Fieldbus and DeviceNetworks

This tutorial focuses on the popular DeviceNet standard and is broken down into the following sections:

- Introduction
- Fundamentals of DeviceNet
- Configuration of a device
- Physical Network
- Introduction

DeviceNet is becoming popular as an international de-facto standard for device level networks. It is a real-time system for time-critical I/O and messaging data and is aimed at byte-level transfer of information. Hence Foundation Fieldbus and Profibus would be more effective at transferring a flow meter type instruments data; but not necessarily as efficient in transferring byte-level data (such as from on-off switches/variable speed drives/proximity switches which is where DeviceNet is targetted). (There will be some warranted objections from the Profibus-DP camp on this last comment !).

Fundamentals of DeviceNet

DeviceNet is based on the CAN (Controller Area Network) bus chips originally designed by Bosch for use in the automobile industry. DeviceNet is structured as indicated in the diagram below and takes up the Application Layer , MAU and Transmission Media layers. Use of the CAN bus chips means a low cost implementation as CANbus chips are produced by the million every year.

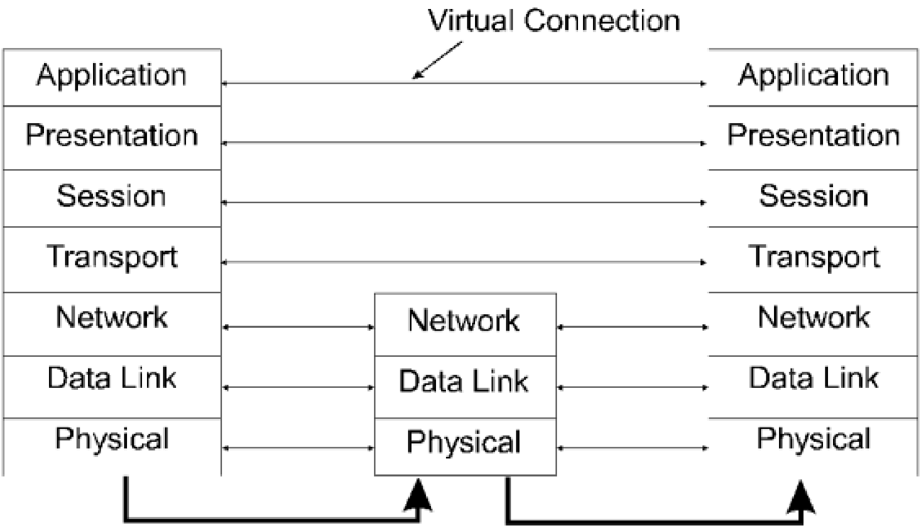

Figure 1 - Positioning of DeviceNet and CANbus.

DeviceNet uses the Producer Consumer model approach to transfer data over the network. This is as indicated below:

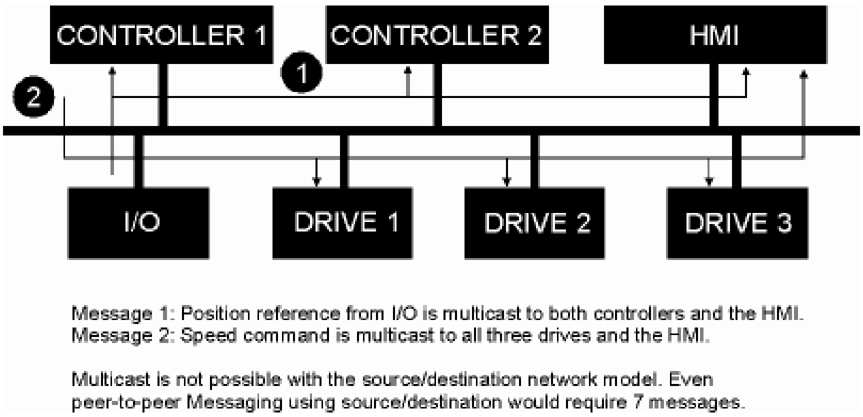

Figure 2 - Producer/Consumer Model with a multicast message
(Courtesy of Rockwell Automation)

In a producer/consumer model there are two types of devices:

- The producer of the data
- The consumer of the data

If a node requires data, it will read that data off the bus and consume it. Data is identified by its content. This means that multiple nodes or stations can consume data at the same instant from a single producer. The classical transmission of a message and then getting a response from a device (the source/destination model) takes up more network bandwidth than the producer/consumer model approach discussed above.

A quick summary of the key characteristics of DeviceNet are as follows:

- Uses CAN technology at the lower levels
- Supports both so-called thick and thin drop lines
- Able to run at one of three different baud rates (125Kbaud/250kBaud/500 Kbaud)
- Uses a linear bus topology
- Shielded twisted pair contains both the power and signal pairs.
- Supports up to 64 nodes
- Support drop lines from the bus of up to 6 m in length

DeviceNet provides the following communication mechanisms:

- Strobe/Poll I/O mechanisms. This is simple to configure and is suitable for systems where there are many I/O points that change state rapidly. This mechanism does not make very good use of the available bandwidth because the device has to be checked frequently for any inputs that may have changed.
- Cyclic I/O Mechanism. The device is regularly updated at a pre-defined minimum interval with inputs and outputs. It is very efficient and minimises the use of the network bandwidth.
- Change of State I/O. This relies on the device being updated when a point changes state (eg switch goes from the On to Off state). This is a very efficient use of the industrial network.
- Explicit Messaging. This is for use on infrequent access of system parameters such as limits and thresholds. These do not have a major impact on available network bandwidth.

Configuration of a device

A few factors need to be considered in using DeviceNet devices. When commissioning your system you need to check the following items:

- Does the device support the selected baud rate ? If not, adjust the baud rate to the correct one.
- Check the required communications strategy supported by the device. Some of the mechanisms above may not be supported.
- Check that the device conforms to the DeviceNet standard and has been officially certified.
- Check whether the device conforms to a standard device profile. Conformance here makes it a lot easier to interchange devices from different manufacturers on the same network.
- Design the Physical Communications Network carefully as discussed in the following section.

Physical Communications Network

- Ensure that the distances and construction of the network trunk line matches up with the specifications. This could be a combination of thick and thin cable.
- Ensure that the trunk line is terminated at each end with a resistor terminator.
- Ensure that the trunkline-dropline topology guidelines are followed.
- Follow the power consumption guidelines where the DeviceNet system provides 24Vdc and each device has a minimum of 11 Vdc with a maximum common mode voltage of 5 Vdc.
- Watch out for issues such as maximum inrush current specification.
- Be careful of multiple power supplies and ensure that the power supply common (V-) does not vary by more than 5 V between any two points on the network.

References

Jones, N., Building a Functional DeviceNet Network, S-S Technologies
Rockwell Automation web site and press releases.

Now click here to go to the short quiz based on this tutorial.