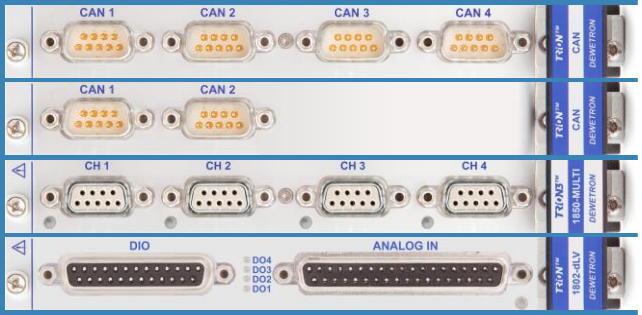
DEWETRON

OXYGEN Training

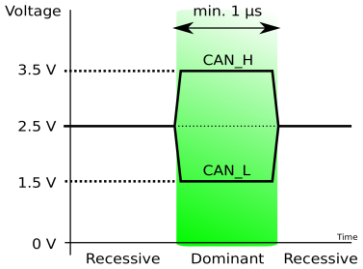
CAN
CAN-FD
FlexRay

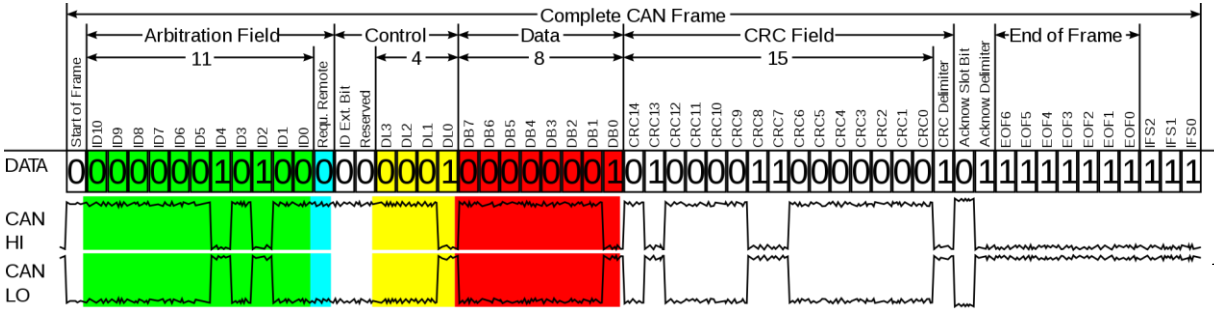
CAN

CAN port available on
- > TRION-CAN (2/4 port)
- > TRION-2402-MULTI (1 port)
- > TRION-1802/1600-dLV (1 port)
- > TRION-1820-MULTI (1 port)
- > TRION(3)-18x0-MULTI (1 port)



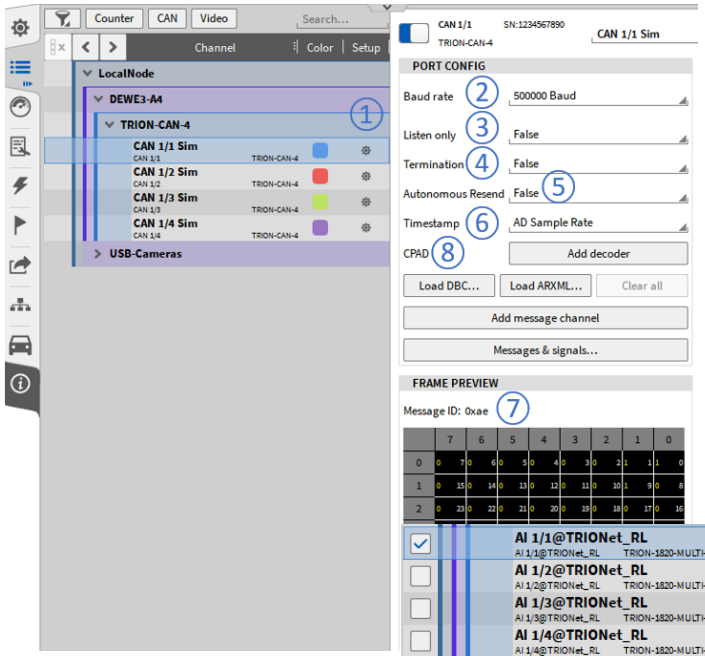
- > CAN (Control Area Network) is a serial bus system and was initiated 1983 by BOSCH and is mainly used in the automotive industries
- > Differential data transmission, CAN-High, CAN-Low ref. to CAN-GND
- > High Speed CAN (1 Mbaud) for short distances and much data vs. Low Speed CAN (125 kBaud) for long distances and reduced data
- > Data: 0-8 times 8-bit

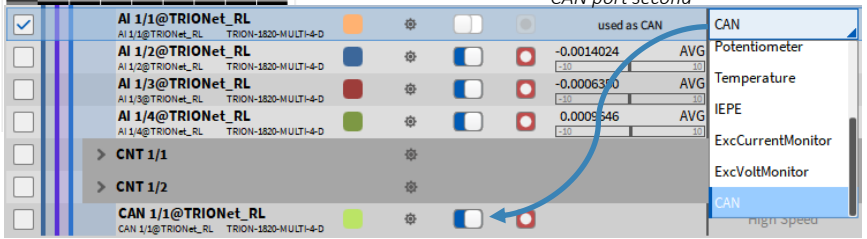


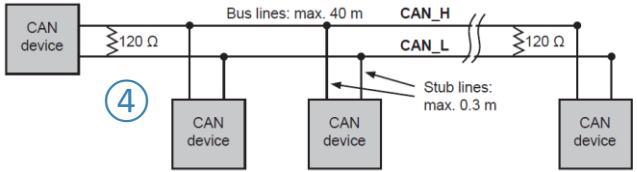


CAN – CAN Port Configuration

①	Go to the CAN port configuration
②	Select the proper Baud rate of the CAN bus
③	Not applicable for CAN receive
④	Optionally apply a 120 Ohm resistor to the CAN bus
⑤	Not applicable for CAN receive
⑥	Sets the time base on which the CAN signals are aligned
⑦	If all settings are applied correctly, the frame preview will show the received messages
⑧	If CPAD are used, the a decoder can be added to decode the signals without a dbc-file







