DeviceNet™

Overview and analysis

The DeviceNet protocol dramatically reduces costs by integrating up to 62 devices on a 4-wire trunk network. Communications data is carried over two wires with a second pair of wires carrying power. Discrete and analog devices may be connected into the DeviceNet protocol.

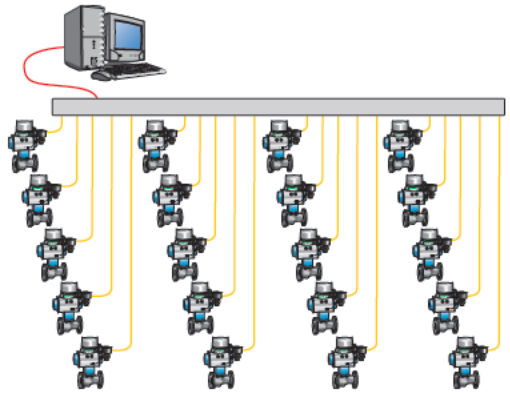
DeviceNet is based on CAN (Controller Area Network) technology originally developed by Bosch to replace expensive wire harnesses with low cost network cable in automotive applications. The fast response and high reliability of the CAN system makes it ideal for "mission critical" applications.

DeviceNet has high noise immunity, and the communication electronics are available with wide temperature ranges, making the protocol desirable for industrial and process automation. Systems may be installed in hazardous environments by using acceptable explosionproof wiring or power limited wiring practices with nonincendive or explosionproof enclosures. Plug-in connectors are readily available for heavy washdown, general purpose environments.

DeviceNet system features

- More than 30% savings in installation costs over conventional systems.
- Capability to handle both analog and discrete valve and instrument applications.
- Power and communication supplied over the 4-wire bus. Capability to install up to 62 devices on the same bus network.
- Electronic Data Sheet provides accurate device configuration details.
- Hot insertion of field devices without dropping power. (General purpose environments.)
- Message prioritizing to enable fast throughput rate for critical information.
- Technology with proven reliability in millions of mission critical applications.

Figure 1
Conventional system



DeviceNet vs conventional systems

The DeviceNet protocol uses a trunk wiring network that may directly connect to field devices containing analog as well as discrete information. PLCs and/or PCs may also be attached directly to the trunk network.

Conventional systems

Conventional systems have racks of inputs and outputs (I/O) located in distributed panels or in a centrally located control room. See figure 1. Discrete automated control valves typically have individual output control and feedback wiring from the I/O. When installing instruments and controls in a conventional system, substantial costs may be incurred for:

1. Design layout time for I/O cabinetry and conduit runs.
2. Space allocation for cabinets and conduit.
3. Conduit, wiring and fittings cost and installation time.
4. System commissioning and trouble-shooting time.

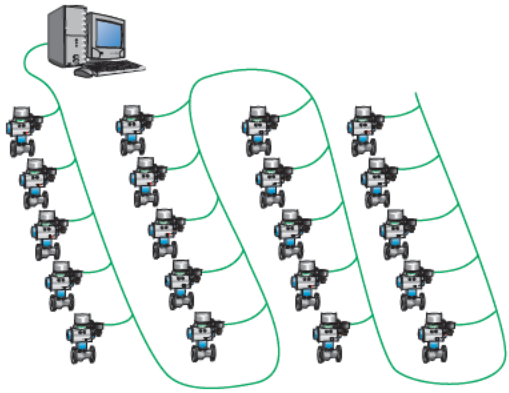
DeviceNet systems

In a DeviceNet system, up to 62 valve communication terminals, process instruments and PLC/PCs may be connected via drops or branches on a trunk network. See figure 2. Power and signal are carried over the 4-wire network. Each device has its own address and it may have several I/O points. Any discrete or analog instruments may be connected into the network provided it is DeviceNet compatible. Passive field devices may also connect into the network via Stonel DeviceNet VCTs and I/O modules, which have provisions for auxiliary inputs and outputs.

