D-Link®

DFE-916D
DFE-916Dx
Ethernet/Fast Ethernet
Dual-Speed Stackable Hub Series
User's Guide

Wichtige Sicherheitshinweise

1. Bitte lesen Sie sich diese Hinweise sorgfältig durch.

2. Heben Sie diese Anleitung für den spätern Gebrauch auf.

3. Vor jedem Reinigen ist das Gerät vom Stromnetz zu trennen. Vervenden Sie keine Flüssig- oder Aerosolreiniger. Am besten dient ein angefeuchtetes Tuch zur Reinigung.

4. Um eine Beschädigung des Gerätes zu vermeiden sollten Sie nur Zubehörteile verwenden, die vom Hersteller zugelassen sind.

5. Das Gerät is vor Feuchtigkeit zu schützen.

6. Bei der Aufstellung des Gerätes ist auf sichern Stand zu achten. Ein Kippen oder Fallen könnte Verletzungen hervorrufen. Verwenden Sie nur sichere Standorte und beachten Sie die Aufstellhinweise des Herstellers.

7. Die Belüftungsöffnungen dienen zur Luftzirkulation die das Gerät vor Überhitzung schützt. Sorgen Sie dafür, daß diese Öffnungen nicht abgedeckt werden.

8. Beachten Sie beim Anschluß an das Stromnetz die Anschlußwerte.

9. Die Netzanschlußsteckdose muß aus Gründen der elektrischen Sicherheit einen Schutzleiterkontakt haben.

10. Verlegen Sie die Netzanschlußleitung so, daß niemand darüber fallen kann. Es sollete auch nichts auf der Leitung abgestellt werden.

11. Alle Hinweise und Warnungen die sich am Geräten befinden sind zu beachten.

12. Wird das Gerät über einen längeren Zeitraum nicht benutzt, sollten Sie es vom Stromnetz trennen. Somit wird im Falle einer Überspannung eine Beschädigung vermieden.

13. Durch die Lüftungsöffnungen dürfen niemals Gegenstände oder Flüssigkeiten in das Gerät gelangen. Dies könnte einen Brand bzw. Elektrischen Schlag auslösen.

14. Öffnen Sie niemals das Gerät. Das Gerät darf aus Gründen der elektrischen Sicherheit nur von authorisiertem Servicepersonal geöffnet werden.

15. Wenn folgende Situationen auftreten ist das Gerät vom Stromnetz zu trennen und von einer qualifizierten Servicestelle zu überprüfen:

    a) Netzkabel oder Netzstecker sint beschädigt.

    b) Flüssigkeit ist in das Gerät eingedrungen.

    c) Das Gerät war Feuchtigkeit ausgesetzt.

    d) Wenn das Gerät nicht der Bedienungsanleitung ensprechend funktioniert oder Sie mit Hilfe dieser Anleitung keine Verbesserung erzielen.

    e) Das Gerät ist gefallen und/oder das Gehäuse ist beschädigt.

    f) Wenn das Gerät deutliche Anzeichen eines Defektes aufweist.

16. Bei Reparaturen dürfen nur Orginalersatzteile bzw. den Orginalteilen entsprechende Teile verwendet werden. Der Einsatz von ungeeigneten Ersatzteilen kann eine weitere Beschädigung hervorrufen.

17. Wenden Sie sich mit allen Fragen die Service und Repartur betreffen an Ihren Servicepartner. Somit stellen Sie die Betriebssicherheit des Gerätes sicher.

Limited Warranty

D-Link warrants its hardware products to be free from defects in workmanship and materials, under normal use and service, for the following lengths of time from the date of purchase from D-Link or its Authorized Reseller:

Product Type	Warranty Period
Network adapters	Lifetime
Unmanaged and managed hubs (10Mbps)	Lifetime *
Unmanaged hubs (100 Mbps)	Lifetime *
Managed hubs (100 Mbps)	One year
* Power supply and fans in these devices	One year
Other hardware products	One year
Spare parts and spare kits	90 days

If a product does not operate as warranted during the applicable warranty period, D-Link shall, at its option and expense, (1) repair the defective product or part, (2) deliver to Customer an equivalent product or part to replace the defective item. All products that are replaced will become the property of D-Link. Replacement products may be new or reconditioned. Any replaced or repaired product or part has a ninety (90) day warranty or the remainder of the initial warranty period, whichever is longer.

D-Link shall not be responsible for any software, firmware, information, or memory data of Customer contained in, stored on, or integrated with any products returned to D-Link pursuant to any warranty.

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Warranty service may be obtained by contacting a D-Link office within the applicable warranty period for a Return Material Authorization (RMA) number. If a Registration Card has not been previously sent, proof of purchase, such as a copy of the dated purchase invoice, must be provided. Once an RMA number is issued, the defective product must be shipped back to D-Link prepaid, insured and wrapped in the original or similar shipping package to ensure that it will not be damaged during shipment. When returning the defective product to D-Link for service, the RMA number must be marked on the outside of the shipping package. Any product returned without an RMA number shall be rejected and sent back to the Customer, and D-Link reserves the right to have Customer bear the cost of sending back such products. A service charge may or may not be levied to Customer by D-Link. To find out if a service charge is levied or not, and the charged amount, read the RMA that is returned to Customer, or ask the D-Link office when an RMA is requested.

For Warranty Service:

To obtain an RMA number or warranty service, contact the D-Link office nearest you. A list of contact addresses for D-Link's international offices can be found in the back of this User's Guide. Your Warranty Registration Card needs to be filled-out and sent to your regional D-Link office.

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FCC Warning

This equipment has been tested and found to comply with the regulations for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this user's guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

CE Mark Warning

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

VCCI A Warning

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがありま す。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

TAIWANESE BCIQ A Warning

警 告 使 用 者

這是甲類的資訊產品 , 在居住的環境中使用時 , 可能會造成 射頻干擾 , 在這種情況下使用者會被要求採取某些適當的對 策.

TABLE OF CONTENTS

ABOUT THIS GUIDE

This guide discusses how to install and use your D-Link DFE-916D, or DFE-916Dx dual-speed stackable Ethernet/Fast Ethernet hub.

Conventions

As used in this guide, the term *hub*, unless otherwise noted, refers to the DFE-916D or DFE-916Dx with which this guide was packaged.

Overview of the User's Guide

♦ Chapter 1, *Introduction*. Provides information on Fast Ethernet networks and introduces your hub's features.

♦ Chapter 2, *Unpacking and Setup*. Helps you get started in setting up the hub.