When using the CAN port of a TRION(3)-18x0-MULTI or a TRION-2402—MULTI board, the CAN port is available on AI 1 of these boards. For accessing and using these CAN ports, you have to set the Input mode of AI 1 to CAN first and activate the dedicated CAN port second

CAN – CAN Data Decoding dbc- and arxml-files

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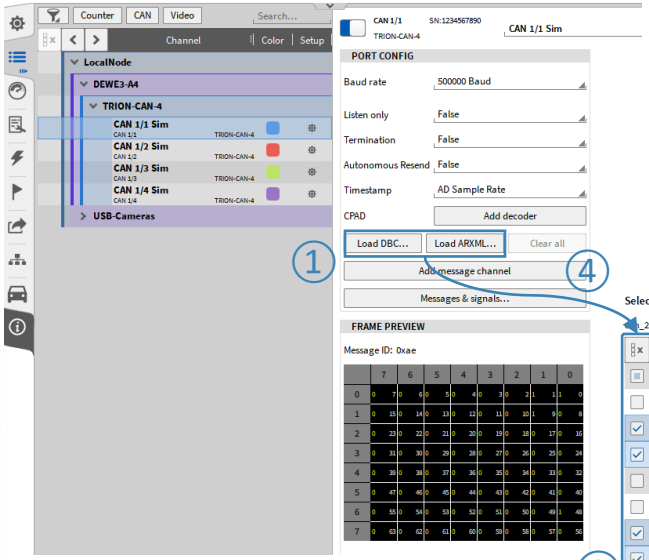
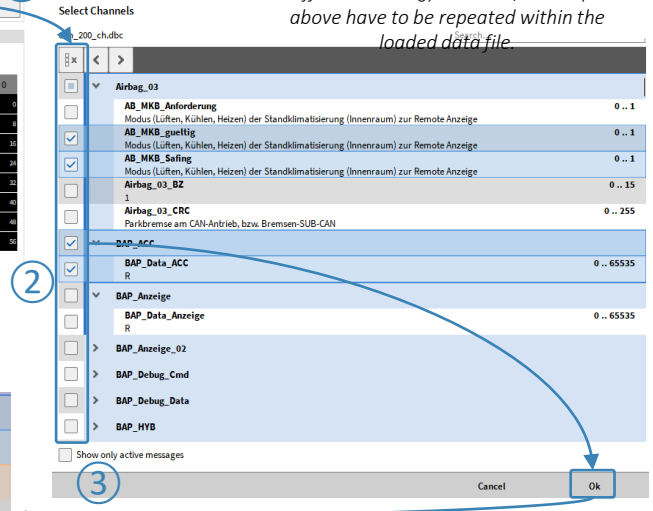
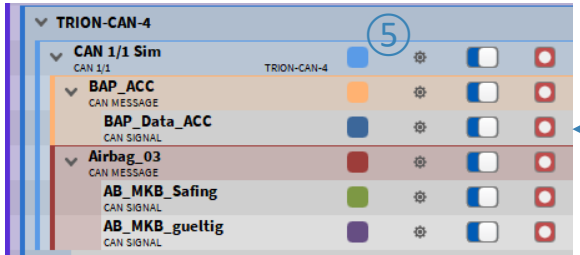
①	Press *Load DBC…* for dbc-decoding or *Load ARXML…* for arxml decoding
②	A channel picker dialog will open to select the messages and signals to be decoded. Press *Ok* when finished
③	The option *Show only active messages* performs a scan on the CAN bus to check which CAN messages are available on the CAN bus and filters the channel picker accordingly
④	If one or several messages available on the CAN bus should not be defined in the selected dbc- or arxml-file you can manually add them by pressing *Add message channel* and defining the correct settings in the CAN message setup
⑤	After pressing Ok you will find the selected messages and signals in the channel list



ARXML file decoding is supported in OXYGEN R5.6 or higher
ARXML file version 4.1 or high is required

