VECTOR

Getting Started with VN5640

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Abstract Document about the configuration steps of the VN5640 interface to make settings which are relevant for your use case. The focus is on the Ethernet-specific configuration.

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1 Overview

With the VN5640 interface, Vector provides you with a 16-channel Ethernet interface for complex measurement, simulation and test tasks. In addition to the Ethernet channels, the interface has two CAN channels and an I/O interface. Besides the hardware channels, the configuration of the interface includes further settings which are to be made depending on the use case. This document provides an overview of the necessary configuration steps. The focus is on the Ethernet-specific configuration.

2 Definitions of Terms

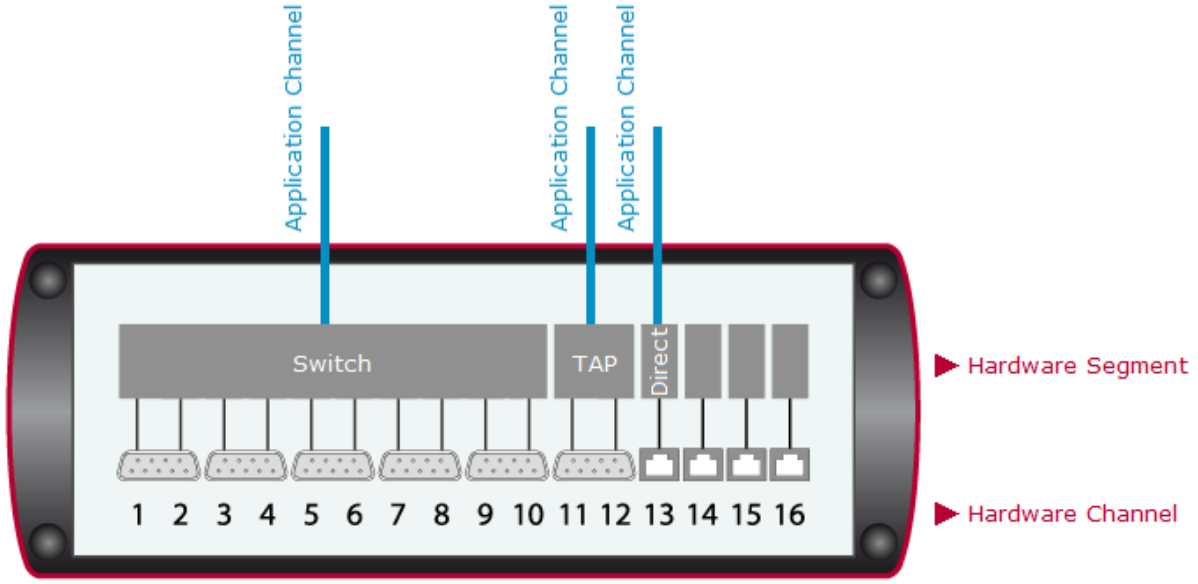

Figure 1 - Definitions of terms

2.1 Client Application

Applications, such as CANoe, CANalyzer or CANape which are connected to the VN5640 interface by assigning one or several application channels.

2.2 Hardware Channel

Physical connection on the VN5640 interface. The periphery is connected to it.

2.3 Hardware Segment

A hardware segment allows you to provide access to an Ethernet network. A hardware segment can combine several hardware channels and provides one application channel towards the client application. Hardware segments are currently available in the following types with different functionality:

- **Switch**
  Behavior of a layer-2[1] switch. Includes one or several hardware channels. The switch learns MAC addresses and the packets are transmitted based on these rules. The rules are still stored after each measurement stop and will only be ereased when the interface is switched off.
- **TAP (Test Access Point)**
  Includes two hardware channels and represents a measuring point (for further description, see section 2.4)
- **Direct connection**
  Includes exactly one hardware channel and is typically used for the direct access to the network, for instance with diagnostic applications.

1 See OSI model, ISO/IEC 7498-1

It is **currently not** possible to freely define the number of hardware segments. By selecting a corresponding operation mode, you define which segments in which types are available on the interface (see section 3.1.1).

