



CANoe .J1939

Product Information

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This document presents the application and functions of the Option .J1939 for CANoe. CANoe.1939 extends the standard functionality of CANoe.

Product information and **technical data** for the basic functions of CANoe can be found in separate documents.

1 Introduction

SAE J1939 is a communication protocol based on CAN for real-time 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

Because of its simulation capabilities, CANoe.J1939 is well-suited to the development, design and verification of J1939 networks. Its practical application as a diagnostic and debugging tool is just as feasible as its use in simulating the rest of the bus during startup or assembly. Especially the J1939 XML Test Module Manager supports the user in preparing integration and module tests. Since the SAE J1939 specification is the basis for other networks such as NMEA 2000®, ISO 11783, ISO 11992 (Truck & Trailer), FMS (Fleet Management System) and GB/T27930, the Option can be used in those applications as well.

When used in parallel with the .J1939 and .CANopen Options, CANoe is the ideal development and test environment for the CiA DS-413 CANopen Truck Gateway. In combination with the .J1587 Option it offers a uniform approach to systems that extend across bus boundaries with a common time base.

1.2 Features and Advantages

Using CANoe.J1939 from the very beginning allows the developer to use the same tool through the entire development process, from planning to realization. The models created in the design phase and checked by simulation are continually reused in other forms. It is possible to use the models to verify the implementation and later for functional end-of-line testing.

It is not necessary for the user to become familiar with the J1939 protocol, instead concentrate on the actual task of creating a simulation or data analysis. This significantly increases the quality of the development process and the efficiency of data analysis.