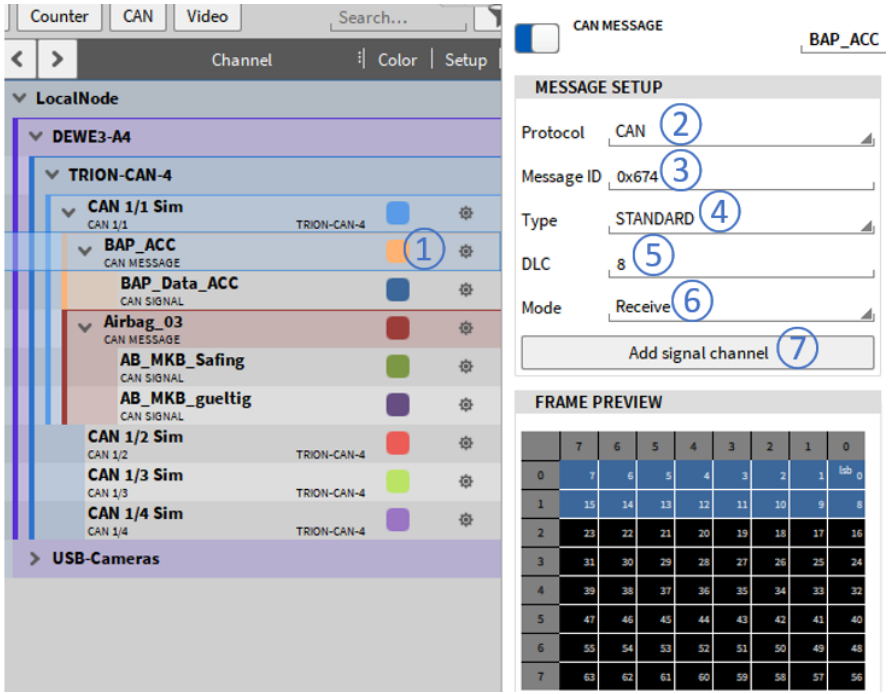
It is also possible to add and decode other CAN channels from a dbc- or arxml file during the data analysis (CAN offline decoding). To do so, the steps above have to be repeated within the loaded data file.





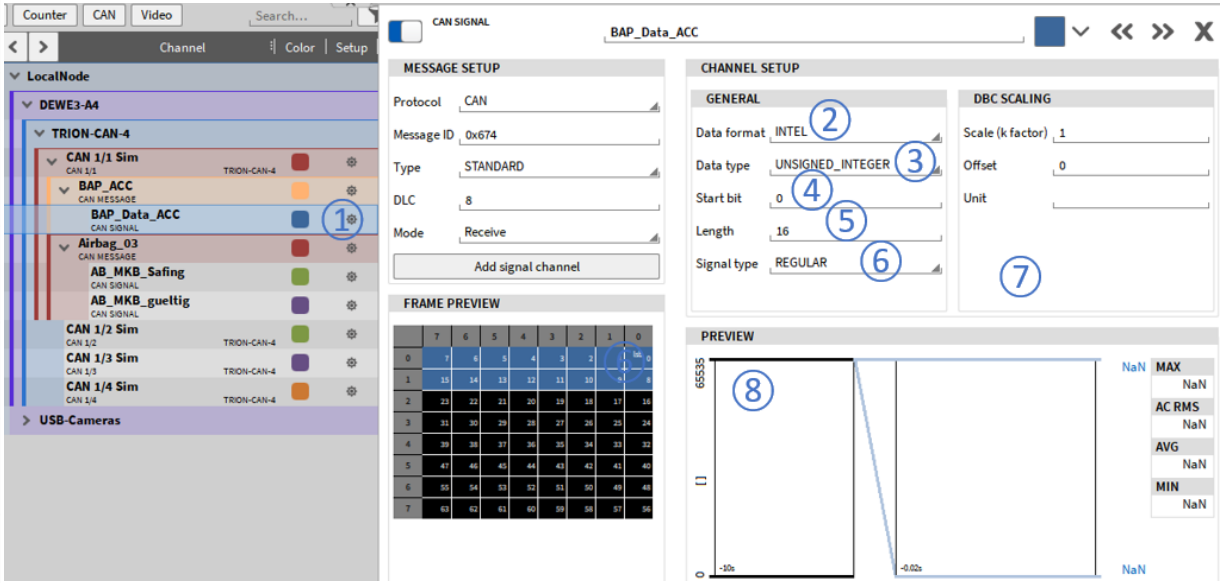
CAN – CAN Message Setup

①	The CAN message setup can be accessed if certain settings of the CAN message shall be changed
②	Protocol type *CAN*, *J1939* or *CAN-FD*
③	Message ID from 0x0 to 0x7ff
④	Message type *Standard* or *Extended*
⑤	The DLC can be set from 0 … 8 (…64 for CAN-FD)
⑥	The message can be swapped between receiving or transmitting CAN data
⑦	If the CAN message includes one additional signal which is not loaded from the dbc-or arxml-file or available within the dbc-file, a new signal can be added