♦ Chapter 3, *Understanding Indicators*. Describes all LED indicators on the hub's front panel. Understanding these indicators is essential to effectively using the hub.

♦ Chapter 4, *Making Connections*. Provides information on connecting to the hub's twisted-pair ports, stacking hubs, and uplinking hubs together.

♦ Chapter 5, *Network Configuration Examples.* Shows detailed implementation schemes for dual-speed hubs.

♦ Appendix A, *Cables and Connectors.* Provides specifications on the cables and connectors used with the hub.

♦ Appendix B, *Specifications.* Lists the hub's specifications.

1

INTRODUCTION

This chapter introduces your DFE-916D, or DFE-916Dx dual-speed stackable Ethernet/Fast Ethernet hub and gives some background information about the technology the hub uses.

Product Description

Your DFE-916D or DFE-916Dx is designed to allow easy integration and migration between 10-Mbps Ethernet and 100-Mbps Fast Ethernet.

The hub can operate with both IEEE 802.3 10BASE-T connections (twisted-pair Ethernet operating at 10 megabits per second) and IEEE 802.3u 100BASE-TX connections (twisted-pair Fast Ethernet operating at 100 megabits per second). All of the twisted-pair ports support NWay auto-negotiation, allowing the hub to automatically detect the speed of a network connection. This means you can connect all of your Ethernet and Fast Ethernet hosts to your hub (or a stack of hubs) without any rewiring required when a host is upgraded from 10 Mbps to 100 Mbps.

Each DFE-916Dx has a built-in switching circuit to allow communication between network end nodes operating at different speeds. The **SW Enable** indicator on the front panel of the hub shows when this switching circuit is able to operate. On a hub that

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does not have such a switching circuit, only end nodes operating at the same speed (10 or 100 Mbps) can communicate with each other, unless the hub is stacked with a hub that *does* have such a switching circuit.

Your hub has 16 twisted-pair ports and can be stacked together with other hubs in the same product family to a maximum of five hubs in a stack. A stack of five sixteen-port hubs gives a total of eighty Ethernet or Fast Ethernet ports. (Stacking is also referred to as daisy-chaining).

Because it conforms to the standards for both Ethernet and Class II Fast Ethernet repeaters, your hub (or a stack of hubs in the same product family) can also be "uplinked" together with other Ethernet and Fast Ethernet hubs or hub stacks to expand the network still further.

Product Features

The list below highlights your hub's features and specifications:

♦ Compatible with the IEEE 802.3 10BASE-T Ethernet and 802.3u 100BASE-TX Fast Ethernet industry standards for interoperability with other Ethernet and Fast Ethernet network devices.

♦ Ethernet connections support Category 3 or better twisted-pair cables.

♦ Fast Ethernet connections support both shielded twisted-pair and Category 5 unshielded twisted-pair cables.

♦ 16 NWay ports per hub for connecting stations to the network.

♦ Hubs with built-in switching circuitry (shown by the presence of a **SW Enable** indicator on the front panel)

automatically transfer packets between Ethernet and Fast Ethernet connections, allowing communication between end nodes operating at different speeds.

♦ LED indicators for power, 10-Mbps collision, 100-Mbps collision, connection speed, port status, and (on hubs with built-in switching circuitry only) switching circuitry status.

♦ Auto-partitioning for network protection.

♦ Data collision detection and handling.

♦ Preamble regeneration and signal retiming.

♦ Daisy-chaining ports for interconnecting up to five hubs to form one large repeater hub.

♦ **Uplink** jack for easy linking of other hubs or hub stacks to further expand the network.

♦ Optional brackets for mounting in a standard 19-inch equipment rack.

♦ Internal auto-adjusting power supply (100 to 240V, 50 or 60HZ).

Dual-Speed Ethernet Hub Technology Overview

Dual-speed Ethernet hubs have been developed to make it simpler to plan networks containing both 10-Mbps Ethernet and 100-Mbps Fast Ethernet technologies, especially when network hosts are being gradually migrated to new Fast Ethernet connections.

Ethernet and Fast Ethernet workgroups, also called collision domains, are configured in a star topology where all end-nodes (computers, servers, bridges, etc.) branch out from a central hub. Two hubs can also be 'uplinked' to each other to form a much

larger collision domain consisting of two linked stars. And collision domains can be easily interconnected through switching hubs and bridges to form a network large enough to encompass a high-rise building or campus environment.

A dual-speed hub is actually two repeaters in one housing. Any device that is plugged into the hub is automatically connected (by NWay) to the fastest repeater it can use. The 10-Mbps repeater receives Ethernet transmissions from any port connected to it, and retransmits them to all other ports operating at 10 Mbps. Similarly, the 100-Mbps repeater retransmits Fast Ethernet transmissions from ports operating at 100 Mbps to all other ports operating at the same speed as shown below.
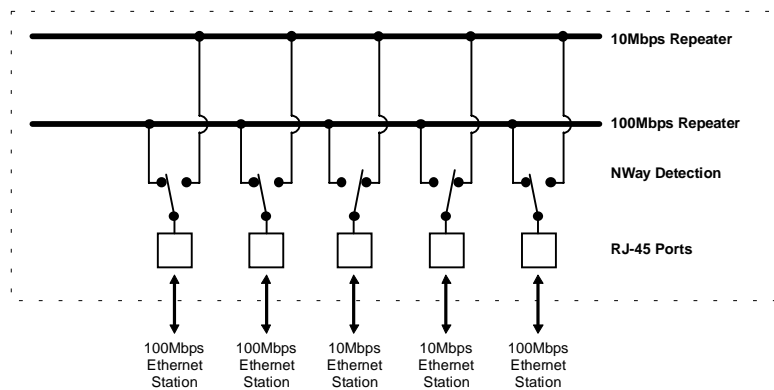
If there is a switching circuit in the hub (or in any hub in a stack), it will serve as a bridge between the two repeaters.
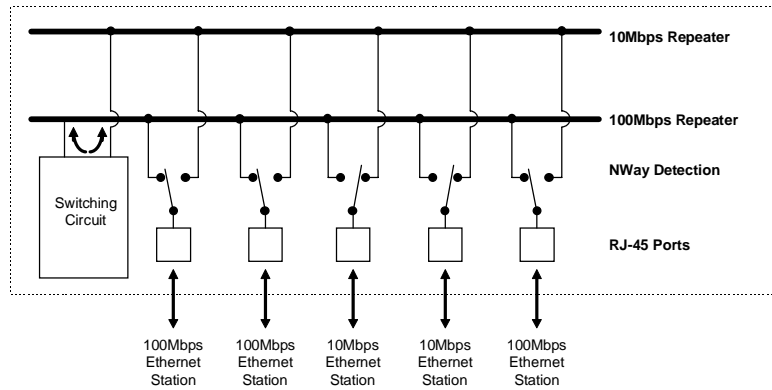
The switching circuit does not, however join the 10Mbps Ethernet collision domain with the 100Mbps Fast Ethernet collision domain; it only allows them to communicate. The two repeaters are two separate collision domains regardless of whether a switching circuit (found in the DFE-916Dx) is present.

