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This document presents the application and functions of the Option .J1939 for CANalyzer. CANalyzer.J1939 extends the standard functionality of CANalyzer.

Product information and technical data for the basic functions of CANalyzer can be found in separate documents.
1 Introduction

SAE J1939 is a communication protocol based on CAN for the data exchange between control units in the area of commercial vehicles. It originates from the international Society of Automotive Engineers (SAE) and operates on the physical layer with high-speed CAN per ISO 11898. J1939 is a multimaster system with decentralized network management and primarily connection-less communication.

1.1 Application Areas

CANalyzer.J1939 can be used wherever J1939 networks are developed, diagnosed, and tested. Networks can also be simulated to a limited extent.

CANalyzer.J1939 can be used to monitor and debug other J1939 networks, since the SAE J1939 specification is the basis for NMEA 2000, ISO 11783, ISO 11992 (Truck & Trailer), FMS (Fleet Management System) and GB/T 27930 networks. In combination with further CANalyzer options it offers a uniform approach to systems that extend across bus boundaries with a common time base.

1.2 Features and Advantages

In addition to CANalyzer’s high-performance functionality, the J1939 extension gives the user a tool that can be used from initial development to production of a J1939 project. The J1939-specific extension allows the user to concentrate on the actual tasks of data analysis without detailed knowledge of the J1939 protocol. This significantly increases the efficiency of data analysis. Misinterpretations of CAN frames are avoided.

![CANalyzer.J1939](image)

Figure 1: CANalyzer’s analysis properties are being extended with J1939-specific features, e.g. new functions for displaying the J1939 protocol in the Trace window and the addition of the J1939 Filter.
1.3 Further Information

- **Vector Download-Center**
  Various documents related to CANalyzer are available on the Internet. In the Demo version, for example, you get sample configurations for the various use areas and detailed online Help texts, in which all CANalyzer functions are described. In addition, you benefit from our valuable know-how in the form of technical articles and application notes.

- **CANalyzer Feature Matrix**
  More information on variants, channels and bus system support is presented in the feature matrix.

2 Functions

- CANalyzer.J1939 expands the standard functionality of the CANalyzer with:
  - Protocol-specific display, checks, interpretation, filters and search functions in the Trace window
  - Support for the BAM, CMDT and Fast Packet transport protocols
  - Graphic display of the network nodes (scanner)
  - J1939 Filter in the measurement setup
  - Expanded database
  - Expanded Generator Block
  - J1939-specific programming functional properties in CAPL
  - Diagnostic Trouble Code Monitor (DTC Monitor)
  - Diagnostic Memory window
  - OBD Inspection and Maintenance Monitor
  - GNSS-Simulator, GNSS-Monitor and GPS Window
  - Support of J1939 AUTOSAR 4.2.2 System Descriptions

These functions will be described in detail below.
3 Hardware Interfaces

All hardware interfaces for CAN supported by CANoe and the Vector Test System (VT System) can be used. For compatibility, however, the use of ISO 11898 (ISO High speed) compatible bus drivers (for example CANcab 251mag) is recommended. Special bus transceivers (CANcab 10011opto or CANpiggy 10011opto) need to be used in conjunction with ISO 11992 (Truck & Trailer). All standardized physical layers (SAE J1939-11, -14 and -15) are supported and are easy to configure.

4 Transport Protocols

If a Transport Protocol described in the standard is used (BAM, CMDT or Fast Packet), CANalyzer.J1939 can reassemble the individually transmitted CAN messages.

5 Protocol-specific Display

Protocol interpretation is limited to CAN channels the user has configured as J1939. This makes it easy to monitor gateway solutions with different protocols. Simultaneous display of both 29-bit and 11-bit CAN identifiers is supported.

CANalyzer.J1939 allows the user to monitor communication symbolically in a Trace window. The parameter groups transmitted are displayed. All relevant information is output in separate columns, such as the parameter group number, priority, source and destination addresses as well as protocol interpretation in text form. Individual subject areas such as transport protocols, network management and diagnostics are color coded. In particular, highlighting of protocol violations help to assure J1939-conformant communication. Additional functions such as the topic-based analysis filter, context search and the column filters of the Trace window make it easier to find specific parameter groups.

The user may select signals for display in the Data window, including display by source address (SA) or destination address (DA). Wide ranges of display options are available to the user for this purpose, including bar diagrams, hexadecimal, decimal, and binary display. The SAE J1939-specific coding of signal values (‘Error’ and ‘Not Available’) is realized with the help of a status display. Signal processes can be displayed and evaluated as a function over time with the online Graphic window.

After the measurement stop, windows can be synchronized with one another, e.g. the Graphic window, Trace window and GNSS Monitor. This makes it easy to quickly track events of interest that are observed in the Graphic window back to the Trace window.

6 J1939 Filter

The J1939 Filter in the measurement setup offers protocol-specific configuration options such as PGN and ECU address filters. In addition, it supports networks with changing ECU addresses. The filter is configured using the J1939 device name, so you can create CANoe configurations that are largely independent of the real addresses used. The configurable column display enables a clearly structured view.

7 J1939 Scanner

The scanner monitors communication and makes available a clear display of all network nodes. Changes in a dynamic network can be easily traced and analyzed. If necessary, a central and clearly structured reconfiguration of the node addresses or J1939 device names can be executed. Information about function or manufacturer is also output.