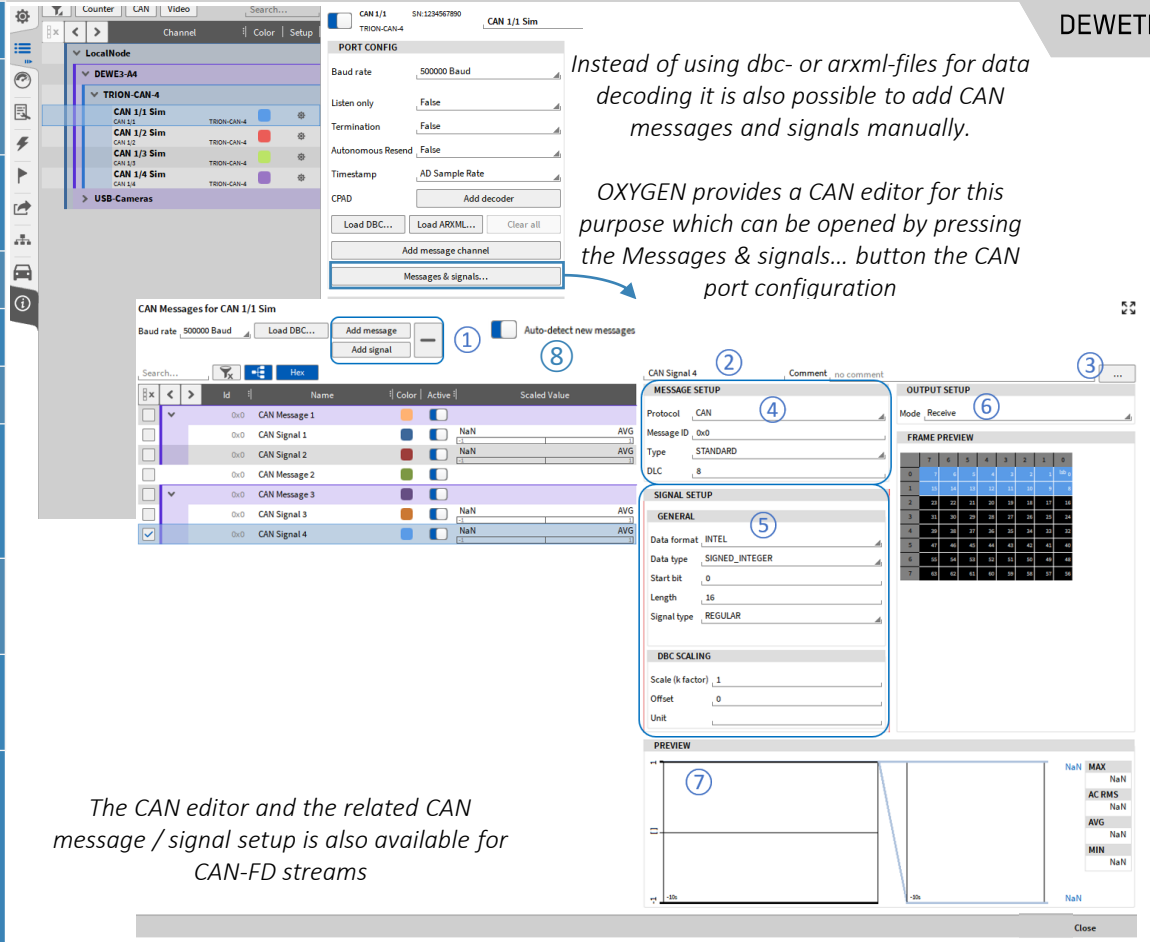
CAN – CAN Signal Setup

①	The CAN signal setup can be accessed by pressing the gear button of the respective CAN signal in the Channel List
②	Data format: *Intel* or *Motorola*
③	Data type: *Double*, *Float*, *Signed Integer* or *Unsigned Integer*
④	Start bit: Define the start bit of the signal within its message
⑤	Length: Define the length of the signal within its message
⑥	Signal Type: *Regular*, *Multiplexed* or *Multiplexor*
⑦	DBC Scaling: Change the scaling of the signal
⑧	The preview shows the past 10 seconds of the signal to check if proper settings have been applied to the signal



CAN – CAN Editor

	The CAN Editor can be used to
①	Manually add or delete CAN messages and signals
②	Rename the currently selected CAN message and signal
③	Add comments to messages and signals
④	Edit CAN messages
⑤	Edit CAN signals
⑥	Set the CAN Message mode to Receive for acquiring data or transmit for outputting OXYGEN data over CAN
⑦	Providing a preview of the past 10 seconds
⑧	Option to automatically detect new CAN messages occuring on the bus



Instead of using dbc- or arxml-files for data decoding it is also possible to add CAN messages and signals manually.

OXYGEN provides a CAN editor for this purpose which can be opened by pressing the Messages & signals... button the CAN port configuration

The CAN editor and the related CAN message / signal setup is also available for CAN-FD streams

CAN – SAE J1939

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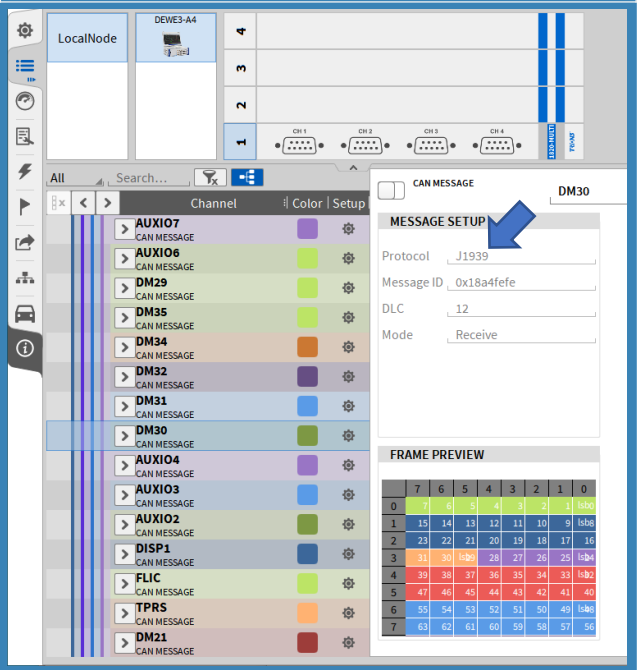
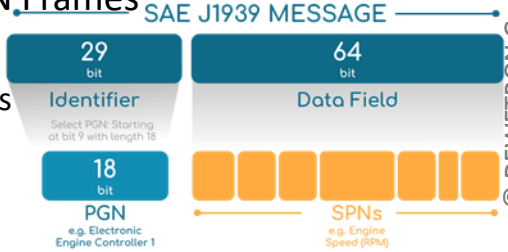
- Create DBC-File, adapt Message IDs to specify source address if necessary
- Load DBC-File in Oxygen
- Check Messages for right PGN and Source Address