Operation mode	Number of segments	Type/function	Function
Simulation	1	Switch	1 layer-2 switch
Measurement	8	TAP	8 TAPs
Direct connection	16	Direct connection	16 direct connections
Media converter	8	TAP	4 TAPs with media conversion, 4 TAPs without media conversion

2.4 TAP

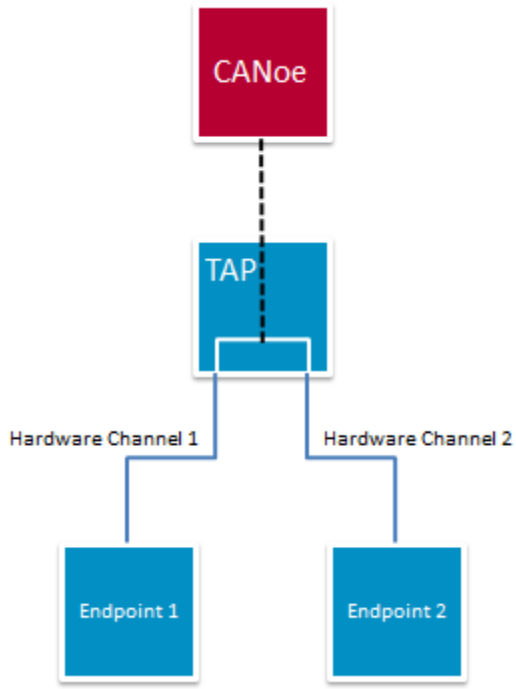

Figure 2 - TAPs

A TAP is a measuring point between two communication partners. In CAN-based communication systems, such measuring points can be implemented by means of a Y-cable. If a point-to-point Ethernet connection between two endpoints is established, a measuring point can only be implemented by integrating an "intelligent" unit like a VN5640 or VN5610.

The following options are available for each TAP:

- **PHY Bypass (Physical Layer Bypass)**
  Packets are transmitted between the two hardware channels almost without latency. Each "Nibble" is forwarded immediately after receiving. Thus, erroneous packets are also transmitted between the endpoints. Once the complete packet has been received, it is sent to the client application. It is not possible to send from the client application.
- **MAC Bypass (Media Access Control Layer Bypass)**
  Packets are transmitted between the two hardware channels with minimum latency. The packets are buffered in accordance with the **Store and Forward** principle and forwarded when they have been received completely. Erroneous packets are discarded. Once the complete packet has been received, it is sent to the client application. In addition, packets can be sent from the client application.

Note

To get more information on exact bypassing latency, please consult the VN5640 user manual.

> **Bypass Off (“man in the middle”)**
The packets are not automatically transmitted between the two hardware channels. You must ensure yourself that the extracted packets are fed in at the correct position again (e.g. in the program with the help of CAPL, .NET). This setting allows you, for example to filter out or manipulate packets precisely.

2.5 Application Channel

The Vector interface is connected to the client application via an application channel. In communication systems, such as CAN or FlexRay, an application channel is always directly assigned to a physical hardware channel. The assignemt is done within **Vector Hardware Config** dialog. Each application channel currently corresponds to exactly one network in a client application..

