DeviceNet™ System Description

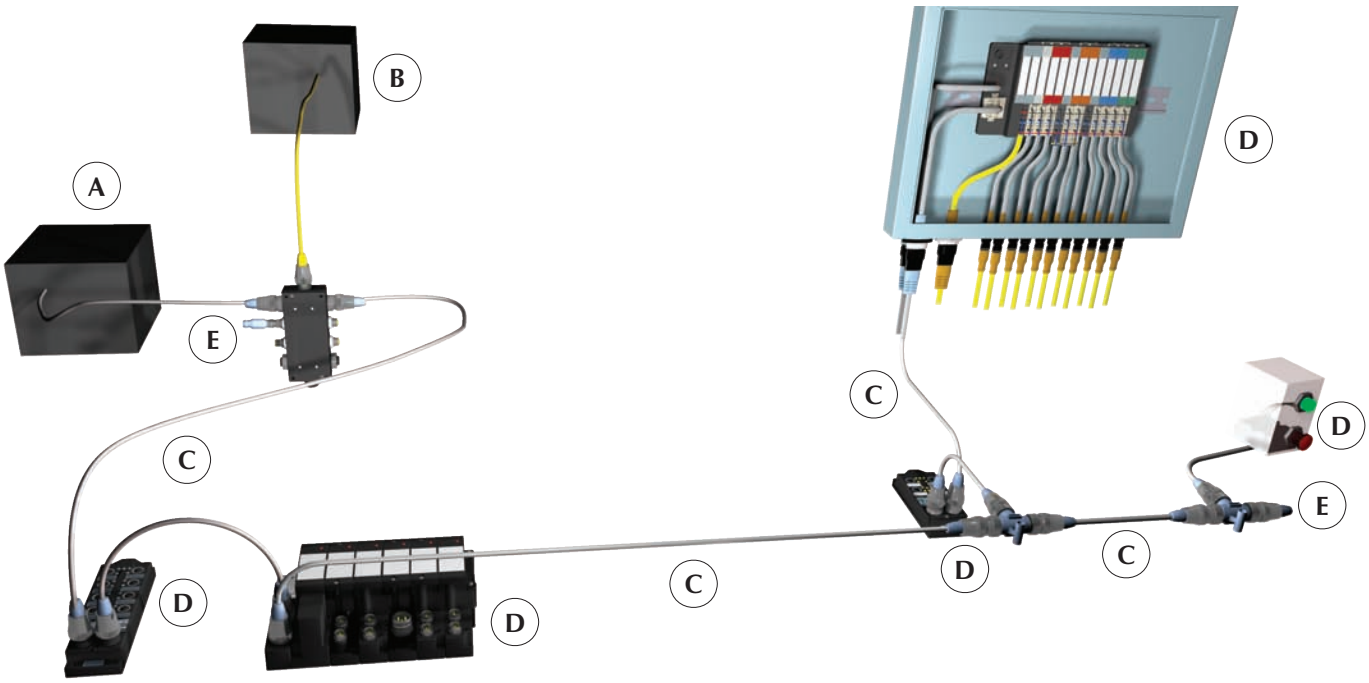
DeviceNet is a low-cost communications protocol that eliminates hard wiring and connects industrial devices such as limit switches, photoelectric sensors, valve manifolds, motor starters, process sensors, bar code readers, variable frequency drives, panel displays and operator interfaces to a network. DeviceNet's direct connection provides improved communication between devices, as well as important device-level diagnostics not easily accessible or available through hard-wired I/O interfaces.

DeviceNet is based on the Controller Area Network (CAN) broadcast-oriented communication architecture. CAN uses a bus arbitration method, CSMA/BA, that assures the highest priority message always gets use of the bus in the event of a data collision. The DeviceNet protocol further defines message priorities such that I/O messages are given top priority and configuration messages have lower priority.

A DeviceNet network supports up to 64 nodes and virtually an unlimited amount of I/O. The bus uses a trunkline/dropline topology, where bus power and communication are supplied on a single cable. Bus power is 24 VDC and supplies current to operate the nodes and (typically) power input devices. Some **TURCK** stations require an additional 24 VDC auxiliary power to supply current for outputs.