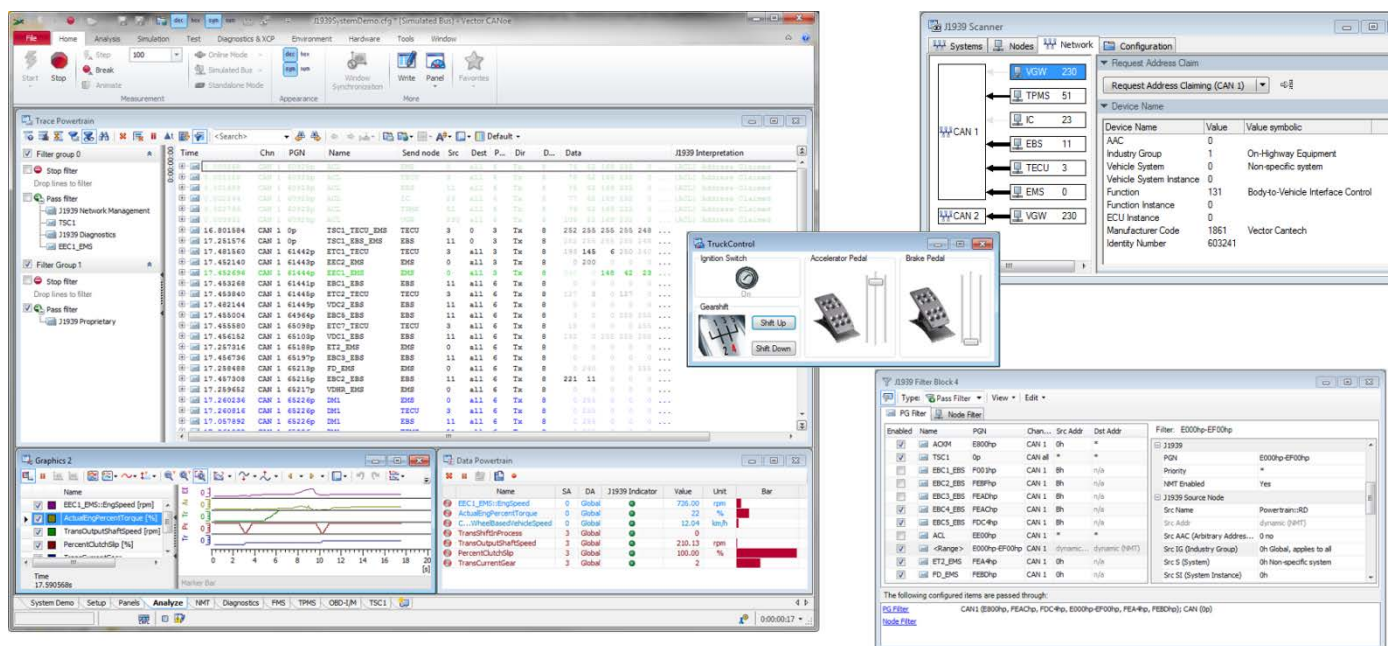


Figure 1: CANoe's analysis and simulation properties are extended by J1939-specific functions, e.g. display of the J1939 protocol in the Trace window and a network overview in the Scanner.

1.3 Further Information

> [Vector Download-Center](#)

Various documents related to CANoe 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 CANoe functions are described. In addition, you benefit from our valuable know-how in the form of technical articles and application notes.

> **CANoe Feature Matrix**

More information on variants, channels and bus system support is presented in the feature matrix.

2 Functions

CANoe.J1939 expands the standard functionality of CANoe with:

- > Support of the transport protocols BAM, CMTD and Fast Packet
- > Graphic display of the network nodes (scanner)
- > Protocol-specific display, checks, interpretation, filters and search functions in the Trace window
- > J1939 Filter in the measurement setup
- > Rapid simulation of ECUs
- > Expanded database
- > Diagnostic Trouble Code Monitor (DTC Monitor)
- > OBD Inspection and Maintenance Monitor
- > Diagnostic Memory window
- > J1939-82 Compliance Test (2008 und 2015 revisions)
- > GNSS Simulator and GNSS Monitor
- > Support of J1939 AUTOSAR 4.2.2 System Descriptions

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, CMTD or Fast Packet), CANoe can reassemble the individually transmitted CAN messages.

5 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.

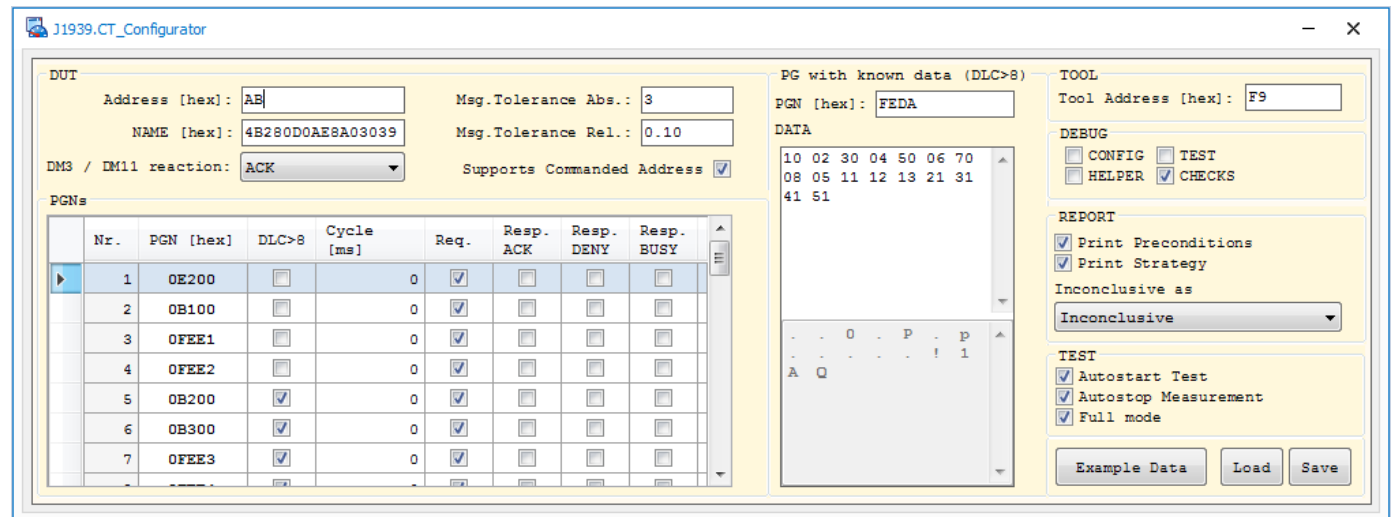
6 J1939-82 Compliance Test (2008) with J1939 XML Test Modul Manager