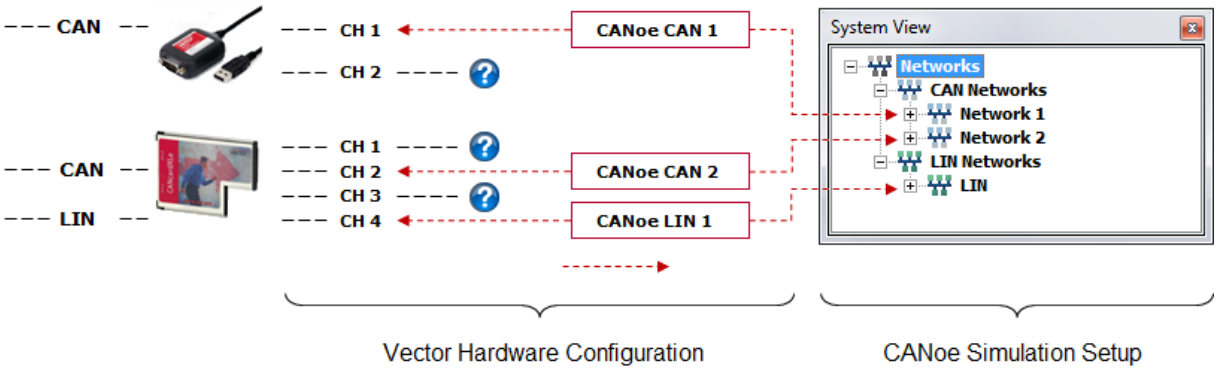

Figure 3 - Interface connection via application channels

With the introduction of the VN5640 interface, you have hardware segments to which you can assign application channels of the client applications. It is possible to assign one or several hardware channels to one hardware segment. You define this assignment by selecting an operation mode (see section 3.1.1). On the side of the tool, the application channels are still assigned to a network.

2.6 Standard Configuration

You can configure the settings for your VN5640 in the **Vector Hardware Config** dialog. These settings include the

> Definition of the number of segments
> Configuration of the hardware channels (PHY settings)
> Configuration of the TAPs

The settings are permanently stored in the Flash on the VN5640 as standard configuration. This configuration is the basis for the interface configuration that is done after each **Power ON** of the VN5640.

2.7 Standalone Mode

The VN5640 interface can be operated in standalone mode, i.e. without connection to a computer or without using a client application. The standard configuration is used whenever the VN5640 interface is in the standalone mode. Read section 4 to learn how to overwrite the standard configuration of CANoe/CANalyzer at the start of a measurement.

3 Configuration of the VN5640 Interface

3.1 Creation of the Standard Configuration

The VN5640 interface is configured in the **Vector Hardware Config** dialog. Open the dialog via the **Vector Hardware** entry in your system control (alternatively, you can open it by pressing the **[Driver…]** button of the **Network Hardware Configuration** dialog from CANoe/CANalyzer).

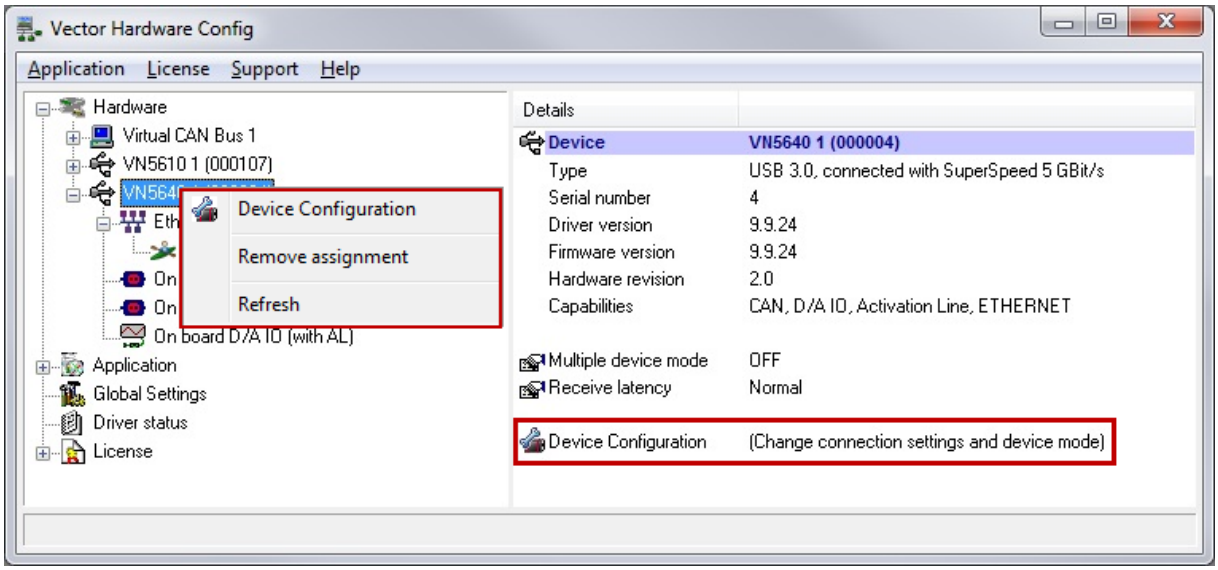

Figure 4 - **Vector Hardware Config** dialog

In the left tree view of the dialog, the connected Vector interfaces are listed. Under the **VN5640** entry, you will find the available hardware segments. An application channel is assigned to the hardware segment via the context menu of the hardware segment, using the right mouse button. Select the desired application channel of your client application in the context menu. The number of the available hardware segments depends on the set operation mode. Select the **VN5640** entry with the right mouse button and select the **Device Configuration** entry in the context menu to change the operation mode (and thus the number of segments) and to make further settings. Alternatively you can use the **Device Configuration** entry on the right in the **Details** view.