If a DFE-916D series hub or hub stack is uplinked through a twisted-pair or Uplink port to another dual-speed or Fast Ethernet hub or stack, the hub will function as a Class II Fast Ethernet device and be subject to those connectivity rules. If it is uplinked to a 10BASE-T Ethernet hub or stack (10Mbps only) then it will function as a normal 10BASE-T Ethernet repeater and is then subject to those connection rules. And because it is a dual-speed hub with two separate repeaters, it can connect to both at the same time, counting as a repeater in each of the collision domains. For more detailed information, please refer to Chapter 4, *Making Connections*.

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UNPACKING AND SETUP

This chapter provides information on the unpacking and initial installation of your hub stack.

Unpacking

Open the shipping carton of your hub and carefully unpack the contents. The carton should contain the following items:

♦ One DFE-916D or DFE-916Dx dual-speed stackable Ethernet/Fast Ethernet hub

♦ One AC power cord, suitable for your area's electrical power connections

♦ One daisy-chaining cable

♦ Four rubber feet to be used for cushioning

♦ This *User's Guide*

Inspect the hub and all accompanying items. If any item is damaged or missing, report the problem immediately to your network equipment dealer.

Identifying External Components

This section identifies all the major external components of the hub. Both the front and rear panels are shown, followed by a description of each panel feature. The indicator panel is described in detail in the next chapter.

Front Panel

The figure below shows the front panels of all hubs in the product family that includes your hub. The first hub has a built-in switching circuit and the second one doesn't. Please identify your own hub's front panel in the figure before going on.
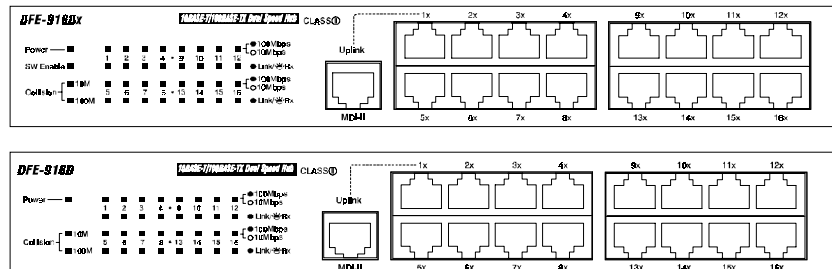
♦ **LED Indicator Panel**

Refer to the next chapter, *Understanding Indicators*, for detailed information about each of the hub's LED indicators.

♦ **Twisted-pair Jacks**

Use these jacks (labeled 1x - 16x) to connect stations to the hub. These are MDI-**X** (Medium-Dependent Interface, Cross-wired) jacks, which means you can use ordinary straight-through twisted-pair cables to connect user machines and servers to the hub through them. If you need to connect another device with an MDI-**X** jack, such as another hub or an Ethernet switch, you should use a crossover cable, or make the connection using the **Uplink** jack (described below). For more information about crossover connections, see the section entitled *Crossover Cables* on page 31.

♦ **Uplink Jack**

The **Uplink** jack is an MDI-**II** jack, which means you can connect the hub (or a hub stack) to a device with an MDI-**X** port using an ordinary straight-through cable, making a crossover cable unnecessary.

The port 1 **1X** jack and the **Uplink** jack are really the same port, except that their pinouts are different. **Do not use both the port 1 1X jack and the Uplink jack at the same time.**

Rear Panel
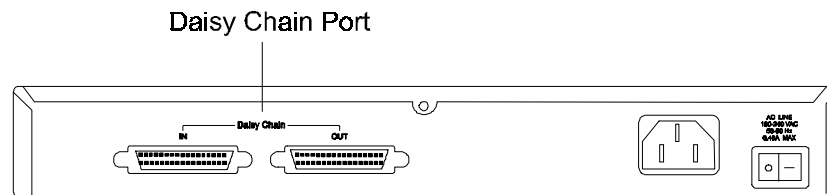
Daisy Chain Port

♦ **Daisy Chain IN Port**

When stacking your hub with one to four other hubs in the same series, this port should be connected to the Daisy Chain OUT port of the previous hub in the stack (usually placed immediately above it). A stack of five hubs can be created in this way. The first and last hubs in the stack use only one of the daisy-chaining ports, while the others use both.

♦ **Daisy Chain OUT Port**

This port works in conjunction with the Daisy Chain IN port (see above). Connect this port to the Daisy Chain IN port of the next hub in the stack (usually placed immediately below it), using the enclosed daisy-chaining cable.

♦ **Fan**

Provides air circulation and heat dissipation.

♦ **AC Power Connector**

For the power cord.

Installing the Hub

Installation

The site where you install the hub stack may greatly affect its performance. When installing, consider the following pointers:

♦ Install the hub stack in a fairly cool and dry place. See Appendix B, *Specifications*, for the acceptable temperature and humidity operating ranges.

♦ Install the hub stack in a site free from strong electromagnetic field generators (such as motors), vibration, dust, and direct exposure to sunlight.

♦ Leave at least 10 cm of space at the front and rear of the hub for ventilation.

♦ Install the hub on a sturdy, level surface that can support its weight. When installing the hub stack on a level surface, attach the rubber feet to the bottom of each device. The rubber feet cushion the hub and protect the hub case from scratches.