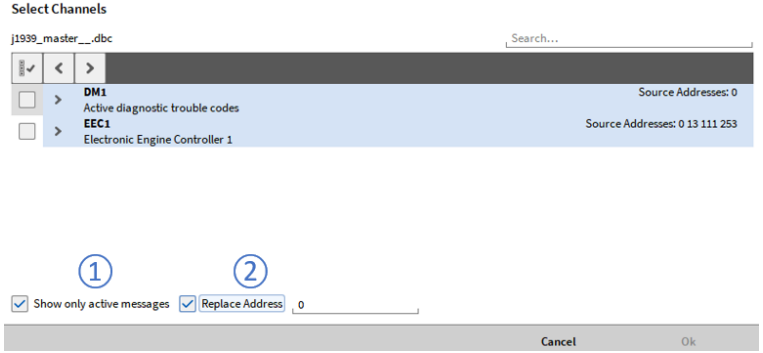


- J1939 is a protocol overlay of CAN-Bus used in heavy duty vehicles
- Message IDs have standarized pattern
- Oxygen CAN is able to decode J1939 CAN Frames
  - Loading of DBC-files with J1939 Messages
  - Showing PGN Number and Source Address
  - Decoding of Multi-frame messages
  - No special setting necessary



Replace Source Address:
If a dbc- or arxml file is loaded that contains J1939 messages, the source Address will be displayed when Show only active messages is activated.

By Selecting Replace Address it is possible to replace the current source address of the dedicated message by a user defined one.



CAN OUT – GENERAL

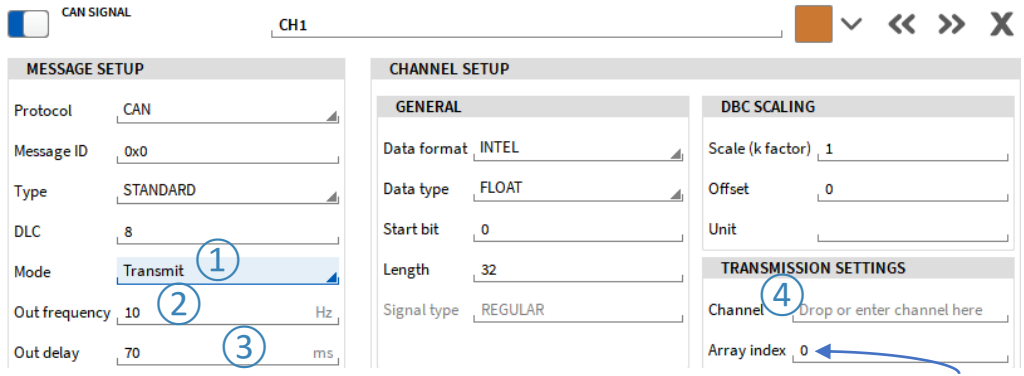
DEWETRON

- Cyclic output of measurement data via TRION-CAN
- Compatible with all TRION-Based CAN interfaces and Vector VN-series CAN interfaces
- Selectable transmission rate (0.1 Hz to 100 Hz) for each CAN-Message
- Selectable delay for tuning the signal quality
- Receive/Transmit setting for each message
- Messages and signals must be predefined within a .dbc or can be defined by using the CAN Editor
- **Usecase:** Testbed Integration, Automotive Testbed environment for electrical Powertrain testing

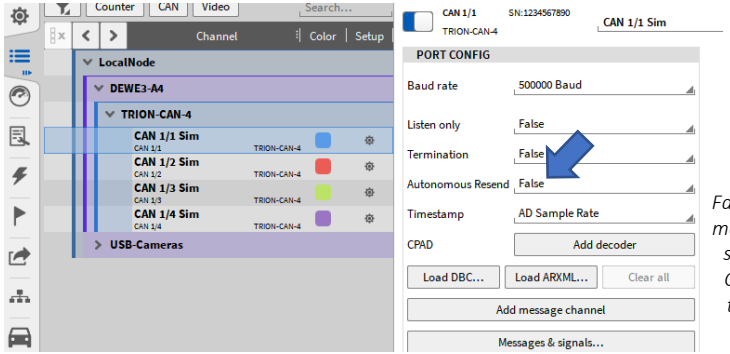
CAN OUT – SOFTWARE SETUP

①	To transmit OXYGEN data over CAN, the CAN message Mode must be set to Transmit
②	Output rate can be defined from *0.1 … 100 Hz*
③	Output delay can be set from *1 … 500 ms*
④	Drop the channel or type its name into the *Transmission Settings - Channel*

Please note that the preview will not show the currently transmitted data but has no functionality when the message mode is Transmit



If one element of an array channel shall be output, the element's index can be directly defined here



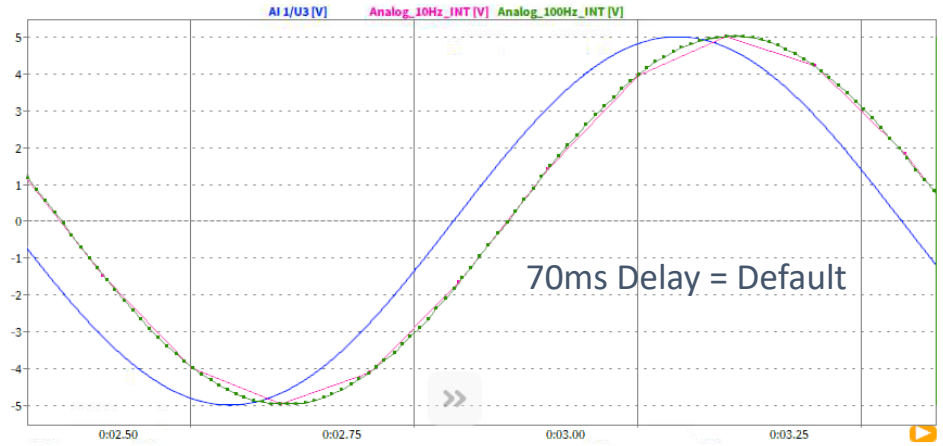
The Autonomous Resend option provides the following functionality for CAN buses which transmit data:

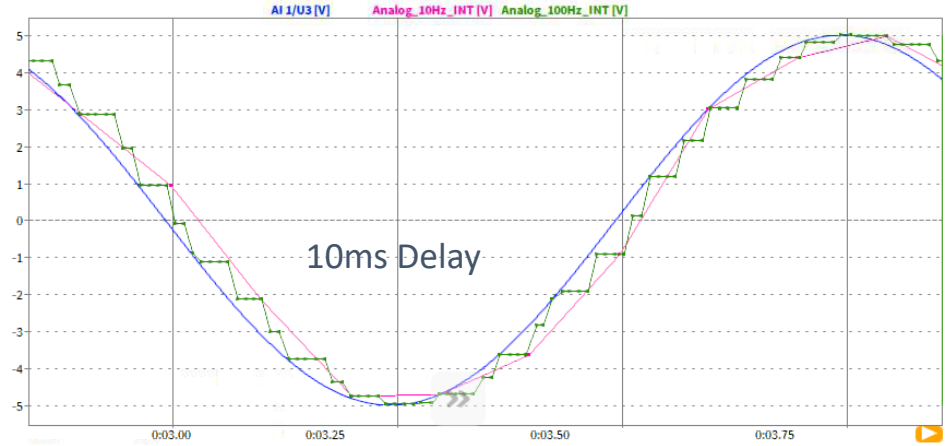
False (Default): The transceiver only sends the data once no matter if the receiver send an acknowledgement or not and sends the next message right afterwards. This makes the CAN data transmission more deterministic on a correctly terminated CAN bus. But there is a remaining risk that a messages gets lost.

True: The risk of losing messages during transmission is low as message is resend in case no acknowledgement is sent by the receiver. But the risk of colliding messages of several transceivers is higher.

CAN OUT – INFLUENCE OF DELAY

- Due to signal path delays in some parts in the software, realtime processing is not possible
- With the selectable output delay, the user can choose between smoothness or fast reaction





CAN-FD - GENERAL

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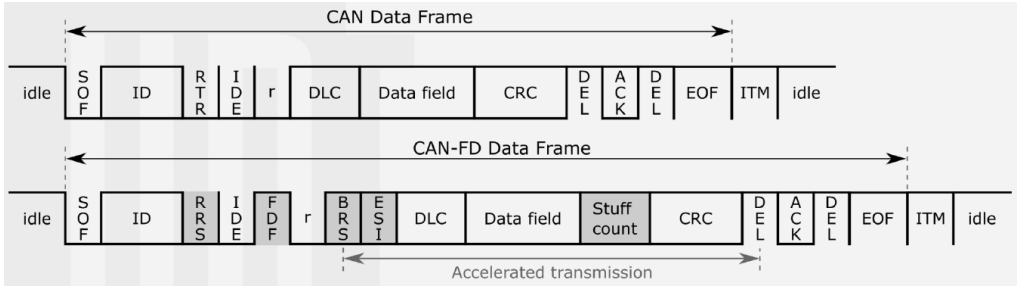
CAN-FD support with

- Vector VN 1610
- Vector VN 1630
- Vector VN 1640
- NEXDAQ

- Connection via USB
- Theoretically, the whole VN family with CAN-FD support should work
- Multiple Adapter support
- Synchronized to Analog Data with Delay lower than 50 µs
- Can be used as CAN device as well

- CAN has reached practical limits in current applications
- CAN buses exceed recommended busloads (>50 %)
  - High overhead for sending CAN messages (≥50 % overhead) → Only around 40-50 % of the bandwidth is used for actual data
  - CAN bus speeds are limited to 1-Mbit/s
- CAN-FD is based on the CAN 2.0 specification
  - Physical layer not changed
  - Support for variable bitrates (*FD → Flexible Data*) for the two main message segments:
    - Arbitration phase –same as standard CAN
    - Data phase –bitrates >1-Mbit/s possible (up to ~8-Mbit/s)
    - Support for larger data payloads – up to 64 bytes/message