3.1.1 Selection of the Operation Mode

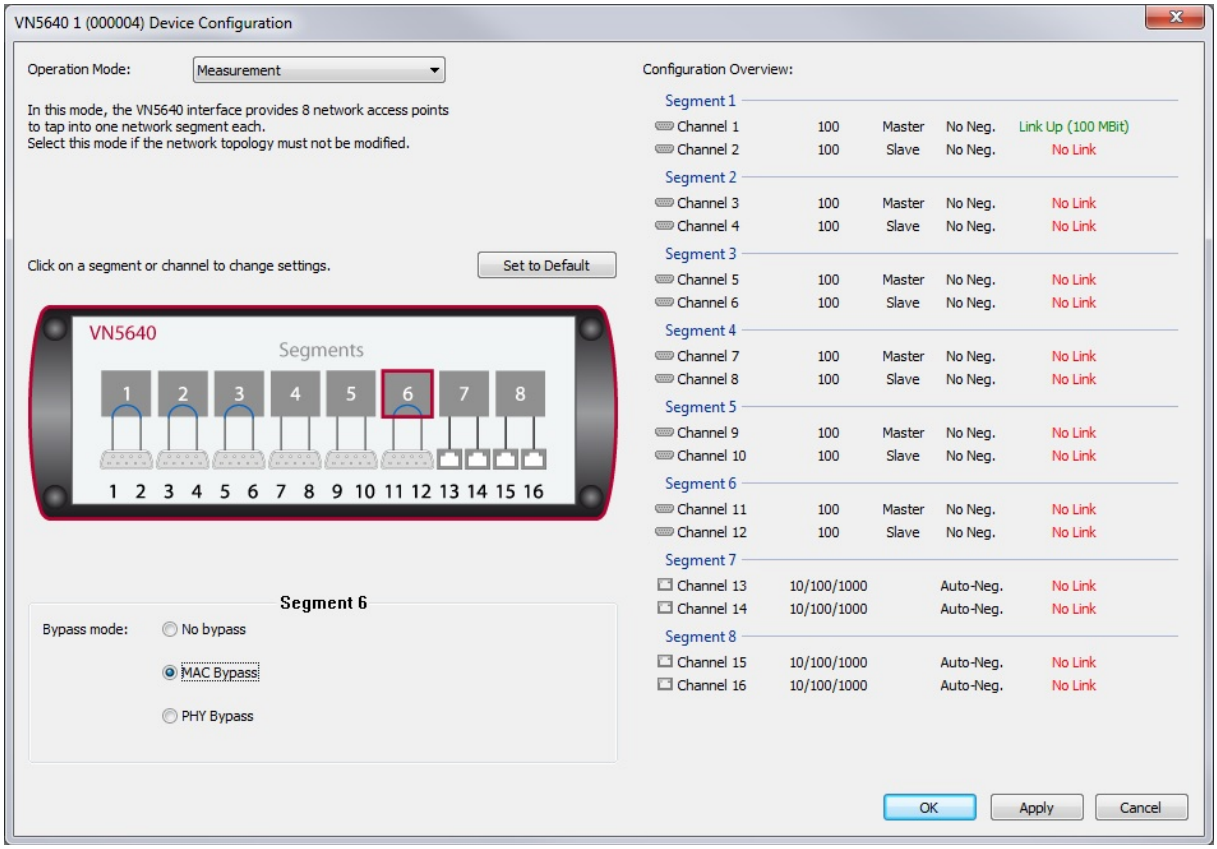

Figure 5 - Selection of the operation modes

In the **Operation Mode** selection field, select the operation mode which is suitable for your use case:

- **Simulation**
  Select this mode if the network topology is not important. Simply connect your devices to any connector – the VN5640 interface will forward all Ethernet packets to the correct destination. In doing so, the built-in Ethernet switch will collect MAC addresses at runtime. This MAC address table is then used for correct forwarding of the Ethernet packets. Furthermore, the provided CAPL functions allow direct sending of packets via a specific connector (ignoring the switch).
- **Measurement**
  Select this mode if the network topology must not be modified. In this mode, the VN5640 interface provides 8 network access points to tap into one network segment each. For each access point you may choose whether it operates in MAC or PHY bypass mode, or if the internal network bypass should be opened – for example to modify transmitted packets. Furthermore, the provided CAPL functions allow direct sending of packets via a specific connector (ignoring the TAP).
- **Direct Connection**
  Select this mode to get direct access to all 16 hardware channels – for example to get access to diagnosis ports of multiple devices. All channels are operated independently, and no packets are forwarded between channels by the device.
- **Media Conversion**
  Select this mode to connect Ethernet devices with different transmission media requirements to each other. The VN5640 provides four media converters and four additional network access points (see **Measurement** operation mode). For each converter and each access point you can select whether it operates in MAC or PHY bypass mode, or if the internal network bypass should be opened. Furthermore, the provided CAPL functions allow direct sending of packets via a specific connector (ignoring the TAP).
- **Direct Connection with TAP (legacy)**
  Select this mode if you are using a CANoe configuration that has been established for VN5610/VN5610A (no segment usage). With this operation mode, you can set a TAP between two segments.

After pressing the **[Apply]** button, the selected settings in the **Device Configuration** dialog are permanently stored in the Flash on the VN5640 as standard configuration.

3.1.2 Configuration of the Hardware Segments/Hardware Channels

Once the operation mode has been selected, the graphics in the central area of the dialog is updated. This interactive graphic is used for further configuration of the hardware. Select an element (segment or hardware channel) using the left mouse button and make the desired settings in the lower area of the dialog.

Note

Once you have selected a hardware segment using the left mouse button, the Interface LEDs of the assigned hardware channels will flash several times. The corresponding LED on the interface also flashes when a hardware channel is selected, which is especially very useful when cabling the system.

Example: Configuration of a TAP

> Select the operation mode **Measurement** or **Media Conversion**.
> Select a hardware segment.
> Select the desired bypass functionality (e.g. **PHY Bypass**).
> Select the hardware channel 1 of the segment and select the physical layer.
> Select the hardware channel 2 of the segment and select the physical layer.
> Close the **Device Configuration** dialog. The settings you have made will be stored in the device as standard configuration and automatically used in the standalone mode.

4 Overwriting the Standard Configuration at the Start of a Measurement of CANoe/CANalyzer

The standard configuration of the VN5640 interface can be overwritten at the start of a measurement by the client application. As soon as you stop the CANoe measurement, then the standard configuration will be active again. Note that not each client application supports this functionality.

Open the **Network Hardware Configuration** dialog in CANoe/CANalyzer via the **Hardware** ribbon tab|**Network Hardware** to overwrite the standard configuration with the following settings that do not concern the segments. The segment/channel assignment can only be done using the **Vector Hardware Config** dialog and its operation mode (see 3.1.1).