Rack Mounting

The DFE-916D series hubs can be mounted in an EIA standard-size, 19-inch rack, which can be placed in a wiring closet with other equipment. For information about the DFE-700B Rack Mounting Brackets, consult your computer hardware dealer. If you already possess the brackets, attach the mounting brackets at the hub's front panel (one on each side), and secure them with the provided screws.
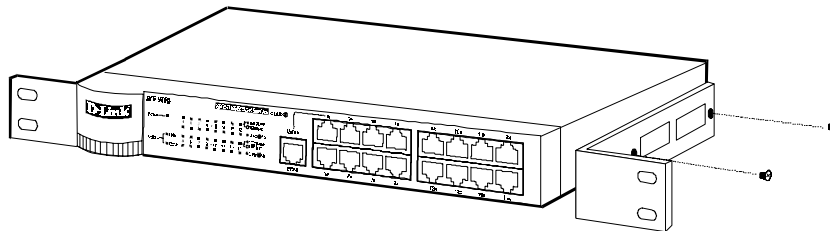
Then, use screws provided with the equipment rack to mount each hub in the rack. Follow the directions provided by the rack manufacturer.
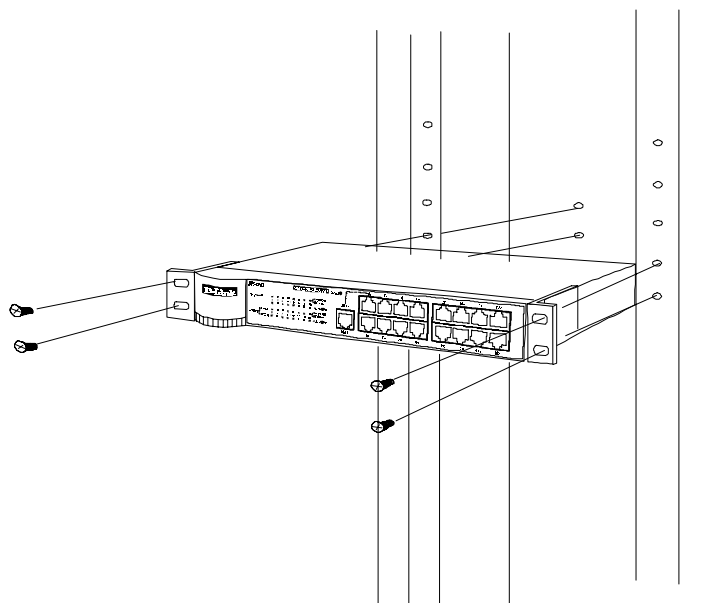
Connecting the Power Supply

Power is supplied to the stackable Fast Ethernet hub through an AC power cord. The AC power input voltage ranges from 100 to 240 volts AC. A power cord is included with the device.

UNDERSTANDING INDICATORS

Before connecting network devices to the hub, take a few minutes to look over this section and familiarize yourself with the front panel LED indicators of your dual-speed hub, depicted below.
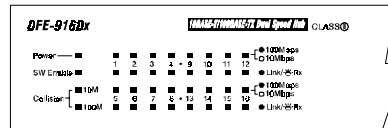
Sixteen-port hub with built-in switching circuit
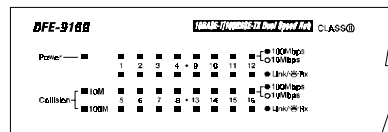
Sixteen-port hub without switching circuit

Hub State Indicators

♦ **Power Indicator**

This indicator shines green when the hub is receiving power; otherwise, it is off.

♦ **Collision—10M and Collision—100M Indicators**

These indicators indicate data collisions on the respective 10-Mbps Ethernet or 100-Mbps Fast Ethernet segments of the hub. (If several hubs are stacked or uplinked together, all of them should detect and indicate the same collision, since collisions span the entire network segment.) Whenever a collision is detected, the respective collision indicator will briefly blink amber.

SW Enable Indicator

The **SW Enable** (DFE-916Dx) indicator on a hub shows the presence of an active switching circuit in the hub. This indicator is not present on DFE-916D units, which do not have such a switching circuit.

A switching circuit transfers signals between 10-Mbps and 100-Mbps network segments. If a stack contains more than one hub with a built-in switching circuit, only one hub's **SW Enable** indicator will shine; the other hubs' switching circuits will automatically be disabled to prevent signal loops.

If a hub with a switching circuit is used alone (that is, not in a stack), its **SW Enable** indicator will shine all the time, even if all devices connected to the hub operate at the same speed.

Port Speed Indicators

There is a port speed indicator for each of the hub's twisted-pair ports. A port's speed indicator should shine green when a 100BASE-TX device is connected to the port, and remain dark if the port is unconnected or if a 10BASE-T device is connected.

Port Status Indicators

There is one port status indicator for each of the hub's twisted-pair ports. When a good link to a powered-up but idle device is detected on a port, the port's status indicator shines steadily. When packets are received from the device, the indicator blinks off and on.

If a powered-up device is connected to a port and the port's status indicator is unlit, the most probable cause is a cabling or connection problem (for example, wrong cable type or bad contact) or a device malfunction.

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MAKING CONNECTIONS

This chapter discusses how to connect end nodes, create a stack, and uplink two hubs (or two stacks, or a hub and a stack) together.

Connectivity Rules

Ethernet (10-Mbps) networks have the following connectivity rules:

♦ The maximum length of a twisted-pair cable segment is 100 meters. Cabling should be Category 3 or better.

♦ Between any two end-stations in a collision domain, there may be up to five cable segments and four intermediate repeaters (hubs, hub stacks, or other repeaters).

♦ If there is a path between any two end-stations containing five segments and four repeaters, then at least two of the cable segments must be point-to-point link segments (e.g., 10BASE-T or 10BASE-FL), while the remaining segments

may be populated segments (that is, they can be 10BASE-2 or 10BASE-5 segments with end nodes attached).

Fast Ethernet (100-Mbps) networks have the following connectivity rules:

♦ The maximum length of a twisted-pair segment (that is, the distance between a port on the hub and an addressable network device such as an end-station computer, server, or Fast Ethernet switch) is 100 meters. All cabling should be certified as Category 5 UTP or better (for example, Type 1 STP with RJ-45 plugs).

♦ The maximum diameter of a collision domain is 205 meters using two Class II hubs (or two hub stacks, or one hub and one stack) uplinked together.

♦ Between any two end-stations in a collision domain, there may be up to three cable segments and two Class II hubs (or two hub stacks, or one hub and one stack).

Hub-to-end-node Connections

After the hub is properly installed, it can support up to sixteen end-node connections.

Each Fast Ethernet connection requires either a Category 5 UTP cable or a Type 1 STP cable. These cables can be up to 100 meters long.

Each Ethernet connection requires a Category 3 or better UTP cable. These cables also can be up to 100 meters long. It is recommended that you use Category 5 cabling for all connections in order to make it easier to transition all stations to 100 Mbps.