DeviceNet allows peer-to-peer data exchange (where a DeviceNet node can initiate communication with other nodes or peers), and a master/slave configuration in which the master node initiates all communication and all other nodes, or slaves, respond to the master node's requests.

Typical System Configuration



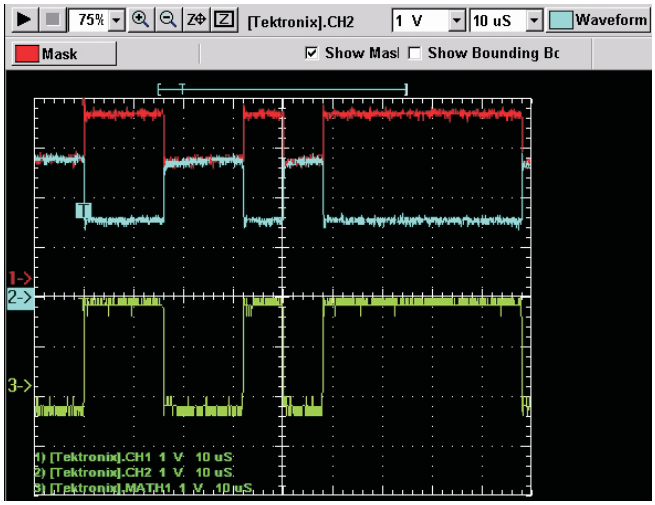
A typical DeviceNet system consists of the following parts:

- A - Controller
- B - Power Supply
- C - DeviceNet Cable
- D - DeviceNet I/O Modules (or Slaves)
- E - Terminating Resistors

DeviceNet stations require a network master (also called a scanner) to interface the stations to the host controller. **TURCK** DeviceNet stations are designed to be fully compatible with DeviceNet equipment from other manufacturers.

Communication Signal and Power

The DeviceNet™ signal conforms to the Controller Area Network (CAN) standard. This signal type is a differential square wave, allowing for very good common mode noise rejection. The network communication rate (baud rate) can be configured for 125, 250 or 500 kbaud. All stations on a DeviceNet system must be set for the same baud rate.

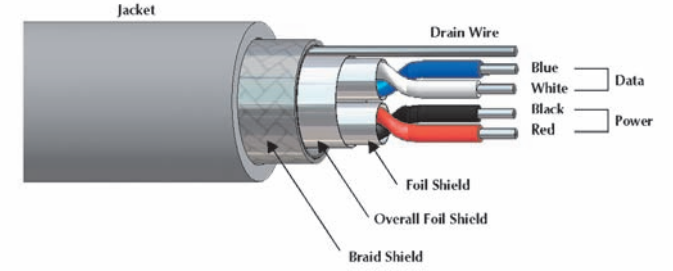


Oscilloscope capture of a typical DeviceNet signal, showing both the high and low components as well as the resulting difference.

Several factors must be considered when calculating the complete cycle time of a DeviceNet system, including:

- Number of nodes being scanned
- Amount of data produced and consumed by the nodes
- Type of I/O messaging (change of state, strobe, poll)
- Network communication rate
- Device time-out and explicit messaging traffic
- Cycle time of the control program

The DeviceNet cable also includes a wire pair for carrying 24 VDC power to all nodes on the network. This power supply is required for DeviceNet systems, as the signal lines are referenced to it. A key benefit of carrying supply voltage in the network cable is that many DeviceNet stations do not need a further supply, allowing the user to only need to run one cable to the station.



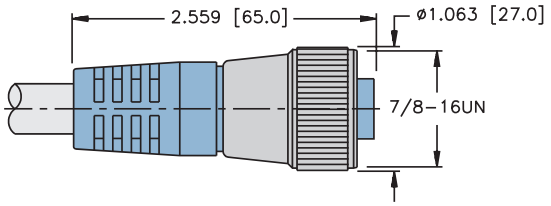
Typical DeviceNet cable.