8 Database

J1939 parameter groups and signals are described in a database. This database is already filled with sample standard objects. The user can expand the database using the CANdb++ Editor (included with delivery). This makes it possible to define application-specific parameter groups, for example. Parameter groups and signals that are defined can be selected symbolically in the entire program.
With the help of the Generator Block, parameter groups can be assembled and transmitted easily. Parameter groups with more than 8 data bytes can also be sent.
10 Programming

By inserting programmable function blocks into the measurement setup, the user can expand the functionality in virtually any way. The C-based, event-driven programming language CAPL (Communication Access Programming Language) has been expanded for J1939. This allows for the creation of J1939-specific test programs and simple node simulations.

11 Diagnostic Trouble Code Monitor (DTC Monitor)

The DTC Monitor offers a simple interface to the J1939 diagnostic protocol. Without programming error codes can be displayed or queried on demand. A button can be used to jump from a selected error code to the respective position in the Trace window. In addition, working with Freeze Frames (extended information from fault memory) is supported. This makes the DTC Monitor very useful for emission related or powertrain diagnostics. The results can readily be exported to other applications using the Clipboard.

Figure 4: The DTC Monitor shows momentary error codes in a well-organized form. Functions such as clearing error memory are provided.

12 Diagnostic Memory Access

The Diagnostic Memory window gives the user direct access to the memory areas of an ECU. This memory may be an error memory or program code, for example. Addressing is achieved with the help of parameter numbers (Suspect Parameter Numbers) or an address. The window is based on the diagnostic services DM14, DM15, DM16 and DM18. Authentication is realized with a manufacturer-specific Seed & Key DLL or a Seed & Key procedure can be implemented in CAPL. The support of diagnostic service DM13 (Start/Stop broadcast) also enables temporary reduction of the network load.
13 OBD Inspection and Maintenance Monitor

The “OBD Inspection and Maintenance Monitor” supports the ECU developer and integrator in emissions-related tests. It is used to initiate internal ECU tests and display their results. The Monitor is based on the diagnostic services DM5, DM7, DM8, DM10, DM21, DM26 and DM30.

14 Extensions for Marine Applications

- The GNSS Monitor and the GPS Window display and optionally record position data. As a third parameter elevation or speed may be shown in color. After measurement stop, the GNSS Monitor/GPS Window can be synchronized with the Trace and Graphic windows.

- With the GNSS Simulator you can define and follow a path virtually. This enables the easy simulation of corresponding devices. Playback of previously recorded paths is also possible.

- The “Fast Packet” transport protocol is supported along with the J1939 transport protocols CMDT and BAM.

- A sample database is also provided, complete with standard objects and sample configurations.

Figure 5: The GNSS Simulator sends parameter groups and simulates position data.
## Comparison Options .J1939 and .ISO11783 for CANalyzer and CANoe

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**CANalyzer .J1939**
- Presentation of PGN, SA, DA, Prio, DP, PGN name, node name, protocol interpretation and protocol violations with corresponding column filters, presentation of networks as a kind of sequence diagram.
- Interpretation e.g. for Virtual Terminal / Process Data / File Server / Peer Control / TIM.
- Previous/next PG from same SA / request-response / transport protocol.
- J1939-specific extensions for PGN, SA, DA and Prio; dynamic SA/DA filter based on J1939 Network Management.
- Network Management / Diagnostics / Proprietary PGs.
- Filters related to PG – dependent or independent from SA, DA and Prio.
- Comfortable configuration of PGN, SA, DA, Prio, etc.; support of transport protocols.
- Language extensions for processing of parameter groups.
- Monitors and displays communication aspects of Controller Applications; provides functions for reconfiguration of addresses and J1939 device names.
- GUI to the J1939 diagnostic protocol.
- On Board Diagnostic Inspection and Maintenance Monitor.
- Read and write SPNs and memory areas.
- Recording of position data and graphical display of covered path.
- Enables tests with different types of Virtual Terminals (resolution, monochrome, colour).
- Process data dialog allows to access individual data of any implement.
- Broadcast Announce Message.
- Connection Mode Data Transfer (unicast).
- Fast transport protocol (e.g. for transfer of position data).
- Extended Transport Protocol (for transfer of large amount of data).
- Database preconfigured with standardized J1939 PGNs.
- Database preconfigured with standardized ISO 11783 PGNs.
- Visualisation and easy configuration of interrelationships between signals, PGNs and CAs.
- System Description according to the AUTOSAR 4.2.2 standard version.
- Examples for diagnostics, exhaust sys., tire pressure monitoring sys., etc.
- Examples with Virtual Terminal, Interactive Task Controller, Address Claiming, etc.
- Simulation of independent nodes for test; simulation of remaining bus.
- Model-based signal-oriented simulation with minimal or no programming.
- J1939 specific function library for processing of network management, PGNs and transport protocols.
- Library with specific functions for complex simulations of a GNSS receiver.
- Easy simulation of implements or Auxiliary Inputs including communication with Virtual Terminal, Task Controller, TIM Server and TIM Client. Comprehensive and comfortable CAPL interface. Seamless integration in a test environment.
16 Training

As part of our training program, we offer a range of classes and workshops on J1939 in our classrooms and on-site at our customers.

You will find more information on individual training courses and a schedule online at: [www.vector-academy.com](http://www.vector-academy.com)
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