You can connect any combination of end-station computers, servers, and other addressable network devices to the twisted-pair ports using straight-through twisted-pair cables. Do *not* use crossover cables. The following figure illustrates the pin assignments for a straight-through cable:
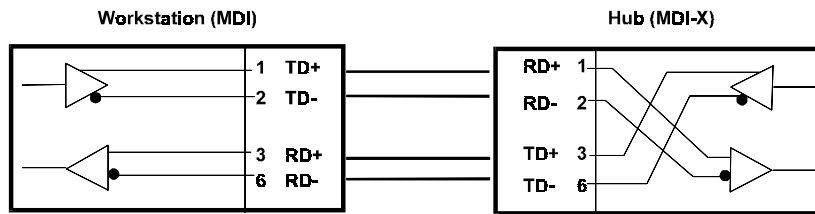
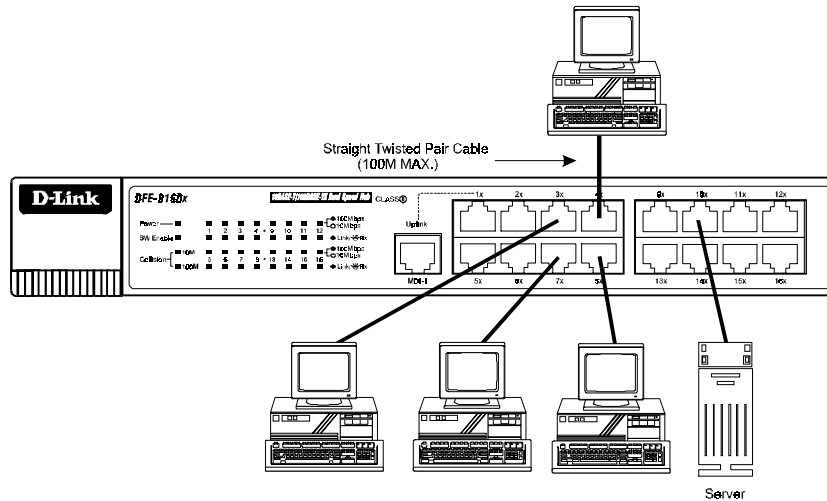When connecting an end-station computer or a server, the system being connected should have an Ethernet or Fast Ethernet network interface card with a twisted-pair port. The following figure shows typical connections between the hub and end nodes:

Note that an end-station can be plugged into any of the twisted-pair ports on the hub since they all function in an identical manner. The only exception is Port 1 (labeled 1x) which shares the

same data path as the Uplink port (which is normally used for linking two hubs using twisted-pair cabling). Thus, never use both the Uplink port and Port 1 on the same hub simultaneously.

You do not need to turn off the power to the end-station or the hub when plugging in cabling.

Creating a Stack

You can stack as many as five hubs together using the daisy-chaining ports to form one logical hub. In this configuration, the interconnected hubs constitute a single large repeater providing a maximum of 80 twisted-pair ports.

Never connect or disconnect a daisy-chaining cable while the power is on to the hub or to any other hub in the stack. **Always turn off power to the entire stack before adding or removing a hub or hubs.**

Use the supplied daisy-chaining cable to connect the **Daisy Chain OUT** port on the rear panel of one hub to the **Daisy Chain IN** port on the hub below it, as shown in the figure below. Repeat this procedure for each hub to be included in the stack. Note that the first hub's **Daisy Chain IN** port and the last hub's **Daisy Chain OUT** port must be left unconnected.
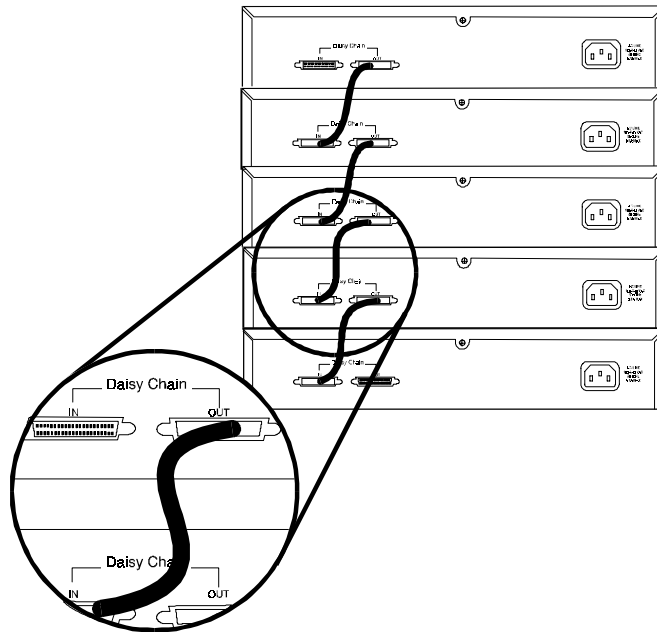
If any hub in the stack is equipped with a built-in switching circuit, network end nodes operating at different speeds throughout the entire stack will be able to intercommunicate; otherwise they will not. If more than one hub in the stack has a switching circuit, only one hub's **SW Enable** indicator will light up, and that hub will provide 10-Mbps/100-Mbps intercommunication capability for all end nodes connected to the stack.

Special notes about stacking hubs:

- We do not recommend stacking D-Link hubs with other brands of hubs. There may be differences in signal protocol between hubs of different brands that would make the network unstable or cause it to fail. Your hub should only be stacked with D-Link hubs that are both **stackable** and **dual-**

speed. Different types or brands of hubs must be added to the network using the Uplink method described below.

- Whenever stacking requires a converter cable (which may be necessary when stacking older models that have a different type of daisy-chain port on the rear of the hub), the maximum allowable hubs in a stack is reduced to four. Contact one of the D-Link offices listed in the back of this manual or your local D-Link dealer for purchasing information regarding this SCSI II D-sub 50 pin to D-sub 25 pin (model no. DE-726) converter cable.

- The daisy-chain connection used to stack hubs provides a complete connection between them. If hubs are stacked, do not also link them using the Uplink method described below.

