SAE J1939 ECU Simulator Board with USB Port

Monitor, Record, Analyze, and Simulate SAE J1939 Data Traffic

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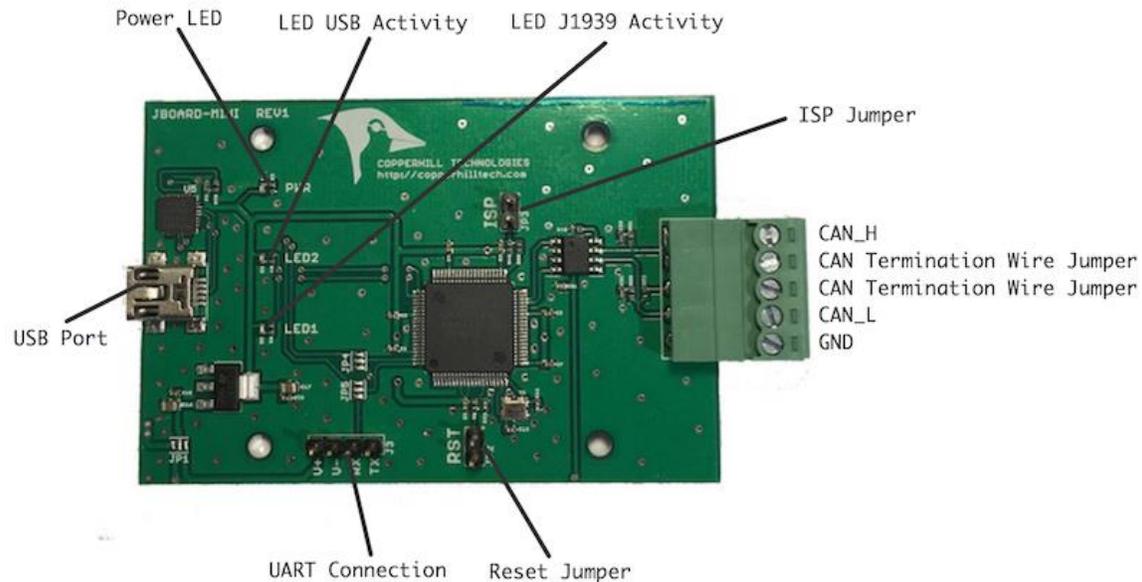
Introduction

The JCOM.J1939.USB gateway board is a high-performance, low-latency vehicle network adapter for SAE J1939 applications. It allows any host device with a USB COM port to monitor SAE J1939 data traffic and communicate with the SAE J1939 vehicle network.

The board supports the full SAE J1939 protocol according to J1939/81 Network Management (Address Claiming) and J1939/21 Transport Protocol (TP). It is also supported by an extensive programming interface for Windows and Linux/Ubuntu applications, including full C/C++/C# source code for short time-to-market developments.

The strength of the board lies in the fact that the entire SAE J1939 protocol, including all timing requirements, is stored on-chip, thus taking the burden off the main system. The board uses a USB COM port to communicate with the main system, i.e., all data transfer is handled through a standard COM port access. The communication protocol between the board and the main system is well documented and thus allows a porting to any computer system with a USB connection. Working source code libraries exist for **Windows (C# under Visual Studio 2102/2013), Linux and its derivatives (C++ using Code::Blocks),** and Raspberry Pi (C using the standard *gcc* compiler).

With all its features, the jCOM.J1939.USB allows the simulation of an SAE J1939 ECU (Electronic Control Unit) using embedded solutions such as the Raspberry Pi, BeagleBone, Arduino, Teensy, and others but also PCs running Windows or Linux (incl. Ubuntu, Fedora, etc.).

Features

- Fully SAE J1939 compliant hardware with on-chip SAE J1939 protocol, including Transport Protocol (TP)
- Free-of-charge Windows analyzer software
- Monitor, record, and analyze SAE J1939 data traffic
- Simulate SAE J1939 data traffic
- Respond to message requests
- Define message filters
- Automatic node address negotiation
- Fully programmable per USB port
- Virtually OS independent
- Programming sample for Windows, Linux, and embedded systems

Board Components

Connecting the jCOM.J1939.USB Board Hardware

Connect the jCOM.J1939.USB board to any free USB port on your host system (such as a PC running Windows or Linux, Raspberry Pi, BeagleBone, etc.). In most cases, the operating system Windows, Linux, Raspbian) will recognize the new USB connection automatically, meaning there is no driver installation required.

However, should that not be the case, please download the driver for your operating system as indicated in below chapter Driver Software.

