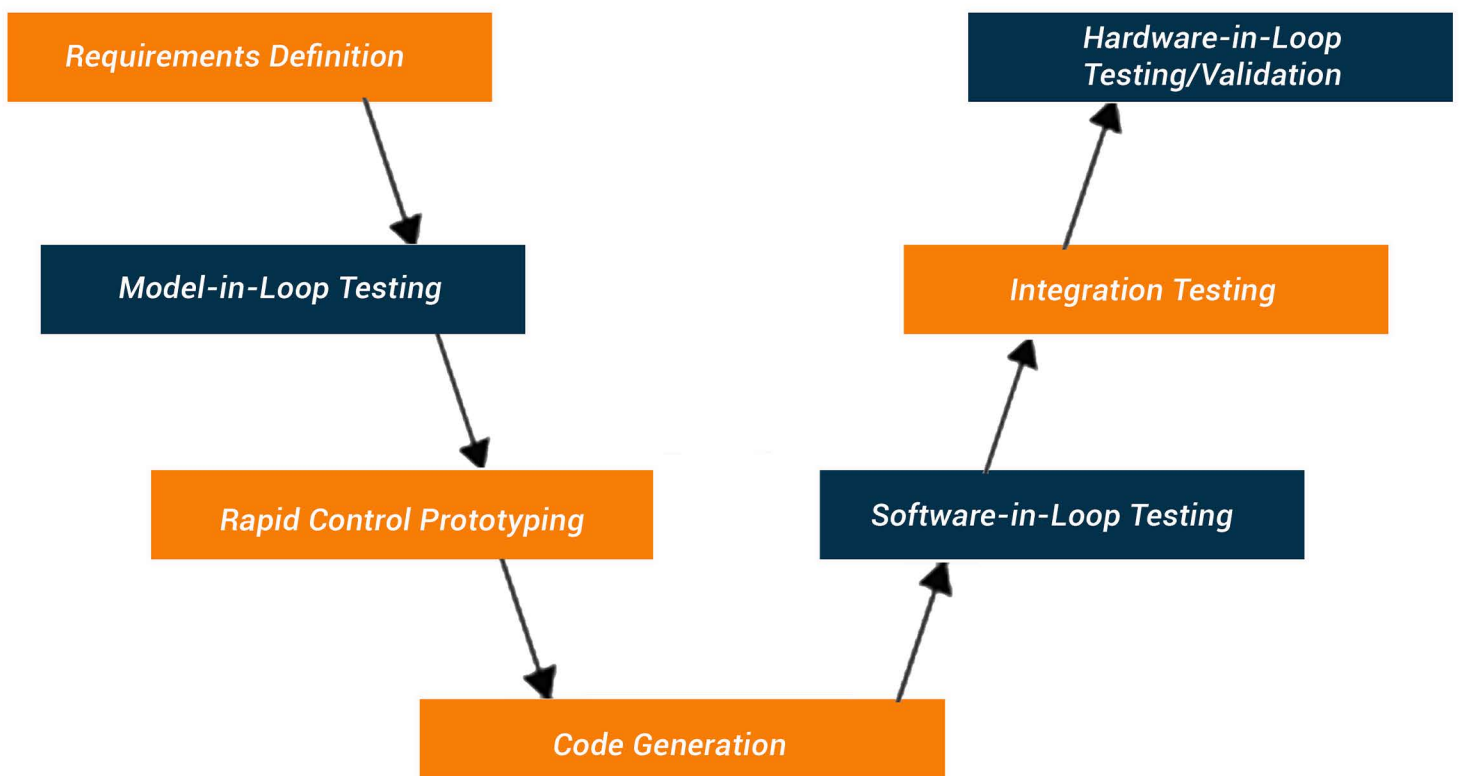
WHAT IS FUNCTIONAL TESTING?

Functional Testing is the part of software verification process where a software is tested against the functional requirements. It ensures that the software is tested for all the requirements defined in the requirement gathering and maturation phase.

Model-in-Loop (MIL), **Software-in-Loop (SIL)** and **Hardware in Loop (HIL)** are the three types of Functional Testing methods.

Let's understand each of them in detail.