The J1939 XML Test Module Manager supports the user in preparing complex tests based on the CANoe XML Test Feature Set. These tests can be implemented very quickly with CANoe and without programming effort. Many test cases are available specifically for J1939 applications, and the manager can be used to select and configure them. Especially the tests described in the SAE J1939-82 (Compliance) document from 2008 are considered.. Detailed fault notifications simplify the analysis of failed test cases.

Applications range from simple test cases to complex integration and compatibility tests for system integrators. The layout of compliance test results is based on the test report from SAE J1939-82. This increases the recognition value which simplifies the exchange of test results between supplier and OEM.

7 J1939-82 Compliance Test (2015) with vTESTstudio

To cover the test scenarios defined in the new J1939-82 Compliance document (release 2015), a Test Unit is provided, which is created using vTESTstudio and a specialized window. All data relevant for test execution are conveniently managed directly in the window J1939.CT_Configurator provided for this purpose. Detailed and exact test protocols provide a clear overview of the test procedure and results, which considerably simplifies subsequent error analysis.



Name	Verdict	
J1939 Compliance Tests Runtime [1]	✓	
J1939 Compliance Test Tables [1]	✓	
Table A3	?	
Table A4 [1]	✓	
1. CTC_A04_01_MsgTolerance ()	✓	
CTC_A04_02_CAN2B ()	?	
CTC_A04_03_PGNReceivePrio...	?	
CTC_A04_04_EDPinPGN ()	?	
CTC_A04_05_DPinPGN ()	?	
CTC_A04_06_FilterOnDstAddr ()	?	
CTC_A04_07_GlobDestAddr ()	?	

1. CTC_A04_01_MsgTolerance ()	Pass
[TC 0x000401] Standard Frame Message Tolerance Verify DUT operation is not adversely affected by CAN Standard Frames on the network	
TEST-PRECONDITIONS - DUT has produce cyclic messages - DUT has to provides requestable messages	
TEST-STRATEGY 1) Generate continuously high frequent low prio standard CAN Frames (11bit) during the test 2) Request all requestable messages from the DUT. They have to be answered correctly 3) Wait 4 times the max. cycle time of all cyclic messages 4) The cyclic messages have to be sent within abs. and rel. message tolerance to identify they are not disturbed	
REFERENCES: J1939-21 - 5.1.3	

Figure 2: Simple configuration of a J1939-82 compliance test, clear representation of test results.

8 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.

CANoe.J1939 allows the user to monitor communication on the symbolic level in a Trace window, where 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). A wide range of display options is 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.

9 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.

10 Simulation

CANoe.J1939 makes simulation and analysis of network data of control unit networks possible by using the J1939 communication protocol. The system environment is modeled by means of system variables and graphic interactive control panels. The different network nodes are simulated by the J1939 Interaction Layer based on the communication relationships in the data-base. In addition, various J1939 libraries are available for the CAPL programming language, which extend CAPL with additional functions.