Uplink Connection

You can link two hubs or hub stacks to each other using any of the normal twisted-pair (1x - 16x) ports or the Uplink port. Linking hubs using normal twisted-pair ports requires crossover twisted-pair cables; linking using one normal twisted-pair port and the Uplink port requires an ordinary straight-through twisted-pair cable. **The Uplink port is shared with Port 1 and they cannot be used at the same time.**

The following table describes different methods of linking hubs:

DEVICE	PORT USED	DEVICE BEING CONNECTED	PORT TYPE	CABLE TO USE
Hub	Normal	Hub or Switch	Normal	Crossover (X)
			Uplink	Straight-Through (||)
		Server (or PC)		Straight-Through (||)

		Normal	Straight-Through (||)
Uplink	Hub or Switch	Uplink	Crossover (X)
	Server (or PC)		Crossover (X)

A crossover cable is a twisted-pair cable in which the wires have been crossed. The figure below shows the pin assignments for an Ethernet or Fast Ethernet crossover cable:
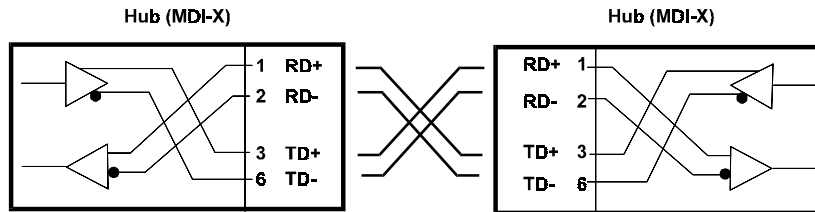
NOTE: *The port 1* **1X** *jack shares its circuitry with the* **Uplink** *jack. If you connect a hub to the* **Uplink** *jack, you cannot plug anything into the* **1X** *jack. And the reverse is also true; if anything is plugged into the* **1X** *jack, the* **Uplink** *jack cannot be used.*

When uplinking two dual-speed or Fast Ethernet hubs or hub stacks in this fashion, the maximum distance between any two end-stations in a collision domain is 205 meters. If the length of the longest hub to end-station connection on each hub is 100 meters, then the hub-to-hub connection is limited to 5 meters. However, if the longest hub-to-end-station connection is less than 100 meters, then the hub-to-hub connection can be up to 100 meters long. Almost any variation of cable lengths are possible as long as each segment is shorter than 100 meters and the total network diameter does not exceed 205 meters.

The DFE-916D and the DFE-916Dx are dual-speed hubs capable of operating at both 10Mbps (Ethernet) and 100Mbps (Fast-

Ethernet). The connection speed is automatically determined using the built-in NWay auto-detection technology, which will always choose the fastest possible connection speed. Thus, if a DFE-916D series hub or hub stack is linked through a twisted-pair or Uplink port to another dual-speed or Fast Ethernet hub or hub stack, the connection speed will be 100Mbps, which will limit the total number of hubs or hub stacks in the network to two and the total network diameter to 205 meters. If a DFE-916D series hub or hub stack is linked through a twisted-pair or Uplink port to a 10Mbps (only) Ethernet hub or hub stack, the connection speed will be 10Mbps, the maximum number of hubs/stacks in the network will be four, and the total network diameter can be 500 meters maximum (assuming the entire network is composed of twisted-pair wiring).

Since the DFE-916D series hubs are dual-speed hubs containing two separate repeaters, they can be part of a Fast Ethernet collision domain and a normal Ethernet collision domain at the same time, counting as one repeater in each.
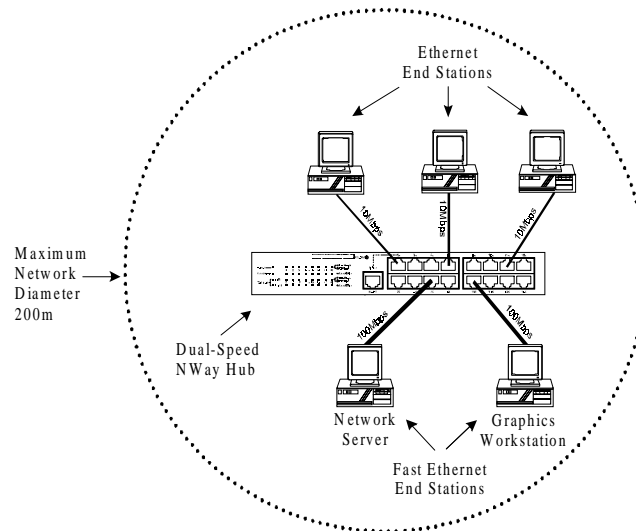
5

NETWORK CONFIGURATION EXAMPLES

This section provides examples on how you might use your stackable, dual-speed DFE-916D or DFE-916Dx hub.

All of the network configuration examples shown below assume the use of twisted-pair cabling.

Example 1 - Basic Configuration

This example shows one of the most basic installations for a dual-speed hub.

Points of note are:

♦ Star Topology

  All end-nodes branch out from the central hub. Also note that there is only one path data can take when traveling from one computer to another.

♦ Maximum Network Diameter is 200 meters

  This is due to the fact that twisted-pair cable segments have a maximum length of 100 meters.

♦ Dual-speed NWay hub

  Notice that computers with both 100 Mbps Fast Ethernet connections and 10 Mbps Ethernet connections are simultaneously connected to the hub. The particular port each computer is connected to is inconsequential, since the NWay feature automatically configures each port to the highest speed attainable by the device being connected.

♦ Inter-connectivity

If the hub does not have a switching circuit (DFE-916D) then computers can only communicate with other computers running at the same speed (i.e. 10 Mbps to 10 Mbps). If the hub has a switching circuit (DFE-916Dx) then all the computers connected to the hub can intercommunicate with each other regardless of their connection speed.

Example 2 - Expanded Configuration

This example shows how a dual-speed hub can be used to increase the size and speed of a network while providing backward compatibility for legacy Ethernet LAN's.
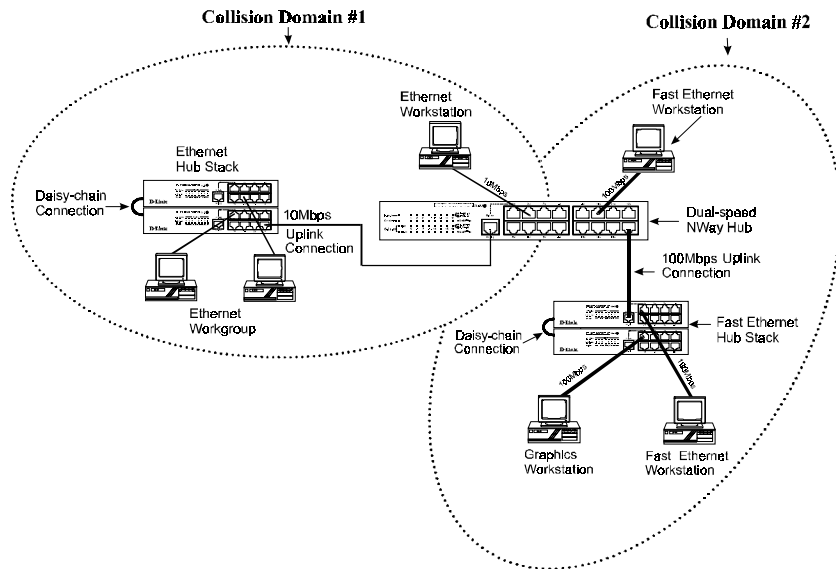
Some points of note:

♦ Star Topology

All end-nodes branch out from a central hub. This configuration shows three linked stars. Also note that there is only a single path data can take when traveling from any one computer to another.