Some stations, particularly those with high current outputs, can draw too much power from the DeviceNet power supply. These stations typically have an auxiliary power connection, allowing the user to use a second power supply for just the I/O. The bus power supply still powers the DeviceNet communication electronics.

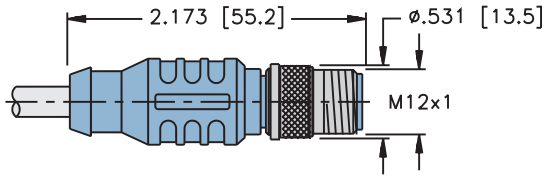
Cordsets

TURCK offers a complete line of molded DeviceNet™ cordsets to facilitate network installation, resulting in a faster start-up and fewer wiring errors. The bus and drop cables are specially designed foil-shielded, high-flex cables with very low inductance and capacitance to minimize propagation delay time. DeviceNet cables consist of a shielded and twisted data pair, as well as a shielded and twisted power pair for the 24 VDC bus power, with an additional outer shield.

In most cases, bus cable connections are made using 5-pin ***minifast***® (7/8-16 UN) or ***eurofast***® (M12) connectors. A variety of stations are also available that support terminal-block type connections.



minifast **connector**



eurofast **connector**

TURCK cordsets for the DeviceNet system are available in standard lengths. Contact your local sales representative to order custom lengths.

Maximum Ratings

The DeviceNet bus uses trunk and drop topology. The trunk is the main communication cable, and requires a 121 ohm resistor at both ends. The maximum length of the trunk depends on the communication rate and the cable type. Drops are branches off the trunk, and may be from zero to 6 m (20 ft) in length. The cumulative drop lengths are dependent on the communication rate. The following table shows the maximum ratings for a trunk using thick, mid and thin cable. Thick and thin DeviceNet communication cable types are defined by the DeviceNet specification; mid cable is a hybrid of the two that is offered by **TURCK**.

Communication Rate	Thick Trunk Length (maximum)	Mid Trunk Length (maximum)	Thin Trunk Length (maximum)	Drop Length (maximum per drop)	Drop Length (cumulative)	Nodes (maximum)
125 kbps	500 m (1640 ft.)	300 m (984 ft.)	100 m (328 ft.)	6 m (20 ft.)	156 m (512 ft.)	64
250 kbps	250 m (820 ft.)	250 m (820 ft.)	100 m (328 ft.)	6 m (20 ft.)	78 m (256 ft.)	64
500 kbps	100 m (328 ft.)	100 m (328 ft.)	100 m (328 ft.)	6 m (20 ft.)	39 m (128 ft.)	64

Diagnostics

TURCK stations provide increased diagnostics when used with standard proximity or photoelectric sensors and discrete actuators. **TURCK** stations also serve as a buffer between I/O devices and the DeviceNet bus by detecting short-circuits without disrupting DeviceNet communication.

For deluxe style stations, each I/O point on the station provides state and status data. State data represents the real world value of the I/O device; for example, when the sensor is on or the actuator is off. Status data indicates short-circuits in the I/O device or in the wiring between the device and the station. Some models also use status data to indicate open circuits.

State and status data are transferred to the DeviceNet scanner where it is available for fault handling in the control program. Additionally, each input and output has a multicolored LED to indicate its state and status and pinpoint I/O problems quickly; for example the module status LED indicates the internal health of the station, and the network status LED indicates the station's communication on the DeviceNet network.

Addressing

The valid range of DeviceNet™ node addresses is 0 to 63. The station's default node address is 63. Each node's address must be initially set, usually via rotary dials or switches on the node. The address can also be set with a DeviceNet configuration tool.

Changes to the address settings take effect when the station power is cycled. Care must be taken to prevent the same address from being assigned to more than one node in a system. If the same address is set on multiple nodes, one node will take control of the address and the others will go into "Critical Link Failure" state, indicated by the network status LED (solid red).

Electronic Data Sheets (EDS) Files

Electronic Data Sheets, or EDS files, are files that contain detailed information about a DeviceNet device, including I/O data size and the device's configurable parameters. The information provided by EDS files guide a user through the steps necessary to configure a device. EDS files are available on the **TURCK** web site (www.turck.com).

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