NDC 中華電訊科技股份有限公司
National Datacomm Corporation

User Manual

(Exhibit 4)

Plug-n-Switch™

10/100 Autosense Switch

Installation Guide

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FCC WARNING

This equipment has been tested and found to comply with the limits for a Class B Digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Table of Contents

List of Figures

Packing List

The package should contain the following items

- One Plug-n-Switch™ Autosense 10/100 Ethernet/Fast Ethernet
  Switch
- One AC Adapter
- This Installation Guide

Chapter 1: Introduction

NDC's Plug-n-Switch™ Series

NDC's Plug-n-Switch™ 10/100 Autosense switches are a family of smarter, faster, smaller and more reliable Ethernet/Fast Ethernet switches that fit into Small/Medium Business (SMB) and Small Office/Home Office (SOHO) environments. The series consists of a 5-port switch and an 8-port switch.

Plug-n-Switch™ Features

- Net-Smart - Fully automatic speed/duplex-mode/packet-forwarding mode setting
- Faster - Requires no bus arbitration
- Smaller - Less components required
- Reliable - System-on-a-chip design ensures reliability

Other key features include:

- Five or eight 10/100Mbps autosensing ports
- Half-duplex/Full-duplex auto-negotiation
- Automatic selection of Cut-Through, Safe Cut-Through, and Store-and-Forward packet forwarding modes(NSH810/NSH810SP support the Store-and-forward mode only)
- Less than 5 microsecond latency in Cut-Through mode
- Intelligent flow control:
  - Half-duplex : Backpressure jamming scheme
  - Full-duplex : 802.3x pause packet(for NSH810/NSH810SP only)
- Intelligent dynamic buffer management on all ports
- MAC address learning and aging
- Supports up to 16000 MAC addresses (5 port up to 8000)
- Power ON self-diagnosis and on-the-fly monitoring
- Comprehensive Power, Status, Diagnostic LEDs
- High-performance inter-ASIC trunking links ensure highest throughput
- Support IEEE 802.1D spanning Tree protocol(for NSH810SP only)

Chapter 2: Getting Started

Introduction

Many of today's Local Area Networks (LANs) are experiencing bandwidth
shortages. There are many reasons for this increase in the amount of data being
transmitted over the network: Internet traffic, ever larger applications being run
from central servers, increasing numbers of users on the LAN, and the inefficient
traffic patterns of many networks.

Efficient

Switching technology is increasing the efficiency and speed of networks, leading
to higher productivity. A workgroup switch performs a similar function to a hub's
in that it connects PCs to a network. Using a hub, network data is broadcast over
the entire network, clogging bandwidth with data that is possibly only required by
a single PC. A switch makes a temporary dedicated circuit between the client and
the destination. It sends information directly from the port of origin to the
receiving port, establishing a direct line of communication between two ports and
maintaining simultaneous links between other ports. Switches enable you to
connect either a shared segment (a workgroup) or a dedicated connection (a power
user or server) to each port. Each switch port works in a similar fashion to a
company telephone PBX: the PBX keeps internal calls within the company. An
external connection is made only when a call is made to a number outside the
company.

By deploying switches to existing networks the overall network performance can
be increased dramatically and immediately while little deployment changes are
required.

To connect Ethernet and Fast Ethernet segments, an auto-sensing switch is the
most cost-effective solution. Just connect the 10Mbps and 100Mbps networks to
the Plug-n-Switch™ and switch it on. The switch automatically sets itself up and
selects the optimum settings.

Self-Managing

All ports on the Plug-n-Switch™ Autosense series of switches fully self-manage
transmission speeds, duplex modes, and packet forwarding modes. Each port
automatically senses the speed of the device attached to it, either 10Mbps Ethernet
or 100Mbps Fast Ethernet. Each port also automatically negotiates the duplex
mode with the device attached to it, either half or full-duplex. In addition, each

port automatically switches transparently from one packet forwarding mode to another, according to the load on the network.

Server/Uplink Port

One port of the Plug-n-Switch™ series is assigned as a first priority port (Server/Uplink port). In extremely heavy data-traffic environments, traffic on the Server/Uplink port will get priority over the other ports. The priority port is usually used for connecting to a server or uplinking to another switch. Set the slider switch depending on whether you want to set the port as a Server or Uplink port. The priority port is located nearest the slider switch (see Figure 1).

Rear View

Figure 1. Server/Uplink Port

Duplex Modes

On a traditional 10Base-T/100Base-TX Ethernet network, nodes (PCs, servers, printers etc.) are connected to each other via a hub, repeater or concentrator, creating a broadcast domain. Each node is capable of receiving all transmissions from all other nodes, but only in a half-duplex mode. This means nodes cannot send and receive data simultaneously. Nodes on an Ethernet network listen before transmitting and only one node on the segment is allowed to transmit at one time.

This increases transmission time because if two nodes begin transmitting at the same time the information collides. They must both stop transmission and try again. Also, once a packet is sent from a node, the LAN will not transfer another packet until the first packet reaches its destination.