♦ Uplink Connections

Since the hubs are connected through an Uplink port and a normal twisted-pair port, a normal straight through cable would be used (the exact same cable used to connect a computer to a hub). The Uplink connection speed is automatically determined by NWay which sets it at the highest speed attainable by both hubs.

♦ Collision Domain #1

This is a normal Ethernet collision domain running at 10 Mbps. It has a maximum network diameter of 500 meters and can contain up to 4 repeaters (it currently contains 2 repeaters: the Ethernet hub stack and the dual-speed hub). Also note that the Ethernet (10 Mbps) workstation connected to the dual-speed hub is part of this collision domain along with the other Ethernet elements.

♦ Collision Domain #2

This is a 100 Mbps Fast Ethernet collision domain having a maximum network diameter of 205 meters and a maximum of two repeaters (which it currently has; the Fast Ethernet hub stack and the dual-speed hub). The only way to increase the number of available ports in this collision domain is by stacking additional hubs (a stacked hub does not count as an additional repeater like an uplinked hub does).

♦ Dual-speed

The dual-speed hub resides in both collision domains, counting as a repeater in each one. A dual-speed hub actually contains two repeaters; a normal Ethernet repeater and a Fast Ethernet repeater.

♦ Inter-connectivity

If the dual-speed hub does not have a switching circuit (DFE-916D) then computers can only communicate with other computers in the same collision domain running at the same speed (i.e. 10 Mbps to 10 Mbps). If the hub has a switching circuit (DFE-916Dx) then all the computers in this network can communicate with each other. The presence of a switching circuit in the dual-speed hub will even allow the graphics workstation in domain #2 to communicate with the Ethernet workgroup stations in domain #1.

Example 3 - Maximum Configurations

This example shows the broadest possible installation for a dual-speed hub using twisted-pair cabling.
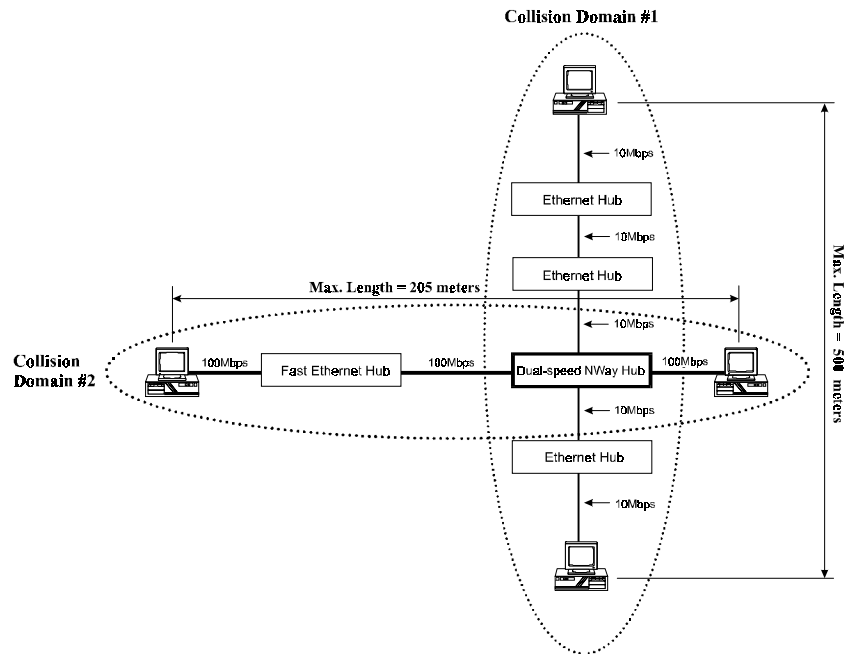
Note: The above diagram does not show all the computers that could be connected to the hubs; it only shows those computers needed to demonstrate maximum distances.

♦ Maximum Lengths

The values shown are for twisted-pair (UTP or STP) 10BASE-T or 100BASE-TX cabling.

♦ Maximum Connections

Collision domain #1 shows the maximum number of connections between any two end nodes in a 10 Mbps Ethernet collision domain: five cable segments and four repeaters.

Collision domain #2 shows the maximum number of connections between any two end nodes in a 100 Mbps Fast

Ethernet collision domain: three cable segments and two repeaters.

♦ Ways to further expand the network include:

Stacking — Assuming that all hubs are 16-port models and also assuming a 5 hub limit to stacking, the total number of ports per hub stack would be 80, and the total number of end nodes that could be connected to the above network would be 392 (after subtracting the ports needed for the uplink connections).

Cabling — Different types of cabling allow for cable segments longer than the 100 meter limit imposed on twisted-pair wiring. Thick coaxial cables, for example, can increase the maximum network diameter of an Ethernet collision domain to 2500 meters, and some fiber optic cable segments can be up to 10 km long.

Repeater Density — Collision domain #1, the Ethernet segment, can actually support more Ethernet hubs if they are directly uplinked to the middle two hubs in the series. Thus, a number of Ethernet hub stacks could have direct uplink connections to the dual-speed hub and the Ethernet hub immediately above it without violating the 5 cable segments and 4 repeaters rule governing the number of connections possible in an Ethernet collision domain. However, in all cases, the network diameter and cable length limitations still apply and ultimately, there can never be more than 1024 end nodes in any collision domain.

Bridging to Other Collision Domains — Bridges, routers and switches can link collision domains, thereby overcoming network diameter restrictions. This enables computers to communicate with each other across town, and even worldwide.

A

CABLES AND CONNECTORS

100BASE-TX Fast Ethernet Cables and Connectors

♦ Cable characteristics: Category 5 unshielded twisted-pair or EIA/TIA-568 compliant, 100-ohm shielded twisted-pair data cable with 0.4 to 0.6 mm (22 to 26 AWG) wires in two or four twisted pairs (only two pairs—that is, four wires—are used for 100BASE-TX).

