HIL System Architecture

BlauPlug's cutting-edge HIL (Hardware-in-the-Loop) solutions are designed to revolutionize your testing processes by simulating the plant environment and stimuli while utilizing real ECU (Electronic Control Unit) devices as the Device Under Test (DUT). This innovative approach significantly reduces real-estate costs and maximizes the utility of your bench hardware, enabling versatile reuse across various testing scenarios.

Our HIL setups are engineered to handle multiple ECUs and subsystems, whether they operate independently or interact with each other. This flexibility ensures comprehensive testing coverage and enhances the efficiency of your development cycle. Moreover, BlauPlug's HIL systems are not limited to ECU testing; they also rigorously evaluate real loads intended to interact with the ECU, ensuring that any faults are not induced by defective hardware.

Partner with BlauPlug to leverage our state-of-the-art HIL technology, streamline your testing processes, and achieve unparalleled reliability and performance in your automotive and industrial applications.

HIL Test is categorized into two levels of testing namely –

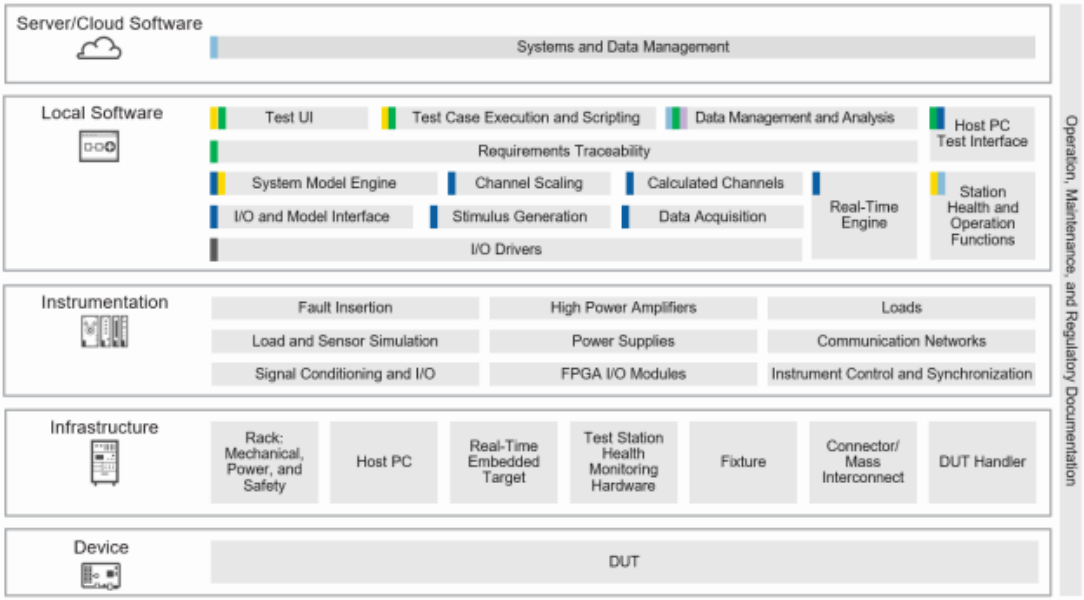
1. **Signal Level Testing:** Simulate the entire test system to test the control electronics. At this level – Simulated signals mimicking the actual output from various sensors and loads are simulated using various programmable Hardware.
2. **Power Level Testing:** Power Level Testing refers to connecting real sensor, actuators and Loads and monitoring the stimuli provided by them as well as the ECU response generated upon interaction.

Most HIL Systems are Designed with a Hybrid Testing Scope by keeping majority of the Signals at Signal Level and testing critical functionality at Power Level.

A Real-Time Controller and a Test Executive Software are at the core of any HIL Systems. Blauplug offers a plethora of options from NI as well as other OEM catalogue to choose from a variety of Hardware options complimented by In-house developed Software which are tailor-made to Customer Requirements.