CAN-FD – SOFTWARE SETUP via Vector Hardware

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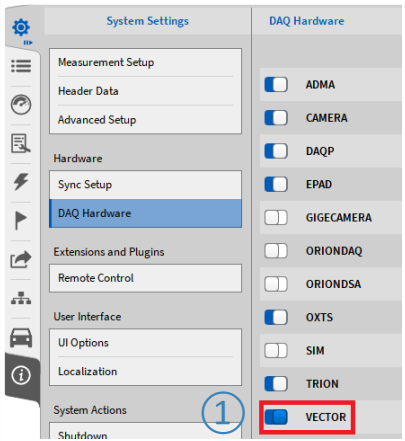
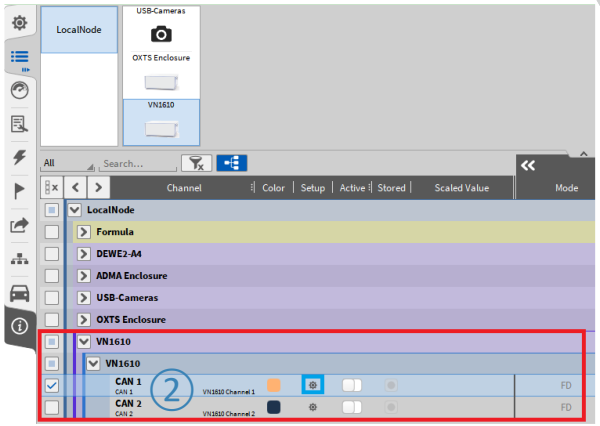
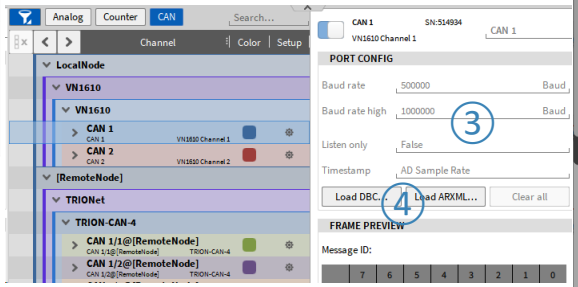
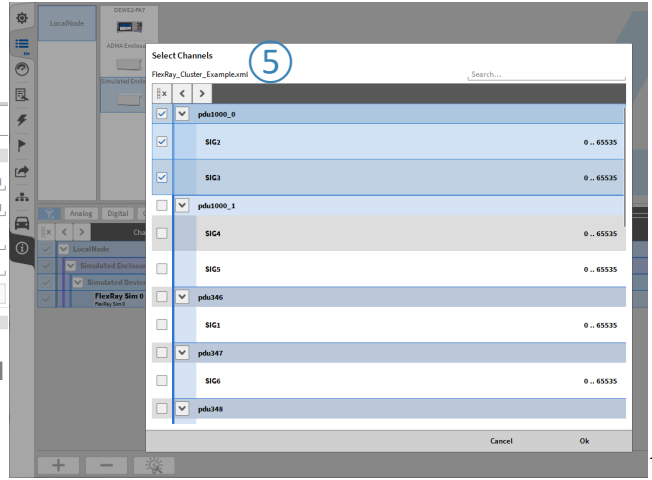
	Latest *Vector driver setup* needs to be installed
①	Enable *Vector* hardware in DAQ hardware setup
②	When hardware is connected, it will be recognized automatically and listed in the Channel List
③	Only difference to conventional CAN setup is *Baud rate high* which describes data transmission speed of the data segment
④	Load the proper dbc- or arxml-file
⑤	A channel selection dialog will open Select either all channels or only certain channels to be decoded and recorded



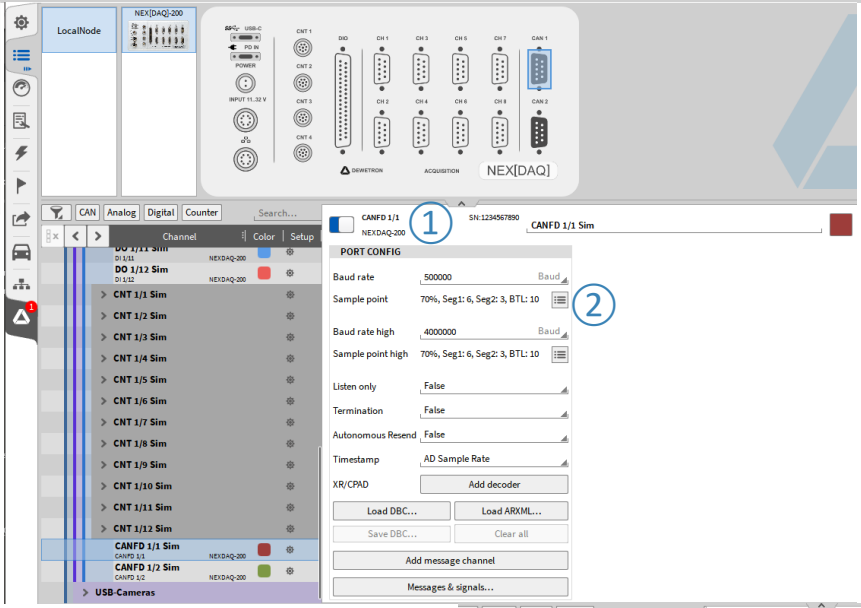


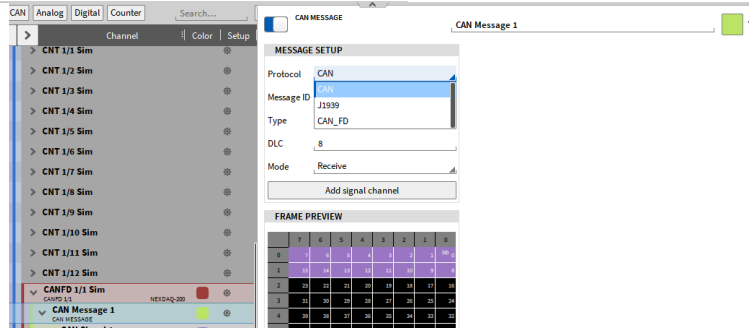




CAN-FD – SOFTWARE SETUP via NEXDAQ

	The NEXDAQ supports CAN-FD natively.
①	Enable one or two CAN-Channels
②	Setup the Baud rate high and Baud rate low.





