

DeviceNet Overview

DeviceNet is a CAN based Layer 7 protocol originally developed by Allen-Bradley. Operation of the DeviceNet is based on an object-oriented communications model. DeviceNet is maintained by the Open DeviceNet Vendor Association (ODVA).

DeviceNet is designed to connect simple devices from multiple vendors that comply with the DeviceNet network standards. DeviceNet device profile standards provide interchangeability between device manufacturers.

Each DeviceNet segment can connect up to 64 devices. It is a four-wire system delivering 8 amps at 24VDC, sufficient for field devices such as solenoid valves. The four wires carry signal and power typically on a single cable. Multiple power supplies can be used for redundancy and additional power requirements.

DeviceNet uses a trunk (bus) line with drop cables connecting devices. The trunkline requires 121 ohm terminating resistors at each end of the trunk.

DeviceNet supports Master/Slave, Peer-to-Peer, and Multi-Master network models. Data can be transferred on a cyclic or change of state basis using a Producer/Consumer paradigm that conserves network bandwidth. DeviceNet is very commonly used for communications from host systems to motor control centers and variable speed drives.

DeviceNet Network Highlights

Type of Network	Device Bus	Primary usage	Motor Control Centers, Variable Speed Drives, Remote I/O applications
Physical Media	Two Shielded twisted pairs in one shielded thick, thin or flat cable (one pair for signal, one pair for power)	Power and Communications on same cable	24VDC power on power bus (multiple supplies may be used for additional power or as backup). A separate 24VDC power supply for communication bus is recommended.
Network Topology	Bus with drops	Device Power Supply	24VDC on power bus
Maximum Devices	62 devices per segment	Wiring Types	
Maximum Distance	(using Thick cable)	Thick Cable	(ODVA Type II cable), generally used for trunk cable
Maximum Distance with repeaters	6,000 meters	Thin Cable	(ODVA Type I cable), commonly used for drop cables
125Kbps	- 500m (1640 ft) - 6m (20 ft) individual drop cable length - 156m (512 ft) cumulative drop cable length	Mid Cable	(ODVA Type III cable), used when more flexible drop cable is needed
250Kbps	- 250m (820 ft) - 6m (20 ft) individual drop cable length - 78m (256 ft) cumulative drop cable length	Blue/White conductors for communications Red/Black conductors for power	
500K bps	- 100m (328 ft) - 6m (20 ft) individual drop cable length - 39m (128 ft) cumulative drop cable length	Grounding aspects	Ground only the power supply closest to the middle of the network
* Thin cable may be used as trunk. Maximum distance is 100 meters, regardless of data rate		Terminators	121 ohm terminator at each trunk line end
Communication Methods	Master/slave, multiple master, peer-to-peer, change of state or cyclic (uses Producer/Consumer Paradigm)	Web Site	www.odva.org

Conventional I/O System vs. DeviceNet Network

DeviceNet is feature-rich, yet cost effective.



CONVENTIONAL I/O SYSTEM

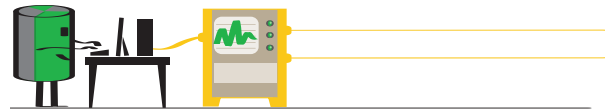
Advantages

- Technology is already understood
- Lower device cost
- Independent wiring from devices to the control system means wiring problems with one device don't affect other field devices

Drawbacks

- Higher installed cost
- Point-to-point wiring is expensive
- Many wiring connections:
 - are labor intensive to install
 - create many points of failure
 - increase complexity when troubleshooting
 - require large amounts of cabinet or rack space for installation of terminal blocks
 - create time-consuming initial checkout and startup
- Expansion requires duplicating the entire wiring scheme for each additional point

DeviceNet is most commonly used when device populations are primarily discrete but have some analog, and when motor control centers and variable frequency drives are present.



DEVICENET NETWORK

Advantages

- Excellent support for motor control centers, variable frequency drives, and conventional I/O
- Moderate device cost adder
- Lower installed cost
- I/O modules allow for conventional analog and discrete device integration
- Relatively fast transmission speeds:
 - Transmission Speed and cable lengths:
 - 125kb @ 420m
 - 250kb @ 200m
 - 500kb @ 100m
- Power and Signal on same cable
- Up to 64 addressable nodes
- Wide variety of topologies available, including Trunk, Line, Drop
- Duplicate node address detection
- Supports some device diagnostics

Drawbacks

- Slaves can only be owned by one master
- Does not support Intrinsically Safe installations

TopWorx Comments on DeviceNet

Strengths

DeviceNet is capable. DeviceNet delivers a solid combination of cost-effective simplicity with a bit of added functionality. It is designed to handle discrete devices but can support analog signals and some diagnostics as well.

DeviceNet is robust. DeviceNet supplies 8 amps of power, offers acceptable cable run lengths, and can control up to 64 devices per segment.

Limitations

Hazardous Areas

Since DeviceNet is an 8 amp bus, it cannot be intrinsically safe. TopWorx has created a variety of solutions for installing DeviceNet in

Class I, Div 1 (Zone 1) and Class I, Div 2 (Zone 2) hazardous environments.

Cost When Simplicity is Needed

If customers have only discrete devices and need no added functionality, then some other protocols are less expensive.