DeviceNet economic analysis

Sizable installation savings are realized over conventional systems when installing a DeviceNet network. The following is an estimate of installation costs of a conventional system versus DeviceNet (costs are listed in the amount per device):

Figure 2
DeviceNet system



Installation cost comparison		
	Conventional	DeviceNet
Valve monitor; VCT and solenoid	$510	$720
Conduit and wiring ($8/ft)	$1,200	$160
I/O cards; DeviceNet scanner	$30	$100
Power supply	$20	$30
Total installed cost	$1,760	$1,010
Total installation savings $750 per device		

This analysis is typical of an installation of 20 automated valve systems located in a cluster approximately 150 feet from the I/O rack. Each of the automated valves is located 20 feet apart in the cluster.

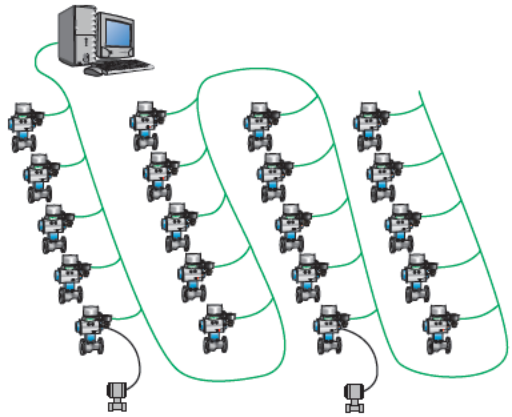
The Stonel DeviceNet I/O module and VCT have an auxiliary 4 to 20mA input that is bus powered. (No additional power is needed.) Other analog instrumentation such as flow meters, level controls, pressure sensors, etc. may be wired directly into the module, cutting installation costs further.

DeviceNet analog point addition to Stonel VCTs or I/O modules

When adding an analog device to an existing Stonel DeviceNet VCT, a convenient connection may be made to the nearest device. In the example in figure 3, the level control was 20 feet from the Stonel DeviceNet VCT and 150 feet from the central controller.

Analog installation cost comparison		
	Conventional	DeviceNet
Conduit and wiring ($8/ft)	$1,200	$160
Analog input point	$30	$ —
Total installed cost	$1,230	$160
Total installation savings $1,070 per added analog device		

Figure 3
DeviceNet analog point addition



As mentioned earlier, there are several other considerations that have not been quantified as follows:

- Design time may be cut in half.
- Conduit and cabinetry space may be cut by two-thirds.
- Right first-time wiring may become the norm and trouble-shooting time dramatically reduced during commissioning.
- Stonel DeviceNet modules have onboard diagnostics to help maintain equipment.

DeviceNet network specifications			
Topology	Trunk line with drops and/or branches		
Cabling	Two (2) separate shielded twisted pairs contained in one (1) shielded cable; may be thick trunk, thin trunk or flat cable.		
Base technology	CAN (Controller Area Network)		
Number of devices	62 per network		
Data delivery	8 bytes of data for I/O; more if device supports fragmentation		
Power	8 amps @ 24 VDC (thick cable) 4 amps @ 24 VDC (thin cable)		
Cable length (thick)	Dependent on data rate and cable type (see table below)		
		Drop length	
Data rate	Trunk length	Maximum	Cumulative
125 Kbaud	500 m (1,640 ft)	6 m (20 ft)	156 m (512 ft)
250 Kbaud	250 m (820 ft)	6 m (20 ft)	78 m (78 ft)
500 Kbaud	100 m (328 ft)	6 m (20 ft)	39 m (129 ft)
Cable length (thin)	100 m (328 ft)		
Communication methods	• Master/slave polling • Cyclic polling • Change of state • Strobed I/O • Explicit messaging		
Data signal	Square wave digital with non return to zero encoding.		
Error detection	Automatic retransmission of corrupted messages and autonomous switching off of defective nodes.		
Address setting	On-line via DeviceNet configuration software and PC interface module; off-line with dip switches.		
Support organization	Open DeviceNet vendor Assn. www.odva.org.		

Valmet's professionals around the world work close to our customers and are committed to moving our customers' performance forward – every day.

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