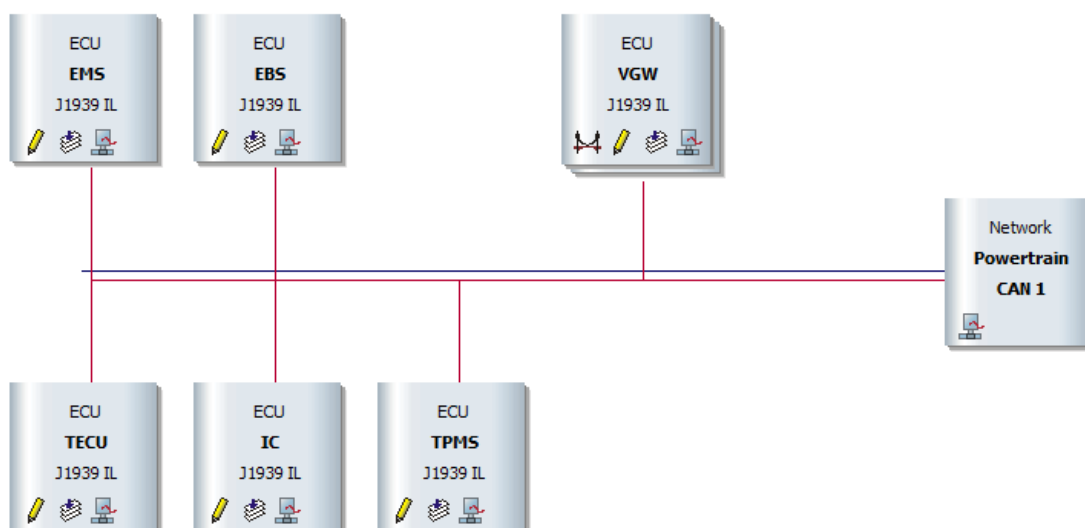


Figure 3: Simulation of a J1939 network

11 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. The CANdb++ Editor was specially extended for use in the J1939 environment with new dialogs and additional views to significantly simplify the process of creating and verifying files for the user. Parameter groups and signals defined thus can be selected symbolically in the entire program.

