



SAE J1939

SAE J1939 Introduction

The SAE J1939 protocol was defined by the SAE for use in commercial vehicles, but it is also used in ships, rail-bound vehicles, agricultural machinery and large generators. In addition, SAE J1939 serves as the basis for the international standards NMEA 2000 (marine) and ISO 11783 (ISO bus for agricultural machinery), allowing the protocol stack to also be used for these applications as well.

In the commercial vehicle sector, serial protocols standardized by the SAE have been used for a long time, for communication between the individual electronic control units and components of the drive train. The J1708/J1587 protocol based on the serial port normally available in microcontrollers can be considered the predecessor.

Due to the required compatibility with the J1708/J1587 protocol, an extension of the CAN message identifier from 11 to 29 bits (extended format) and the development of CAN modules or protocol implementations which support this message format was required for J1939.

With the availability of the extended CAN identifier it is possible to map the principle of the definition of communication relationships to CAN as used in J1708. For this, part of the identifier is used to specify an 8-bit source and an 8-bit target address (node number).

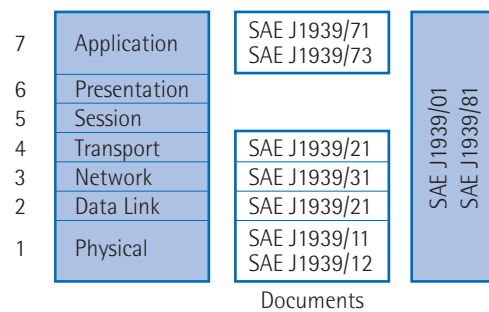
Therefore, via SAE J1939, it is possible to both transmit measurement values and control data and to configure components. In addition, it is also possible to read or delete diagnosis data of individual components and to carry out a calibration of individual controls.

To make this possible, all variables relevant for the commercial vehicle sector are defined with value ranges, resolution, identification number etc. in SAE J1939. This was implemented on the basis of the specification already available for J1587.

Thus, in the J1939 protocol, not only are the type of transmission, the structure of messages and their segmenting, flow checks etc. specified but the content of the messages itself can also be precisely defined.

SAE J1939 in the ISO/OSI layer model

SAE J1939 is divided into several layers according to the OSI layer model, where each level is specified in a separate document. In a fashion similar to practically all fieldbus protocols, since layers 5 and 6 are not needed in SAE J1939, they are also not specified.



The functionality of SAE J1939 is divided into layers as follows:

- **Layer 1** (physical layer) describes, among other things, the electric interface with the physical medium.
- **Layer 2** (data link layer) describes the data communication via CAN based on the specification CAN 2.0B.
- **Layer 3** (network layer) essentially describes the functionality of a bridge for the transmission of messages between two network segments and is only relevant for the implementation of a J1939 bridge.
- **Layer 4** (transport layer) describes the various network services for message request mode, acknowledged transmission, and fragmented transmission of large data blocks.
- **Layer 7** (application layer) describes the actual data (parameters or network variables with value range, resolution, physical unit and the type of transmission). Each message is unambiguously referenced by a number (parameter group number).
- Since the network management can be regarded as a separate unit which reaches through to the hardware (layer 1), this block in the layer model is shown as an independent function block on the right-hand side. The network management basically consists of the automatic allocation or determination of node addresses (plug & play principle). Node monitoring is not defined in SAE J1939 and must be implemented via cyclic messages at the application level.



SAE J1939 Protocol Software

► Software Package for the Development of J1939 Devices

The SAE J1939 protocol software enables a simple, fast development of SAE J1939 devices. All communication mechanisms defined in the SAE J1939 specification are available (except for the bridge functionality), so that the developer can concentrate fully on his or her application.

As the user interface is designed as a universal message-based function interface, the protocol stack can be universally used and is therefore also the basis for other protocols such as NMEA 2000 and ISO 11783 (ISOBUS). In addition, it is possible to adapt the stack to the message defined in the standard 1939/71 and therefore to work on variable/signal level via generatable mapping functions and macros.

This is made possible via a graphic configuration tool which, in addition to generation of the mapping functions, permits the complete configuration of the stack as well as the generation of a template file for the application. In addition, a plausibility check of all configuration parameters ensures that configuration errors of the user are avoided.

The modular structure of the protocol software based on the OSI layer model allows an optimum adaptation to the individual target system. For example, access to the CAN controller is implemented by an appropriate CAN interface whose functions are included in a separate module. The software can therefore easily be adapted to further CAN controllers if required.

The documentation and sample programs provided enable a fast start-up with the SAE J1939 software. All sample programs are directly executable on a reference platform (evaluation board of the CPU vendor or IXXAT PC/CAN interface card). Normally, porting can be carried out on the target hardware within a few days.

FUNCTIONALITY

- Transmission and reception of application-specific messages (acknowledged and unacknowledged).
- Treatment of transport protocols for large data blocks (message- and subscriber-oriented).
- Simultaneous communication to several subscribers
- Support of the "address claiming" process for the dynamic definition of the node address
- Support of cyclic transmission and reception of messages with time-out supervision

The target hardware has to provide one free timer interrupt for time monitoring of the protocol as well as an interrupt line of the CAN controller.

VARIANTS

The SAE J1939 software is available in two variants:

The **Micro variant** is optimized for use on 8-bit CPUs with very limited RAM resources. Here the software is configured completely statically by generated files via the configuration tool. As in this case all configuration parameters can be placed in the Flash memory, the RAM requirement for the SAE-J1939 software is substantially reduced.

The **standard variant** allows the dynamic configuration of the SAE J1939 software via the function interface and therefore during run-time. This variant supports several software instances (CAN channels) and is also prepared for use with a real-time operating system. However, the software can also be used in an application without an operating system.

SUPPORTED PROCESSORS/CAN CONTROLLERS

The SAE J1939 Software is independent of hardware and can be used on a large number of micro controllers and CAN controllers. For processors of the following manufacturers (valid at time of printing of this catalog), IXXAT supplies reference implementations:

- Atmel
- Freescale
- Infineon
- Microchip
- x86 Architecture

A complete overview of all available versions can be found on the web page under the following link:
www.ixxat.com/j1939_stack_available_versions_en.html

Adaptation to SAE J1939 software on processors not directly supported can be carried out with the aid of the standard C code in a few days. IXXAT will be pleased to carry out the adaptations of the SAE J1939 software for you.

CONTENTS OF DELIVERY

- Source code
- Configuration tool with graphic user interface
- Company license (restricted to company location and business field) detailed manual
- Detailed manual
- Sample programs
- Technical support



FURTHER SERVICES

(not included in contents of delivery)

Maintenance contract

IXXAT offers a maintenance contract to supplement the software package. The maintenance contract includes the following services during the contractual period:

- Free updates and troubleshooting
- Technical support

Introduction to the code

One-day introduction to the code. Interfaces, processes and data flows in the SAE J1939 software are explained. Direct questions concerning the adaptation to be carried out can also be answered and adaptations to the code can be made.

Implementation support

IXXAT handles adaptation, implementation and testing of the SAE J1939 software to your hardware or application.

J1939 Module

The J1939 module is an extension for the IXXAT canAnalyser and provides powerful functions for recording, interpretation and analysis of J1939 messages.

ORDER NUMBER

1.02.0285.TTDDC	SAE J1939 Protocol Software (Versions on request)
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