When to Use DeviceNet

Generally speaking, TopWorx recommends DeviceNet when:

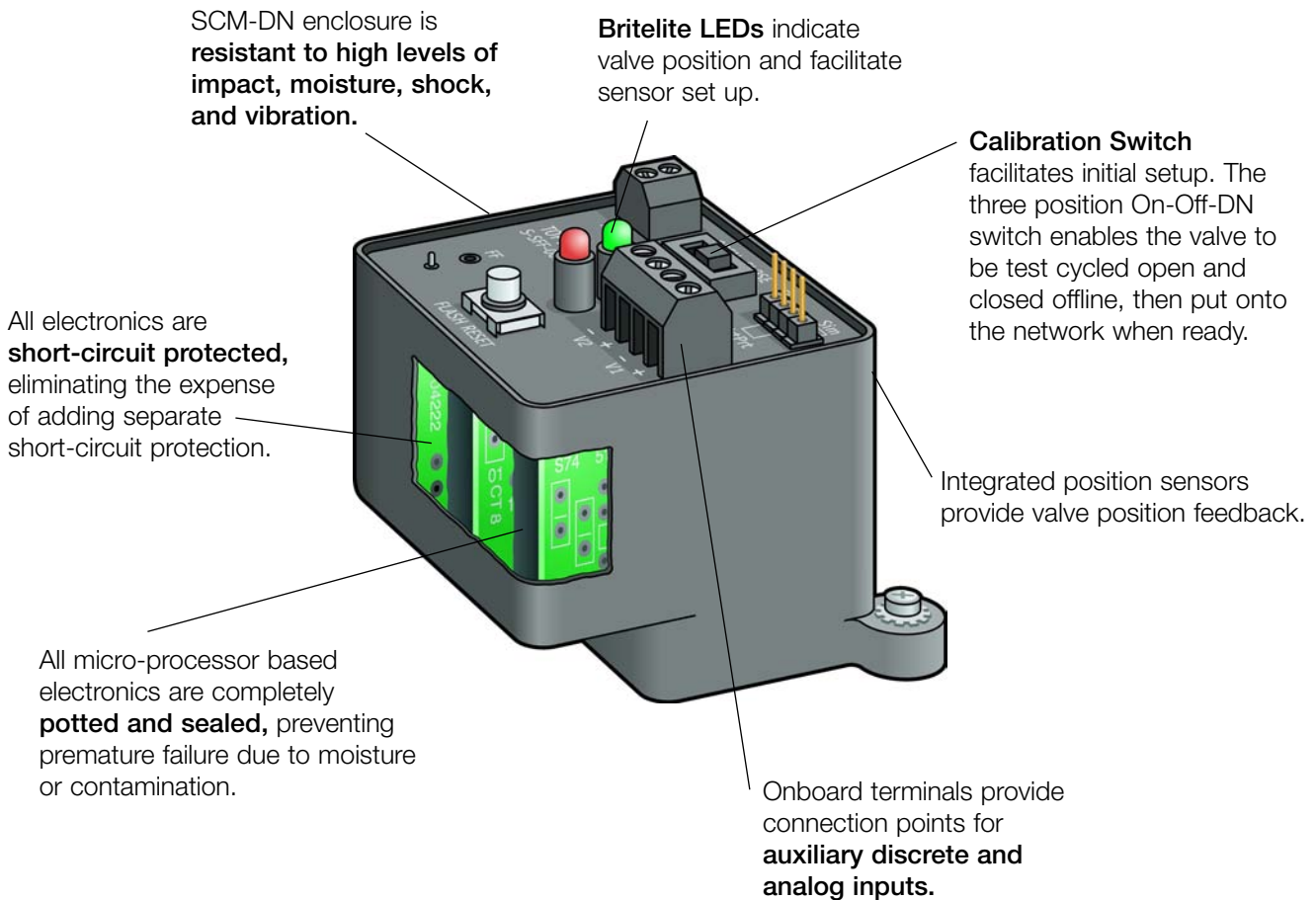
- device populations are primarily discrete and secondarily analog
- end users desire some diagnostic capability for predictive environments
- plants are not intrinsically safe

● Device Bus Network

DeviceNet Sensor-Communications Module

DeviceNet

The TopWorx Sensor-Communications Module (SCM) combines position sensors, DeviceNet communication, solenoid outputs, and wiring terminals into a compact enclosure that is potted and sealed from the environment.



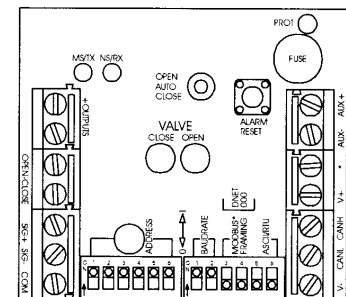
SCM-DN Highlights

The Sensor-Communications Module delivers valve position feedback, communicates directly on the DeviceNet network, pilots the valve actuator, and provides extra wiring terminals for auxiliary inputs.

The TopWorx SCM-DN is a compact, sealed module that can be used in a variety of enclosures suitable for use in any hazardous or corrosive process environment.

- 3 Discrete Inputs (DI)** Open/Closed valve position feedback and 1 Auxiliary Input for dry contact
- 2 Discrete Outputs (DO)** Solenoid outputs for single or double acting
- 1 Analog Input (AI)** Optional 4-20mA input
- Calibration Switch** Open-Close-DeviceNet
- Status/Warning LEDs** Open, Closed, Alarm State
- ODVA Conformance Tested** Yes
- Short Circuit Protection** Yes
- Maximum Output Current** 500mA per output
- Maximum Output Power** 12 watts per output
- Voltage** 11-30 VDC

- Diagnostics**
- Cycle Counter** Records number of cycles
- Cycle Time Alarms** User settable values for Open & Close cycle times
- Visual Alarm Indication** Blinking LEDs
- Auto Baud Rate Detection** 125kb, 250kb, 500kb



SCM-DN Wiring Diagram