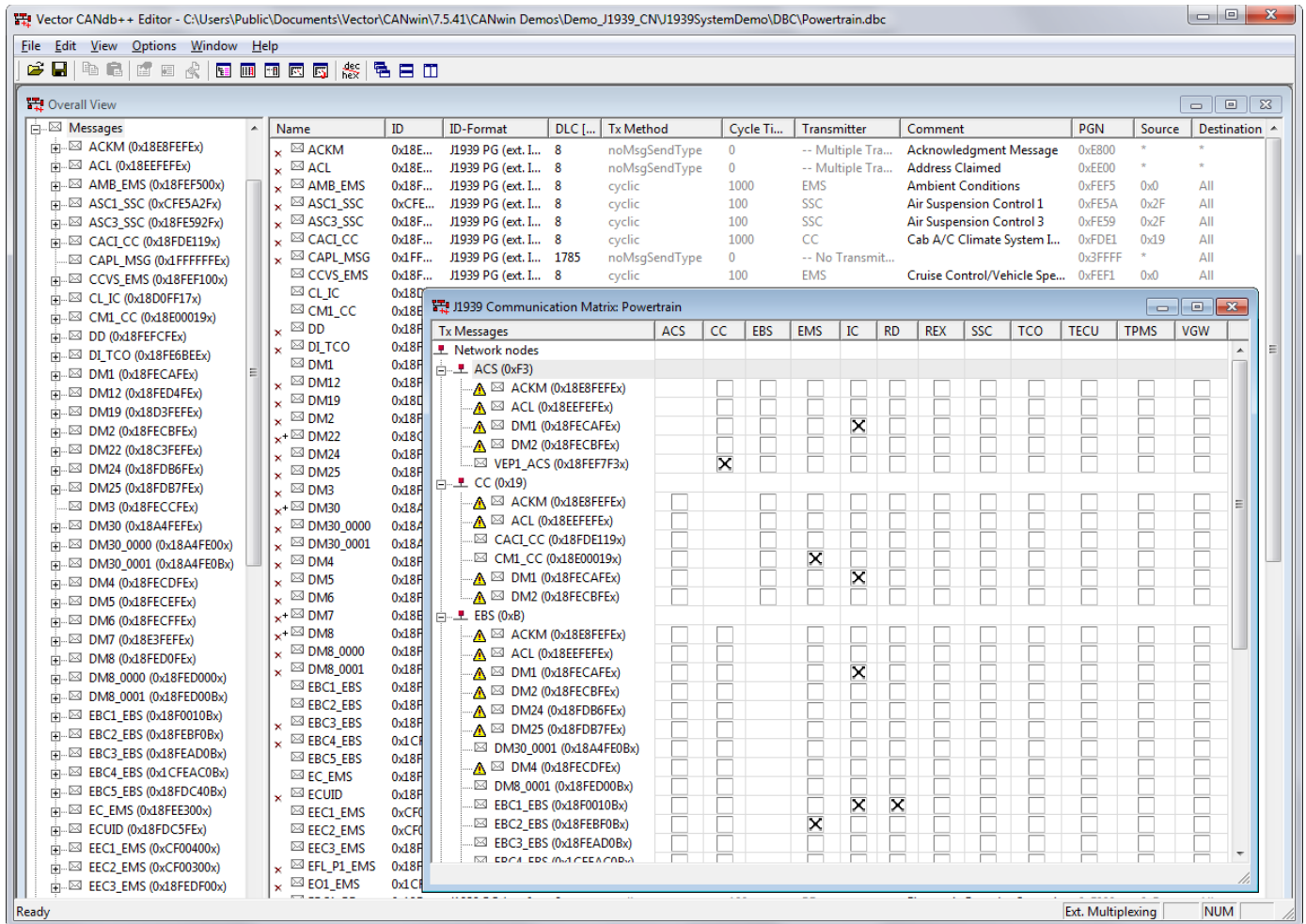


Figure 4: CANdb++ Editor with J1939-specific representation of communication relationships (K-Matrix).

Name:

Type:

ID: ... DLC:

Add. Info:

PGN:	0xFEDF
Priority:	0x6
Source:	0x0
Destination:	All
Format:	PDU 2
EDP and DP:	00 (SAE 1939 page 0 PGNs)

Transmitter:

Tx Method:

Cycle Time:

Figure 5: J1939-specific representation of the PG „Electronic Engine Controller 3“

12 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.

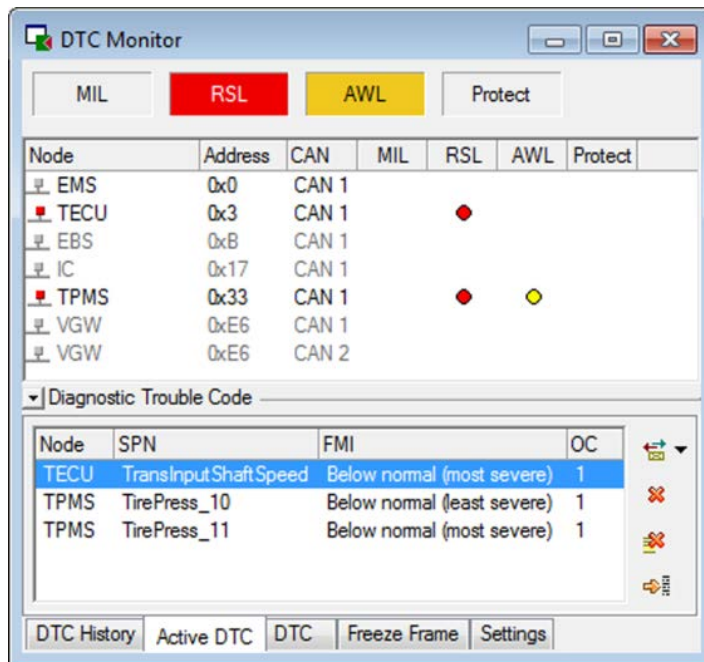


Figure 6: CANdb++ Editor with J1939-specific representation of communication relationships (K-Matrix).

13 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 performed 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.

14 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.

15 Extensions for marine applications

- > The GNSS Simulator and the GNSS Monitor make it easy to simulate or graphically display and log position data. A third parameter such as elevation or speed may be shown in color. After the measurement stop, the GNSS Monitor can be synchronized with the Trace and Graphic windows.
- > With the GNSS Nodelayer-DLL you can also handle complex simulations that take feedback to the system into account, e.g. changes in speed or driving direction.
- > The "Fast Packet" transport protocol is supported along with the J1939 transport protocols CMDT and BAM. For simulation, this is also supported by the J1939 Interaction Layer.