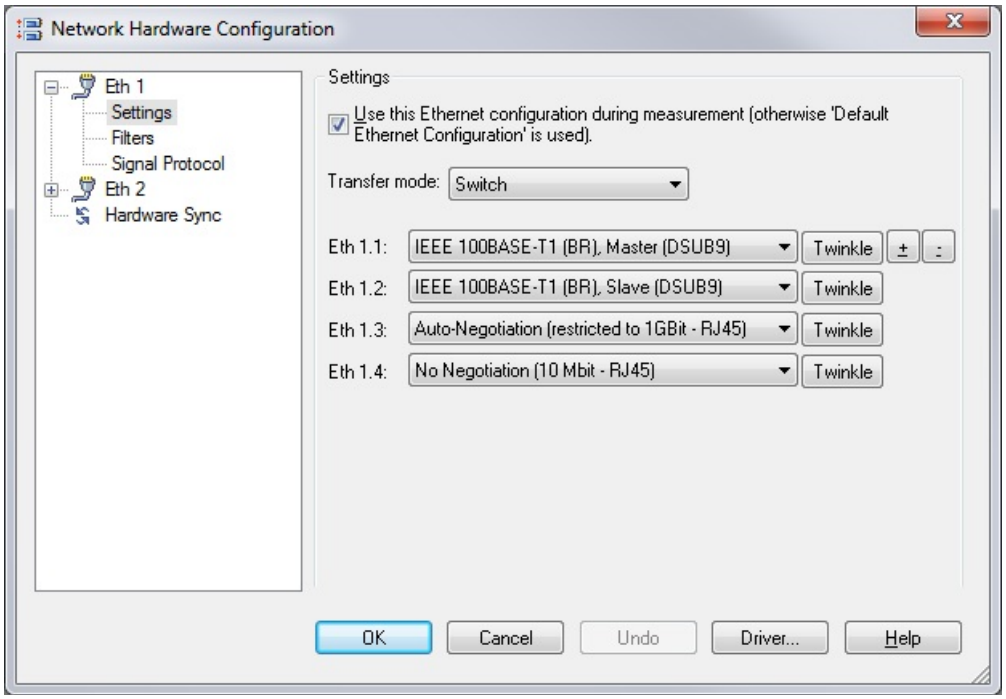

Figure 6 - **Network Hardware Configuration** dialog

Select the **Settings** entry in the left tree view of the desired application channel. On the right side, activate the check box **Use this Ethernet configuration during measurement…**.

Note

After the start of the measurmenet CANoe configures the VN5640 regarding to the settings made in the **Network Hardware Configuration** dialog. This takes some time which might delay the start of the measurement. In some case of simulation this might be problematic. Therefor, it is recommended to directly make the settings using the **Vector Hardware Config** dialog as indicated in 3.1.

However in some cases (see below) it might be necessary to overwrite the standard configuration of the VN5640 within CANoe.

Overwrite the standard configuration at the start of a measurement if

1. You want to ensure that, for example CANoe/CANalyzer automatically makes settings on the Vector interface at the start of a measurement.

   Typical application scenario:
   You have created a CANoe configuration and want to distribute it to colleagues. Your colleagues shall load the configuration and immediately start the measurement without taking care of the standard configuration of the particular VN5640. You do not need to worry about the setup of the used Vector interface, as CANoe overwrites the standard configuration for the measurement period of time. It must only be ensured that:

   > The external hardware is correctly connected to the Vector interface
   > The correct operation mode has been set within the **Vector Hardware Configuration** dialog (see 3.1.1)
   > The correct application channel is assigned to the segments (see 3.1)
   > The standard configuration will be active again as soon as the client application is stopped

2. You want to interfere for a while in an existing network, but the Ethernet packets should be transferred with as little latency as possible as soon as the measurement is stopped.

   Typical application scenario:
   You have set up a measuring point (TAP) in the standard configuration which works as a **PHY bypass** (all packets are transmitted between the two endpoints connected to the TAP with as little latency as possible and no error detection). After the start of the measurement, CANoe should be used to manipulate the network. For this, simply change the TAP option in CANoe **Network Hardware Configuration** dialog to the desired bypass mode. For example you can set a **MAC bypass** to send additional Ethernet packets or deactivate the bypass (**Bypass Off**) to manipulate the received Ethernet packets and send them back into the network. When the measurement is stopped, your system will run without any impairment of the CANoe application as the **PHY bypass** out of the standard configuration will be automatically set again.

Note

Overwriting the standard configuration includes only the configuration of the hardware segments and hardware channels. The operation mode cannot be changed via the client application. This is done exclusively in the **Vector Hardware Config** dialog (see section 3).