♦ Maximum segment length: 100 meters

♦ Maximum network diameter: 205 meters

♦ Connectors: RJ-45
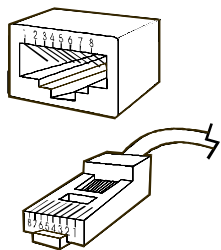
Straight Twisted-Pair Cable Pinouts		
Contact	MDI-X Signal	MDI-II Signal
1	RD+ (receive)	TD+ (transmit)
2	RD- (receive)	TD- (transmit)
3	TD+ (transmit)	RD+ (receive)
4	Not used	Not used
5	Not used	Not used
6	TD- (transmit)	RD- (receive)
7	Not used	Not used
8	Not used	Not used

Workstation (MDI)   Hub (MDI-X)
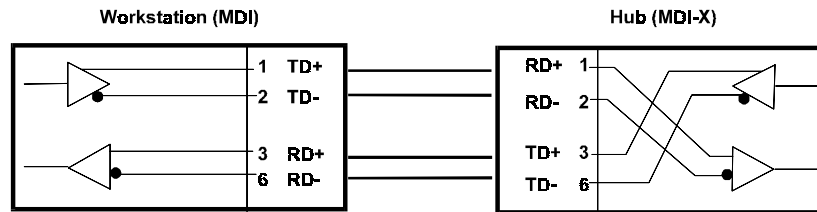
Crossover Cables

When making an uplink connection between one hub and another (or between a hub and a switch or bridge) using **X**-type jacks at both ends, you must use a crossover cable. In a crossover cable, two pairs of wires are switched at one end. Carry out the following steps to create a crossover twisted-pair cable:

1. Leave one end of the cable as-is, with the wiring on the RJ-45 connector unchanged. The wiring needs to be modified at one end only.

2. At the other end of the cable, connect wires 1 and 2 to contacts 3 and 6, respectively. Likewise, connect wires 3 and 6 to contacts 1 and 2. Refer to the following diagram:

Hub (MDI-X)   Hub (MDI-X)

B
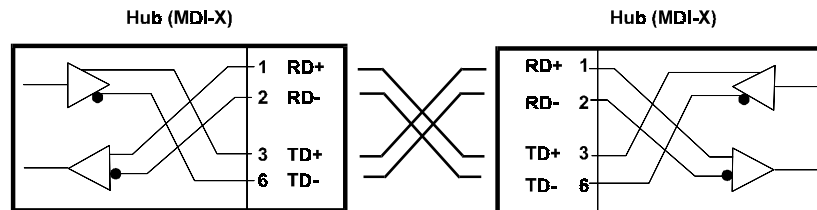
SPECIFICATIONS

General

Standards: IEEE 802.3 10BASE-T Ethernet repeater, IEEE 802.3u 100BASE-TX Fast Ethernet repeater (Class II); ANSI X3T9.5 twisted-pair transceiver

Topology: Star

Protocol: CSMA/CD

Network Data Transfer Rate: Fast Ethernet, 100 Mbps; Ethernet, 10 Mbps

Number of Ports: 16 - all dual-speed (10/100 Mbps)

Network Media: Ethernet: Category 3 or better UTP cable, maximum length 100 meters; Fast Ethernet: Category 5 UTP/STP, 100-ohm twisted-pair (maximum length 100 meters) for hub-to-station links; Cat 5 UTP, 100-ohm UTP/STP (maximum length 5 meters) for hub-to-hub linking

Daisy-chain Specifications

Number of Daisy-chained Hubs: Maximum five hubs per stack

Daisy-chain Connectors: Two D-type receptacles

Daisy-chain Cable: Proprietary cable with integral D-type connectors (included)

LED Indicators

Hub Status: Power, 10 Mbps collision, 100 Mbps collision. Hubs with built-in switching circuits have **SW Enable** indicators.

Port Status (per port): Speed (10/100 Mbps), connection status

Environmental and Physical

Power Supply: 100V to 240V AC, 50 or 60 Hz internal universal power supply

Power Consumption: maximum 24 watts

Dimensions (W × H × D): $324 \times 44.5 \times 231$ mm
                            $(12.76 \times 1.75 \times 9.1$ inches)

Weight: 2.6 kg (5.73 lb.)

Operating Temperature: 0° to 55° C

Storage Temperature: -25° to 55° C

Humidity: 5% to 95% (non-condensing)

DC Fan: $40 \times 40 \times 10$ mm

Emissions: FCC Class A, CE, VCCI Class A, C-Tick

Safety: UL, CSA, CE Mark

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Registration Card

Print, type or use block letters.

Your name: Mr./Ms _____

Organization:_____ Dept. _____

Your title at organization: _____

Telephone: _____ Fax:_____

Organization's full address: _____

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Country:_____Date of purchase (Month/Day/Year):_____

Product Model	Product Serial No.	* Product installed in type of computer (e.g., Compaq 486)	* Product installed in computer serial No.

(* Applies to adapters only)

Product was purchased from:

Reseller's name: _____

Telephone: _____ Fax:_____

Reseller's full address: _____

_____

1. Where and how will the product primarily be used?
☐Home ☐Office ☐Travel ☐Company Business ☐Home Business ☐Personal Use

2. How many employees work at installation site?
☐1 employee ☐2-9 ☐10-49 ☐50-99 ☐100-499 ☐500-999 ☐1000 or more

3. What network protocol(s) does your organization use ?
☐XNS/IPX ☐TCP/IP ☐DECnet ☐Others_____

4. What network operating system(s) does your organization use ?
☐D-Link LANsmart ☐Novell NetWare ☐NetWare Lite ☐SCO Unix/Xenix ☐PC NFS
☐3Com 3+Open ☐Banyan Vines ☐DECnet Pathwork ☐Windows NT ☐Windows NTAS
☐Windows '95 ☐Others_____

5. What network management program does your organization use ?
☐D-View ☐HP OpenView/Windows ☐HP OpenView/Unix ☐SunNet Manager ☐Novell NMS
☐NetView 6000 ☐Others_____

6. What network medium/media does your organization use ?
☐Fiber-optics ☐Thick coax Ethernet ☐Thin coax Ethernet ☐10BASE-T UTP/STP
☐100BASE-TX ☐100BASE-T4 ☐100VGAnyLAN ☐Others_____

7. What applications are used on your network?
☐Desktop publishing ☐Spreadsheet ☐Word processing ☐CAD/CAM
☐Database management ☐Accounting ☐Others_____

8. What category best describes your company?
☐Aerospace ☐Engineering ☐Education ☐Finance ☐Hospital ☐Legal ☐Insurance/Real Estate
☐Manufacturing ☐Retail/Chainstore/Wholesale ☐Government
☐Transportation/Utilities/Communication ☐VAR ☐Systemhouse/company ☐Other_____

9. Would you recommend your D-Link product to a friend?
☐Yes ☐No (why?) _____ ☐I don't know yet

10. Your comments on this product:

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