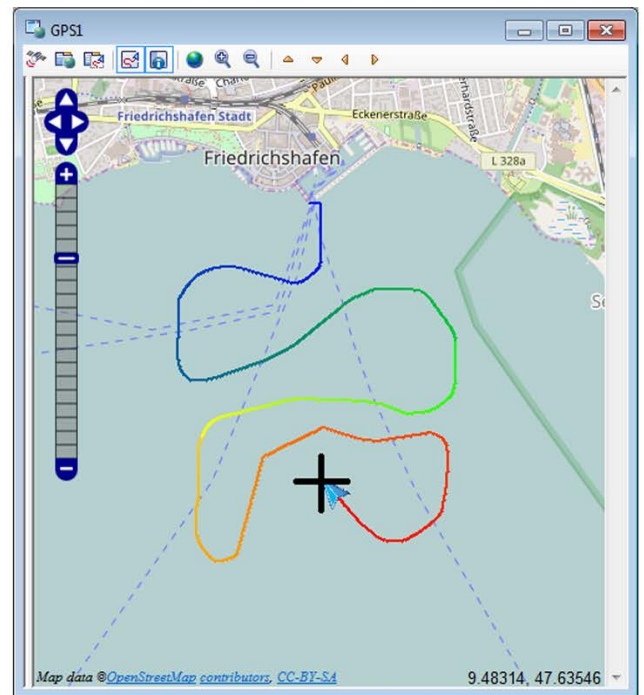
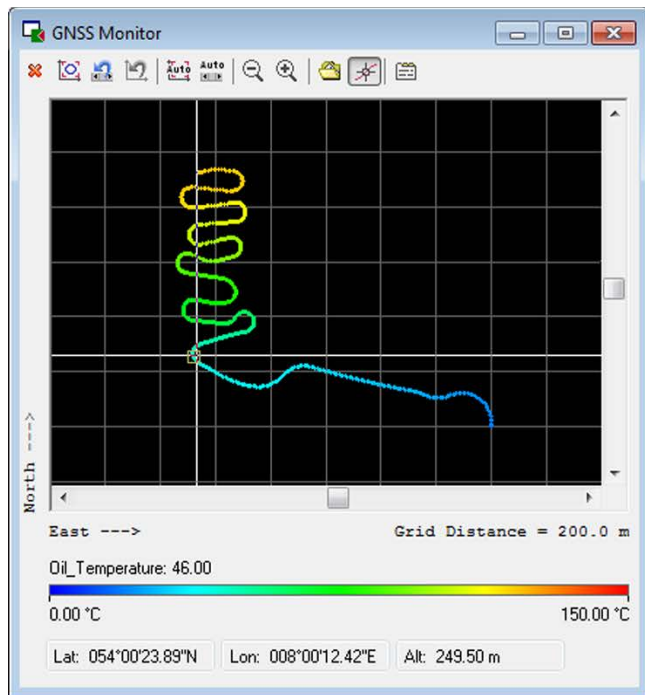


Figure 7: The position data displayed by the GNSS Monitor can be synchronized after stop of measurement e.g. with Graphic window and Trace window.