Some of the common components of the HIL System are listed below:

1. **Operator Interface:** This refers to Software Component which provide the user with control over the HIL system, allowing for configuration, monitoring, and analysis of the tests.
2. **Real-Time Processors**: These are essential for executing simulation models and managing I/O communication with deterministic timing. Examples include processors National Instruments (NI) cRIO & PXI platforms.
3. **I/O Interfaces:** These interfaces handle the interaction between the simulation environment and the hardware under test. They include analog, digital, and bus interfaces to produce stimulus signals and acquire data. NI's PXI systems I/O modules are commonly used.
4. **Fault Insertion Units (FIUs):** These units are used to simulate faults in the system to test the robustness of the hardware. They can create conditions like short circuits or open circuits to see how the system responds. NI SLSC platform is specifically designed for such applications.
5. **Programmable Power Supplies and Loads:** These components provide the necessary power to the hardware under test and simulate real-world electrical loads. Programmable Power Supplies & Programmable Loads are preferred over set value hardware to accommodate over large range to test variety of ECUs
6. **Communication Interfaces:** These include CAN, LIN, Automotive Ethernet, and other communication protocols to interface with the hardware. They ensure that the hardware can communicate with other components in the system and interact across various sub-systems.
7. **Sensors and Actuators:** These are used to replicate the real-world inputs and outputs that the hardware would interact with in its operational environment.



These components work together to create a comprehensive testing environment that can simulate real-world conditions for the hardware under test

Demonstration Agenda

As part of the agenda for this event, the Blauplug team is demonstrating the functionality of the HIL System using two devices:

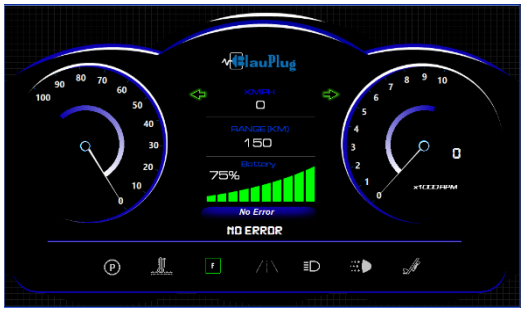
1. Meter Console
2. Climate Control Module

These demonstrations will showcase the capabilities and applications of our advanced HIL technology.

Meter Console

The Meter Console Testing aims to demonstrate how fundamental features of a two-wheeler vehicle console can be effectively tested using a state-of-the-art HIL setup. For this demonstration, simulated switches and indicators are employed to represent actual vehicle controls and loads. However, the real control switches and indicators would operate on the same principles. This demonstration is designed to highlight the concept and capabilities of our HIL system, acknowledging that specific hardware components may vary and evolve over time.

The Demo Aims Test Aim at showcasing how the handlebar switchgear controls would interact with the vehicle cluster in both real and simulated way for switching and indication.



Climate Control Module

The Climate Control Module demonstration is designed to showcase the diverse functionalities of an ECU, including its communication capabilities with LIN (Local Interconnect Network) signals. This demonstration will highlight the ECU's ability to manage and control climate-related functions within a vehicle, emphasizing the robustness and versatility of our HIL system in testing and validating these critical interactions.

Previously Employed Projects

OBC-DCDC Solution Overview:

OBC DCDC stands for On-Board Charger - DC to DC converter. It is a sophisticated electronic system integrated into electric vehicles that serve two essential purposes. Firstly, it converts the high voltage from the electric vehicle's battery pack into a lower voltage needed to charge the vehicle's 12-volt battery, which powers auxiliary systems like lights, infotainment, and power steering. Secondly, it serves as an on-board charger, transforming AC power from charging stations into the DC power required to recharge the electric vehicle's main high-voltage battery pack.

OBC DCDC technology is a fundamental element of electric vehicles, ensuring efficient energy management, seamless charging, and improved performance. As the demand for electric mobility grows, advancements in OBC DCDC systems will continue to drive the evolution of electric vehicles, making them more practical and appealing to a broader range of consumers. Embracing these innovative technologies is essential to accelerate the global transition towards a greener and more sustainable transportation future

Apart from above solutions we can incorporate Vector VT Systems for PSI5, SENT, Automotive Ethernet, and CANOpen protocols, alongside NI C-Series, PXI, and SLSC platforms. Additionally, we seamlessly integrate dSPACE and Morphee control modules as needed. This comprehensive approach ensures that we provide the most effective and innovative HIL solutions tailored to your specific requirements.

Other HIL Solutions

Based on the application requirements BlauPlug has expertise in integrating various devices like Network Emulators, GPS & GNSS Modules, In-house developed Customer Equipment's and more.

Blauplug has a wide client base delivering regular HIL Systems for a variety of test requirements including:

1. ADAS Validation
2. Vehicle Control Unit
3. Motor Control Unit
4. Body Component Testing
5. Infotainment
6. Telematics
7. Wireless charger
8. Battery Management System & more

Please feel free to Contact us for details of other solutions and services required