FLEXRAY - GENERAL

DEWETRON

Flexray support with

> Vector VN 7610

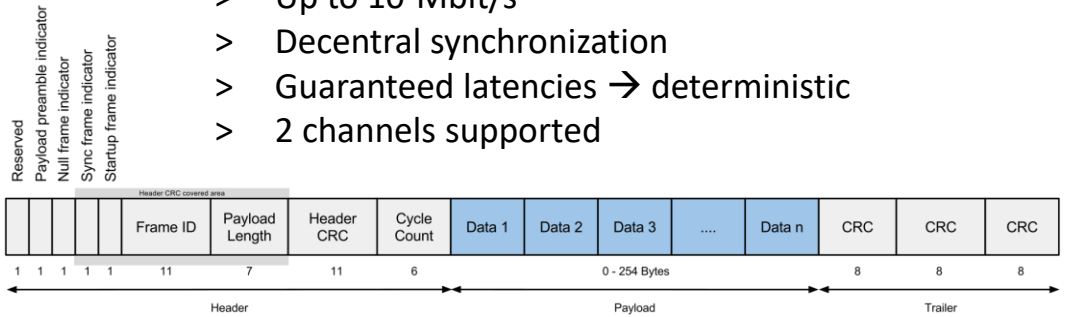
> Connection via USB

> Compatible with Fibex 2.0 to 4.1.2 Standard for description file (ASAM MCD-2 NET)

> Multiple Adapter support
> Synchronized to Analog Data with Delay lower than 50 µs

> Development initiated by BMW, Daimler, Motorola and Philips in 2000
> First car with Flexray was BMW X5 in 2006
> Flexray was developed to compensate CAN disadvantages, like
  > Higher data rates
  > Realtime capability
  > Reliability

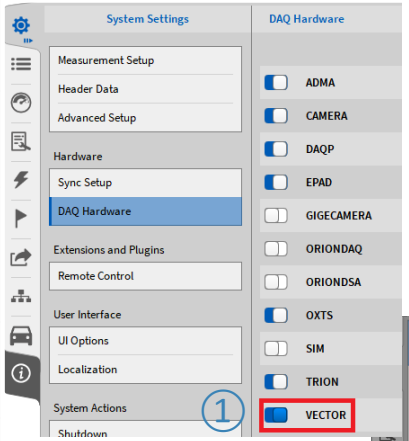
> Characteristics
  > Up to 10-Mbit/s
  > Decentral synchronization
  > Guaranteed latencies → deterministic
  > 2 channels supported

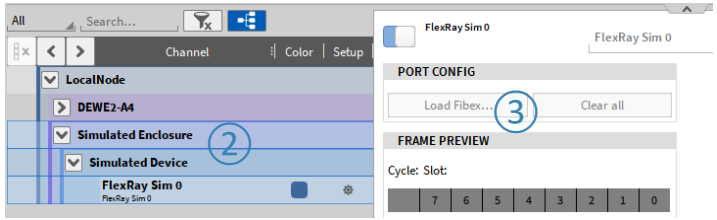


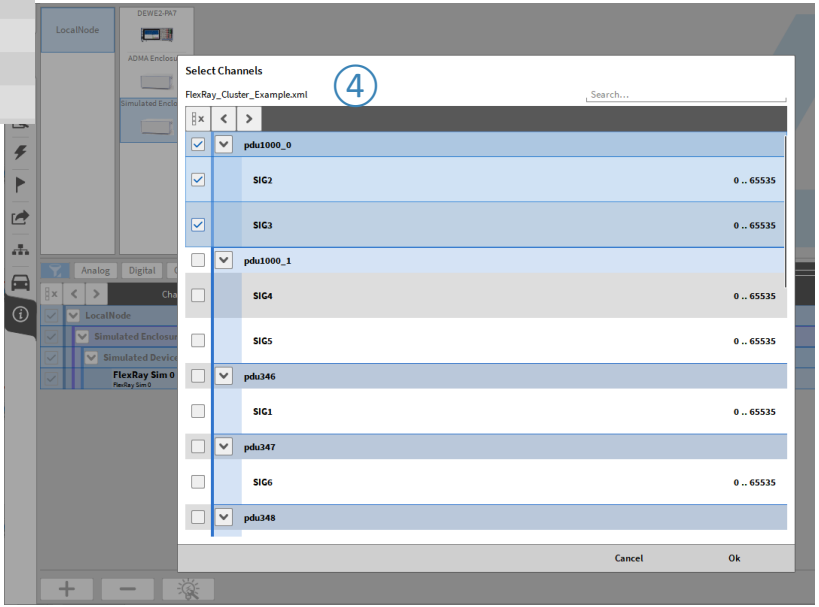
FLEXRAY – SOFTWARE SETUP

DEWETRON

	Latest *Vector driver setup* needs to be installed
①	Enable *Vector* hardware in DAQ hardware setup
②	When hardware is connected, it will be recognized automatically and listed in the Channel List
③	Click „Load Fibex“ and select the Fibex file
④	Select the signals from the Fibex file to be created in OXYGEN OFFLINE DECODING SUPPORTED TOO
	Limitations: > No support of ARXML (AUTOSAR XML) description files > No support of multiplexed frames > No bus settings possible – auto detection enabled > No support of STRING channels > No support of different scaling types of one signal depending on range







ENUM SCALING

- Convert numerical data into text
- Supported for CAN, IMU (ADMA & OxTS), Ethernet Receiver and GPS channels
- Can be configured via dedicated *Enum label editor* in Channel Setup (①)
- Use i.e. Digital Meter or *Data Label* option in Recorder for visualization (②)