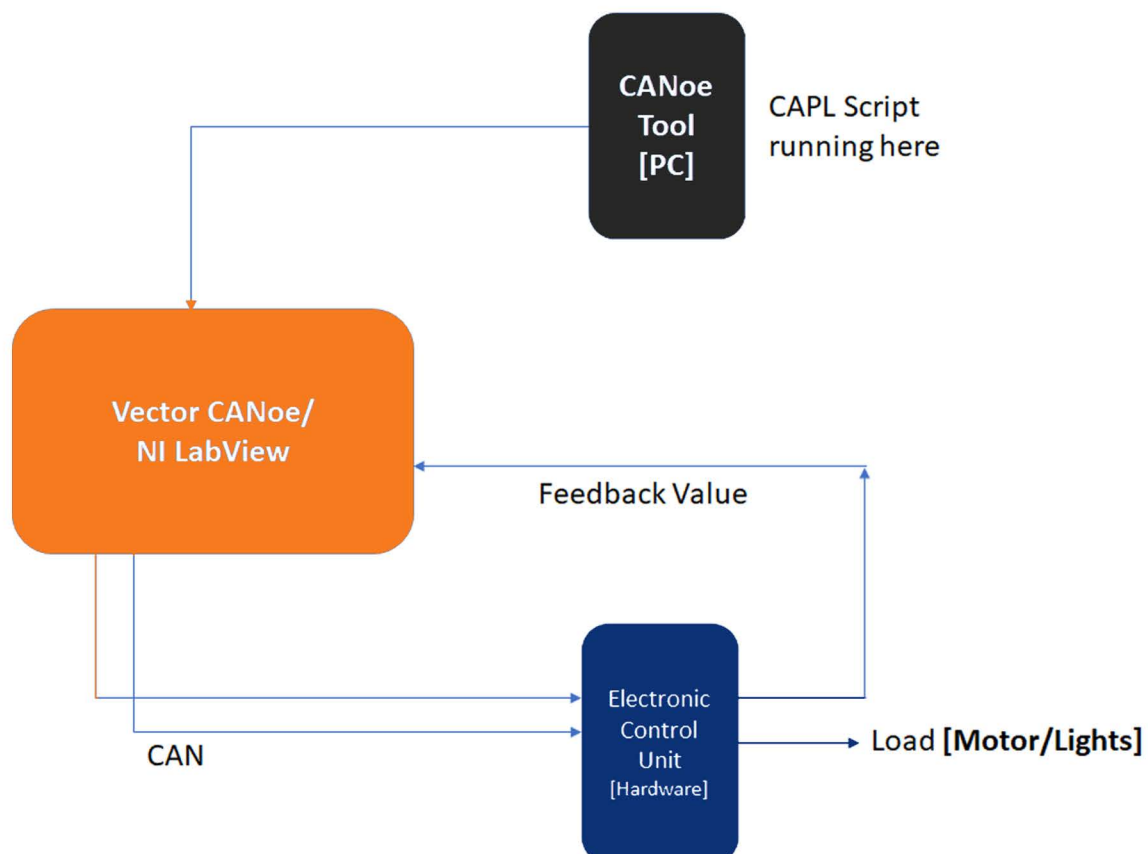
FINDING HIL, MIL, SIL TESTING IN V-MODEL OF SOFTWARE DEVELOPMENT



What is Hardware in Loop (HIL) Testing

- HIL Testing or HIL Simulation is the process of validating a software inside the target hardware (automotive ECU)
- HIL Testing is done against the requirements specified for the software or the feature under test
- The process starts with flashing the software in the automotive control unit. For instance, for a heated seat system, the software feature that controls heating/cooling of the seats is flashed in the Seat ECU.
- Next, the test engineers create test cases using CAPL script based on the requirements specified at earlier stages
- Now using tools like CANoe/VT System, inputs will be given to the ECU.
- The behavior of the software inside the hardware will be checked for any anomaly.
- The output of the test is generated as the HIL Testing Report.

HIL Testing in Action



What is Software-in-Loop (SIL) Testing

- During SIL Testing, the C Code is generated from the controller model.
- Controller Model is replaced with the generated code.
- A simulation is carried out with the Plant Model and the controller block (C Code)
- The output of this step is matched with MIL Testing and if there is any discrepancy, then the same is reported to the product development team

What is Model-in-Loop (MIL) Testing

- MIL Testing is a process associated with the Model Based Development paradigm.
- A plant model, which is a diagrammatic representation of a real-world system, is created using tools like SIMULINK.
- This model is verified with a separate controller model (that hosts the application logic). The MIL Testing verifies if the controller model is able to control the plant model, under the simulated test-case scenarios.
- The output derived from the MIL Testing is used for verification during the later stages of development.

Pro-Tips: How to get started with any Functional Testing Project

Requirements are most important part of Functional Testing, hence, ensure that your requirements are defined.

The Electronic Control Unit to be tested should be properly defined, i.e. its functionalities, features etc.

The test cases need to be written so as to validate every requirement specified for the ECU

After a new feature is added, Regression Tests need to be performed so every detected flaw is rectified.

One of the best practices in Functional Testing Project is to involve the test team from the requirement generation phase.


Our Expertise in various Automation Tools for Functional Testing

The choice of tools for HIL, MIL or SIL testing depends on the specific requirements of the projects.

Our Functional Testing Consultants have delivered successful verification and validation projects with the help of the following tools

VECTOR 
CANoe

This is a software development and Testing tool from Vector. One of the functions of CANoe is to help in analysis and simulation of network communication between various Electronic Control Units (ECU). This is one of the most widely used tool for Functional Testing


LabVIEW

It is a Test Automation Framework from National Instrument. It helps to control and customize a Functional Testing system. LabView expedites the SIL, MIL and HIL Testing process and proves to be an efficient testing framework that also helps reduce time-to-market.

ETAS

ETAS is a test automation tool, that can perform HIL testing as well. In one of our projects, we have used ETAS tool for HIL testing of Exhaust System Software.


Rational Quality
Manager

It is a web-based tool from IBM . It adds value to the Functional Testing (HIL,MIL,SIL) process by automating the test planning, test construction and test management activities

Hope you enjoyed reading this handbook.
For more queries and/or demos, please contact us at
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