

**LOW-COST HARDWARE IN THE LOOP (HIL) TEST TOOL**

**User Manual**

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Table of Contents

[Introduction 4](#_Toc119696305)

[1.1 Concept 4](#_Toc119696306)

[1.2 Scope 4](#_Toc119696307)

[Hardware 5](#_Toc119696308)

[2.1 HIL Test Tool Connection Diagram 5](#_Toc119696311)

[2.2 Interface with Simulated CAN Network 5](#_Toc119696312)

[Software 6](#_Toc119696313)

[3.1 CANoe 6](#_Toc119696318)

[3.2 TCP Client 6](#_Toc119696319)

# Introduction

Test and Validation teams across several automotive companies use COTS (Commercial Off-the-Shelf) technology for the design and development of Automated Test Equipment (ATE). System development programs budget high costs for professional development tools like Vector CANoe/CANalyzer, Vehicle Spy from ICS, etc.

While these tools are excellent to design and develop large simulations and tests scenarios, sometimes startup companies do not require or cannot afford these tools with high-cost licenses. On the other hand, when the test development team has finished the test automation and the rest of the R&D teams just need a simple tool to execute predefined test cases, they need to borrow at least a Runtime license of one of these expensive tools in order to run the test scenarios again to keep with OEM requirements for product maintenance.

## Concept

The purpose of this project is to emulate the functionality of an Automated Test Equipment (ATE) capable of running pre-defined test scenarios via CAN communication to special types of ECUs. For this academic project, a basic simulated Body Control Module will be simulated using Vector CANoe. The simulation will include vehicle engine status, Door locks, Lights and a temperature sensor.

The HIL Test Tool will consist of an STM32 MCU (NUCLEO-H723ZG). The microcontroller will be running FreeRTOS. It will contain the required tasks to interact with the Device Under Test (DUT) simulated in CANoe via CAN. It will receive instructions to run test and configuration modes from a simple TCP client.

## Scope

The HIL Test Tool will provide the ability to run predefined test scenarios to any ECU that has a CAN communication layer.

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# Hardware

This section is divided in 2: HIL Test Tool and.



## HIL Test Tool Connection Diagram

## Interface with Simulated CAN Network

# Software

This section describes the parts of …



## CANoe

* MCU: [STM32H7](https://www.st.com/en/evaluation-tools/nucleo-h723zg.html#overview&secondary=st_all-features_sec-nav-tab) (Cortex-M7) running FreeRTOS 10.3.1 with the following modules:
  + SPI module for TFT 1.8” screen.
  + CAN FD module configured for CAN HS.
  + Ethernet for TCP communication.
  + GPIO for user buttons and LEDs.
* CAN transceiver NXP TJA1441AT.
* Vector VN1640 CAN case to receive data from simulated vehicle sensors.

## 

## TCP Client

* Vector CANoe 12.0
* National Instruments LabVIEW 2020.
* STMCubeIDE 1.10.1