16 Comparison Options .J1939 and .ISO11783 for CANalyzer and CANoe

	CANalyzer .J1939	CANoe .J1939	CANoe .ISO11783	
Trace Window: J1939 specific columns	■	■	■	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
Trace Window: ISO11783	—	—	■	Interpretation e.g. for Virtual Terminal / Process Data / File Server / Peer Control / TIM
Trace Window: Context search	■	■	■	Previous/next PG from same SA / request-response / transport protocol
Trace Window: Analysis filter extensions	■	■	■	J1939-specific extensions for PGN, SA, DA and Prio; dynamic SA/DA filter based on J1939 Network Management
Trace Window: Analysis filter for J1939 subject areas	■	■	■	Network Management / Diagnostics / Proprietary PGs
Trace Window: Analysis filter for ISO11783 subject areas	—	—	■	Virtual Terminal / Process Data / File Server / Sequence Control / TIM
J1939 Filter in Measurement setup	■	■	■	Filter related to PG – dependent or independent from SA, DA and Prio;
Interactive Generator: J1939 specific parameters	■	■	■	Comfortable configuration of PGN, SA, DA, Prio, etc.; support of transport protocols
CAPL: Extensions for PGs	■	■	■	Language extensions for processing of parameter groups
J1939 Scanner	■	■	■	Monitors and displays communication aspects of Controller Applications; provides functions for reconfiguration of addresses and J1939 device names
DTC Monitor	■	■	■	GUI to the J1939 diagnostic protocol
OBD I/M Monitor	■	■	■	On Board Diagnostic Inspection and Maintenance Monitor
Diagnostic Memory Access	■	■	■	Read and write SPNs and memory areas
GNSS Monitor / GPS Window	■	■	■	Recording of position data and graphical display of covered path
GNSS Simulator	■	■	■	Simulation of position data (GNSS/GPS)
Virtual Terminal	—	—	■	Enables tests with different types of Virtual Terminals (resolution, monochrome, colour)
Interactive Task Controller Window	—	—	■	Process data dialog allows to access individual data of any implement
Transport Protocol: BAM	■	■	■	Broadcast Announce Message

	CANalyzer .J1939	CANoe .J1939	CANoe .ISO11783	
Transport Protocol: CDMT	■	■	■	Connection Mode Data Transfer (unicast)
Transport Protocol: Fast Packet	■	■	■	Fast transport protocol (e.g. for transfer of position data)
Transport Protocol: ETP	—	—	■	Extended Transport Protocol (for transfer of large amount of data)
Example Database: J1939	■	■	■	Database preconfigured with standardized J1939 PGNs
Example Database: ISO11783	—	—	■	Database preconfigured with standardized ISO 11783 PGNs
Database: J1939 Communication Matrix	■	■	■	Visualisation and easy configuration of interrelationships between signals, PGNs and CAs
Database: J1939 ARXML (AUTOSAR 4.2.2)	■	■	■	System Description according to the AUTOSAR 4.2.2 standard version
Demos: J1939	■	■	■	Examples for diagnostics, exhaust sys., tire pressure monitoring sys., etc.
Demos: ISO11783	—	—	■	Examples with Virtual Terminal, Interactive Task Controller, Address Claiming, etc.
Simulation	—	■	■	Simulation of independent nodes for test; simulation of remaining bus
J1939 Interaction Layer	—	■	■	Model-based signal-oriented simulation with minimal or no programming
CAPL: J1939 Nodelayer DLL	—	■	■	J1939 specific function library for processing of network management, PGs and transport protocols
CAPL: GNSS Nodelayer DLL	—	■	■	Library with specific functions for complex simulations of a GNSS receiver
ISO11783 Interaction Layer	—	—	■	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.
ISO11783 Virtual Terminal Interaction Layer	—	—	■	Easy simulation a Virtual Terminal. Comprehensive and comfortable CAPL interface. Seamless integration in a test environment.
ISO11783 Task Controller Interaction Layer	—	—	■	Easy simulation a Virtual Terminal. Comprehensive and comfortable CAPL interface. Seamless integration in a test environment.
CAPL: ISO11783 Nodelayer DLL	—	—	■	ISO 11783 specific function library for processing of network management, PGs, transport protocols, IOP and PDD
Test Feature Set	—	■	■	Automation and documentation of test procedures
J1939 XML Test Module Manager	—	■	■	Supports the creation of tests based on the Test Feature Set; automatic generation of a compliance test defined in J1939-82 (2008) in tables 3 to 10
J1939-82 Compliance Test Unit	—	■	■	Automatically performs compliance tests defined in J1939-82 (2015) in tables 3 to 7

17 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.

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