CAN Bus Connection

For the CAN/J1939 connection, the jCOM.J1939.USB board uses a 5-pin terminal connector. The board also features an internal termination resistor of 120 Ohm, which is activated by inserting a wire jumper in the terminal block (the jumper is installed per default).

The connections (from top to bottom; see above image) are:

- CAN_H
- CAN Termination Wire Jumper
- CAN Termination Wire Jumper
- CAN_L
- GND

Important! *It may sound obvious, but it is, nevertheless, overseen frequently: You will need a second SAE J1939 node (or an entire network) to check the board's full functionality. The board comes with a "heartbeat" function (i.e., a heartbeat message sent per USB every one second), which indicates that the board is "awake" and working, but that doesn't proof any SAE J1939 functionality.*

On-Board LEDs

The jCOM.J1939.USB board comes with three LEDs:

- PWR – Directly connected to power.
- LED2 – Indicates USB port activity (including heartbeat message)
- LED1 – CAN / SAE J1939 activity

Upon powering up the board you will see the power LED plus the USB LED blinking with a one second frequency (heartbeat).

Driver Software

The USB driver software supports a variety of operating systems as shown below. Most operating systems, such as Windows or Linux, will recognize the USB port and install the appropriate driver automatically. However, should that not be the case, please download the driver for your operating system as indicated below:

- [CP210x USB to UART Bridge VCP Drivers…](#)

Disclaimer: While the above link provides drivers for most of the popular Linux OS flavors, there is no guarantee they will work on every Linux computer in the marketplace.

Updating the JCOM.J1939.USB-B Firmware

In order to update the firmware, please follow the steps as described here:

1. Check the Firmware Version Number

In the [JCOM1939 Monitor Software](#), select the "Gateway" tab. Please make sure, the communication with the gateway was initiated by clicking "Start COM" command button, otherwise the gateway will not report the firmware version.

In the upper right position of the tab, check the Software Version number and verify it with the newest version as documented on our [Firmware Version & Update](#) page.

2. Download the Firmware File

In order to update the internal program (i.e., the firmware), we provide a .hex file that can be loaded into the device directly per USB port (see the following steps).

Download the .hex firmware file…

3. Activate the Flash Programming Mode

Important! Activating the Flash Programming Mode per jCOM1939 Monitor software will only work with firmware **versions 1.10.00 and higher**! If your firmware is lower than 1.10.00, please use the ISP/RST jumper method as described in the following chapter.

Coming back to the same section of the JCOM1939 Monitor software: First, please assure that the device is not connected to a running CAN/J1939 network.

Click on the "FLASH" command button. The program will prompt you to confirm the action, and if you click "Yes" the following will happen:

The windows software will close, because it uses the same COM port you will need for FlashMagic.

All three LEDs on the gateway will be on, indicating the flash programming mode.

4. Update the Firmware Using FlashMagic

The software (FlashMagic) required to load the firmware is a free download at:

http://www.flashmagictool.com/

Flash Magic is a PC tool for programming flash based micro-controllers from NXP using a serial or Ethernet protocol while in the target hardware.
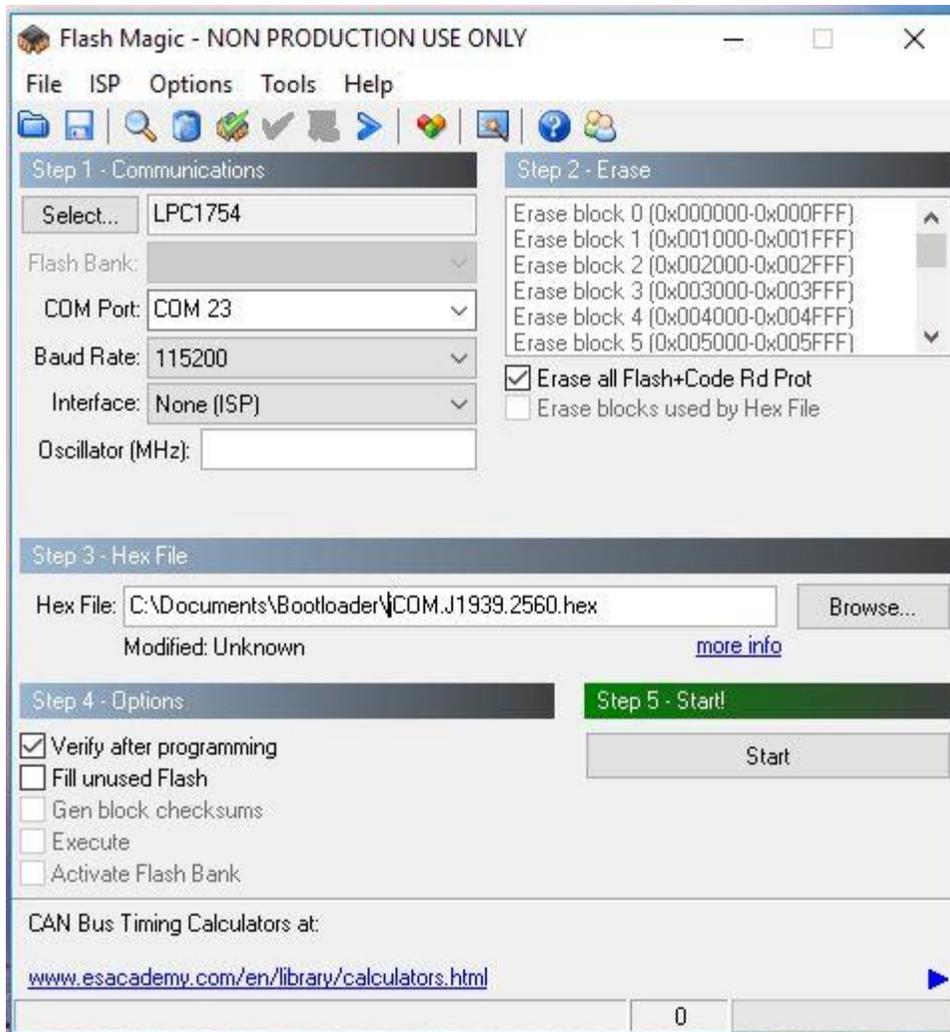
The above image shows the settings you need to apply. The only difference in your setup would be the choice of COM Port and the location and name of the .hex file.