4.1.1 Definition of the Transfer Mode

In the **Network Hardware Configuration** dialog the following **transfer modes** are available for you:

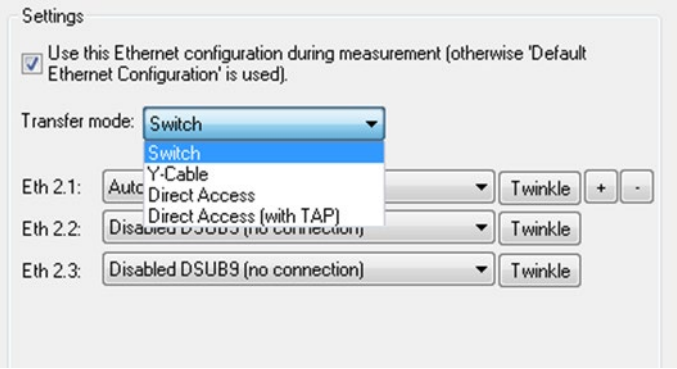

Figure 7 - **Network Hardware Configuration** dialog: Transfer mode selection

- **Switch**
  Configure up to 16 hardware channels. The switch learns MAC addresses and the packets are transmitted based on these rules.
- **Y-cable**
  Use this setting to configure a measuring point (simple TAP or media converter) including two hardware channels.
- **Direct access**
  Includes exactly one hardware channel and is typically used for the direct access to the network.
- **Direct Access (with TAP)**
  Includes exactly one hardware channel and is typically used for the direct access to the network. This mode is only used for compatibility reasons. See section 3.1.1.

You use the **Transfer mode** to define the transmission behavior you expect from the hardware segment. Once the selection is made, the parameters relevant for the configuration are displayed. At the start of a measurement, CANoe checks whether the settings made can be applied. If the settings are incompatible, the start of the measurement is cancelled and you see a corresponding error message in the Write Window.

Example:
You have assigned the application channel in the **Vector Hardware Config** dialog (**[Driver…]** button) to a **TAP** hardware segment. Now, select the Switch transmission mode in the **Network Hardware Configuration** dialog and configure the three hardware channels. The start of the measurement is cancelled as your hardware segment (TAP) has only two hardware channels.
Background: The client application cannot change the segmentation on the hardware and the assignment of the hardware channels.

4.1.2 Definition of the Bypass Method

This selection is only available if one the following transfer modes has been selected:

- Y-cable
- Direct access (with TAP)

Here, set the bypass method (see section 2.3) which must be set up in the TAP at the start of a measurement.

4.1.3 Configuration of the Hardware Channels

You can configure the hardware channels assigned to the hardware segment via the **Ethx.y** selection fields (x: Segment, y: Channel). In the **Switch** transfer mode, you can set the number of hardware channels using the **[+]** and **[-]** buttons. At the start of a measurement, the hardware channels for the hardware segment are configured in ascending order **from left to right**. The first free hardware channel for which the setting can be made is used.

Example with VN5640 interface:

A hardware segment with the **Switch** transfer mode (16 hardware channels) is assigned to the application channel **ETH1**. The following settings were made in the **Network Hardware Configuration** dialog.

- ETH 1.1 IEEE 100BASE-T1 (BR), master (setting 1)
- ETH 1.2 Auto-Negotiation (restricted to 1 GBit) (setting 2)
- ETH 1.3 IEEE 100BASE-T1 (BR), master (setting 3)
- ETH 1.4 Deactivated DSUB9 (no connection) (setting 4)
- ETH 1.5 IEEE 100BASE-T1 (BR), master (setting 5)

At the start of a measurement, the physical hardware channel 1 is configured using **setting 1** as this is the first free channel IEEE 100BASE-T1 (BroadR-Reach). The first suitable hardware channel for **setting 2** is hardware channel 13 as all previous channels are IEEE 100BASE-T1 (BroadR-Reach). Thus, the channel configuration for VN5640 would be:

- Hardware channel 1 → **setting 1**
- Hardware channel 2 → **setting 3**
- Hardware channel 3 → **setting 4 (reserved)**
- Hardware channel 4 → **setting 5**
- Hardware channel 5 → unchanged
- Hardware channel 6 → unchanged
- Hardware channel 7 → unchanged
- Hardware channel 8 → unchanged
- Hardware channel 9 → unchanged
- Hardware channel 10 → unchanged
- Hardware channel 11 → unchanged
- Hardware channel 12 → unchanged
- Hardware channel 13 → **setting 2**
- Hardware channel 14 → unchanged
- Hardware channel 15 → unchanged
- Hardware channel 16 → unchanged

5 Contacts

For a full list with all Vector locations and addresses worldwide, please visit http://vector.com/contact/.