

TECHNOTE!

Networking Considerations when using Control Serial Hubs

(See definitions of various network elements below the following text.)

A Serial Hub is a black box that provides "native COM ports" to PC's while connected anywhere on the Ethernet LAN. Terminator™ DNC, SuiteFactory™ or any software application that addresses COM ports can transparently access machine tool controllers connected to the serial hub just as if they were attached to a multi-port serial controller installed in the computer itself. This means that you can locate serial hubs near the machines where the data is to be transmitted and received without concern for distance limitations of RS-232 communications.

For best performance serial hubs should be isolated from regular network traffic. A serial hub is just like any other device attached to a LAN in that it resides in a Collision Domain. This means that any network traffic in that segment appears at the serial hub. Conversely, network traffic produced by the serial hub appears on all the other devices in that segment. It therefore follows that putting a serial hub on a busy LAN segment can deteriorate the performance of that segment especially if many machine tools are attached to that hub. Worse, the non-DNCwin network traffic can hinder the performance of the serial hub, interfering with communications to the machine tools.

It makes sense, therefore, to put serial hubs and the computers that service them in their own isolated collision domains. There are several ways this can be done. For example, you can put a second NIC in your server dedicated to the serial hub or hubs. Alternatively, you can use an Ethernet switch to segment your LAN into isolated Collision Domains. The method used depends on the specific details of your requirements. Some that come to mind are:

- How many machines?
- How many shop floor workstations for DNCwin?
- How many other workstations?
- How many servers?
- Is the server dedicated to DNCwin or not?
- How powerful are these servers and workstations?
- How is your facility laid out - how far apart are the machines, servers, workstations, printers, etc.?
- Where will your database or databases reside?

CAD/CAM Integration, Inc. can assist you in configuring your network, laying out the topology and recommend hardware. We can also assist in installation and setting it up. Please inquire regarding our terms.

In order to familiarize you with some of the aspects of installing a computer network the following definitions and rules are included below in this document.

Network Definitions

Local Area Network (LAN): A collection of computers (servers, workstations, desktop PC's etc.), printers, and other devices (for example a serial hub) interconnected by means of network interface cards (NIC's), hubs, bridges, routers and switches. A LAN provides the means for computers to communicate with each other either on a peer to peer basis or via a server intermediary. A LAN also provides the means to share resources, such as, printers, fax modems, or Internet access portals.

Collision Domain (LAN Segment): A part of a LAN where data transmitted on it is broadcast to all of the devices on that segment but not to devices on another segment. Each segment may contain a single server or workstation, or multiple workstations that are connected to a hub. In the latter case two or more workstations can broadcast messages simultaneously, hence, the messages collide. That segment is a 'collision domain.' (The Ethernet protocol sorts this problem out with random timing rules for each workstation to re-broadcast its message.)

Network Diameter: The cable distance between the farthest pair of computers in a LAN segment (Collision Domain.)

Network Interface Card (NIC): A circuit card that plugs into a computer to give that computer the ability to be attached to a LAN.

Bridge: A device used to interconnect two like networks.

Router: A device used to interconnect two unlike networks.

Ethernet Hub (repeater): A device that provides the means to interconnect multiple computers on a LAN using twisted pair wiring. Ethernet hubs come in 10 Mbps (10BASE-T) and the newer Fast Ethernet 100 Mbps (100BASE-T) varieties or 10/100 auto-sensing models in which each port adapts to the speed of the computer attached to it. With a hub, when any computer addresses any other computer on the network it broadcasts its message to all of the computers attached to the hub. Each computer looks for its address so that only the addressed computer accepts the message. Note: 100 Mbps hubs come in Class I and Class II varieties.

Ethernet Switch: Switches are used to segment a LAN. A switch is similar to an Ethernet hub in that it provides the means to interconnect multiple computers on a LAN using twisted pair wiring or fiber. Ethernet switches come in 10 Mbps (10BASE-T) and the newer Fast Ethernet 100MB/s (100BASE-T) varieties, or 10/100 auto-sensing models in which each port adapts to the speed of the computer or device attached to it. However, unlike a hub, when any computer addresses any other computer on the network the messages travel only between the two computers. Since messages between pairs of computers are NOT broadcast to the other computers on the switch, network traffic is greatly reduced. Switches can be used, in many applications instead of bridges and routers. Switches also allow networks to be extended indefinitely. When networks are based on Ethernet Hub technology the maximum distance between end stations is limited. For 10BASE-T, up to four hubs between any pair of devices is allowed. For 100Base-T the maximum is two. This is called the 'hop count.' A switch, however, turns the hop count back to zero. So partitioning a network into smaller and more manageable segments and linking them to the larger network using a switch removes these limitations.

Half duplex: Bi-directional communication between two network devices that takes place one direction at a time. Computers attached to an ordinary hub communicate with each other in a half-duplex fashion.

Full duplex: Bi-directional communication between two network devices that takes place both directions simultaneously. This doubles the throughput of that link so that a 100 Base-T, full-duplex link actually provides a 200 Mbps data rate. Servers or other computers attached to an Ethernet switch can be

configured to communicate in a full-duplex manner. Links between two switches or a switch and a hub are full duplex. However, computers attached to the hub communicate in a half-duplex fashion.

Network Configuration

There are many ways to configure a Local Area Network (LAN.) Usually we do not have the luxury of starting out fresh. Very often a corporate network is in place with legacy (read 'old') hardware that has to remain, be supported and not interfered with. The following depicts the connectivity rules for both the legacy 10 Mbps (Ethernet) and 100 Mbps (Fast Ethernet) segments.

10 Mbps Ethernet Segment

Between any two computers in the same 10 Mbps segment, there may be up to 4 hubs with 5 cables links in series.

Maximum Cable Length

Cable Type	Maximum Length
Twisted Pair, Categories 3,4,5	100 m (328 ft.)

Note: For any new installations use category 5 or better.

100 Mbps Fast Ethernet Segment

Rule for Class I Hubs

Between any two computers in the same 100 Mbps segment, there may be only 1 Class I hub with 2 cable links.

Rule for Class II Hubs

Between any two computers in the same 100 Mbps segment, there may be 2 Class II hubs with 3 cable links.

Maximum 100Base-T Network Diameter

Qty. - Hub Type	Cat 5 Twisted Pair
1 - Class I	200 m (656 ft.)
1 - Class II	200 m (656 ft.)
2 - Class II	205 m (672 ft.)

Maximum 100 Base-T Cable Length

Cable Type	Connecting	Max. Length
Cat. 5 Twisted Pair	Any two devices	100 m (328 ft.)
Fiber	Switch to Switch, Server or Workstation - Half duplex	412 m (1,352 ft.)
Fiber	Switch to Switch, Server or Workstation - Full duplex	2 km (6,5467 ft.)