Programming the Device

1. Connect the jCOM.J1939.USB device's USB port to your PC (unless already connected)
2. Start FlashMagic and select COM port and .hex file location
3. Make sure that all other settings match those in the image above
4. On the jCOM board do the following (Not necessary when FLASH mode was activated through the jCOM1939 Monitor software):
   a. Close (i.e., connect) the ISP jumper
   b. Close the RST jumper
   c. Open the RST jumper
   d. Open the ISP jumper
5. In the FlashMagic program click on *Start*

5. Reset the Gateway

After the flash programming process has finished, close FlashMagic, then reset the jCOM gateway, either by shortly jumpering RST or initiating a power-cycle (removing, then re-

connecting the USB cable). Shortly after reset, you should see LED2 blinking with a one-second frequency.

Testing a Device with "Silent Mode" or Automatic CAN Baud Rate Detection?

If you need to communicate with an SAE J1939 node that starts up in "Silent Mode" or supports automatic baud rate detection, please be aware that our USB device will not be able to recognize it. You will be better off using our SAE J1939 Starter Kit as described above,

For more information, see How CAN Bus Automatic Baudrate Detection Works And What To Consider When Connecting To A Network.

JCOM1939 Monitor Software for Windows

The gateway is supported by our free-of-charge jCOM1939 Monitor, an SAE J1939 Monitoring, Analyzer, Recorder, and ECU Simulation software under Windows.

The program represents a complete tool to monitor, analyze, record, and simulate SAE J1939 data traffic. It works in combination with our SAE J1939-USB gateways. The monitor software is a comprehensive and easy-to-use, easy-to-understand tool that displays not only SAE J1939 data traffic; it also allows scanning the network, simulating an ECU (incl. full node address negotiation features), and responding to data request messages.

More Information…

JCOM.J1939 Protocol & Programming Interface

The jCOM.J1939 Gateway Protocol is designed to establish a data exchange between a JCOM.J1939 Series gateway and a host system (e.g., a PC or embedded system such as the Raspberry Pi) per means of serial communication (UART, USB). The protocol enables the host system to take advantage of the gateway's capabilities by providing a set of commands from the host and responses from the gateway.

More Information…

Programming Under Windows, Raspberry Pi, And Linux

- Programming the SAE J1939 ECU Simulator Board Using Visual Studio C#
- SAE J1939 ECU Simulation And Data Monitoring Under Linux
- SAE J1939 ECU Simulator And Data Monitor for Raspberry Pi

More Resources

- [Simulating SAE J1939 PGNs Used By Truck & Bus FMS (Fleet Management System) Standard](#)
- [SAE J1939 Address Claim Procedure - SAE J1939/81 Network Management](#)
- [SAE J1939 Monitor Software - Setting Up PGN Simulation Such As Engine Coolant Temperature](#)
- [SAE J1939 Simulator Generates Frequently Used SAE J1939 Signals (PGNs) For Diesel Engines...](#)