When only one LAN node is connected to a switched port it may operate in full-duplex mode. Full-duplex switching enables data to be sent and received simultaneously. If a single device resides on a switched port there is no requirement for collision detection and there is a suspension of MAC protocols.

Aggregate throughputs on 10Mbps Ethernet networks doubles to 20Mbps, and on 100Mbps networks doubles to 200Mbps, resolving traffic bottlenecks (e.g. such as a frequently accessed server).

Packet Forwarding Modes

Cut-Through

Cut-Through mode begins to forward packets of data to the destination port as soon as the packet destination address has been read by the switch. This ensures the shortest delay time, called latency, from one port to another for packet deliveries. However, Cut-Through mode delivers packets even if the packets are bad. To overcome this drawback, Store-and-Forward mode was developed.

Store-and-Forward

Store-and-Forward mode buffers incoming packets in memory until a complete packet has been fully received and a cyclic redundancy check (CRC) has been run and checked OK. Storing the complete packet in the buffer memory adds latency to the processing time but reduces the number of bad packets and transmission collisions that can slow down the performance of a network.

Safe Cut-Through

Safe Cut-Through mode was developed to take advantage of the best of Cut-Through and Store-and-Forward modes. Safe Cut-Through mode gets more detailed information from a packet (the first 64 bytes) before beginning to send it.

NDC's net-smart Plug-n-Switch™ supports all three modes, and manages the modes intelligently by monitoring the traffic status and determining the best mode for the current situation. For NSH810/NSH810SP, all packets are switched in Store-and-forward mode.

Self-Diagnosis

NDC's Plug-n-Switch™ performs diagnostic checks when it is powered ON, as well as performing constant background monitoring. Internal operations, traffic status, speed, and buffer allocations are all automatically checked and monitored. LEDs provide a visual guide to the status of the switch.
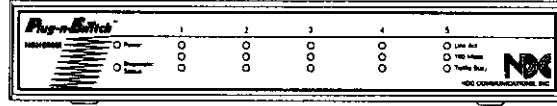
LED Status Indicators
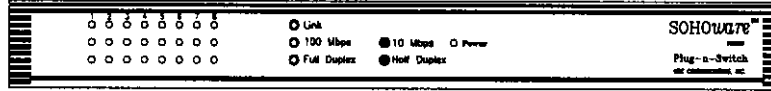
Front View

Figure 2. Plug-n-Switch™ LEDs(NSH500(M))

Figure 3. Plug-n-Switch™ LEDs(NSH810/NSH810SP)

The functions of the LED indicators are as follows:

NSH500(M)

LED Indicator	Color	Description
Power	Green	Power status indicator. Lit when receiving power
Diagnostic Status	Red	Diagnostic Status. Blinks if system fails. Normally OFF
Link/Act (one per port)	Green	Blinks to indicate that the port is transmitting/receiving data. OFF when no device is attached to the port
100Mbps (one per port)	Green	Indicates network speed on the port. Lit when 100Mbps. OFF when 10Mbps

| Traffic Busy (one per port) | Red | Blinks when a traffic bottleneck occurs on the port |

NSH810/NSH810SP

LED Indicator	Color	Description
Power	Red	Power status indicator. Lit when receiving power
Link (one per port)	Green	OFF when no device is attached to the port
100Mbps (one per port)	Green	Indicates network speed on the port. Lit when 100Mbps. OFF when 10Mbps
Duplex Mode (one per port)	Yellow	Indicates nwtwork duplex mode on the port. Lit when works in Full duplex. OFF when works in Half duplex .

Cabling

The 100Base-TX Fast Ethernet specification requires two-pair, Category 5 (EIA 568, CAT. 5) UTP or STP cabling. The 10Base-T Ethernet specification allows the use of two-pair, CAT. 3, CAT. 4, or CAT. 5 UTP cabling.

The maximum distance between any two devices connected with UTP cabling is limited to 100 meters whether running 10Base-T Ethernet or 100Base-TX Fast Ethernet.

Chapter 3: Using The Switch

To control network costs, the existing network infrastructure needs to be preserved as much as possible. It's not necessary to replace installed equipment in order to adopt new, faster, switch technologies. Using Plug-n-Switch™ switches is particularly attractive because the increased bandwidth they support can be achieved with little change to the existing equipment or cabling.

Placing your switch in the best location for your network environment is the key to achieving the most from the switch. Devices that talk mainly to each other should be kept on the same segment in order to confine their inter-segment chatter to that segment and away from the rest of the network. Devices that are accessed by more than one segment (e.g. a company server) are best placed on a dedicated connection to the switch. A single device on a segment also allows the use of full-duplex on that segment which will further increase the performance (see Duplex Modes, page 3). Note that the network adapter on the device must support full-duplex.

This section gives some examples of how to place the switch(s) so as to achieve the maximum benefit in networking performance.

Application Examples

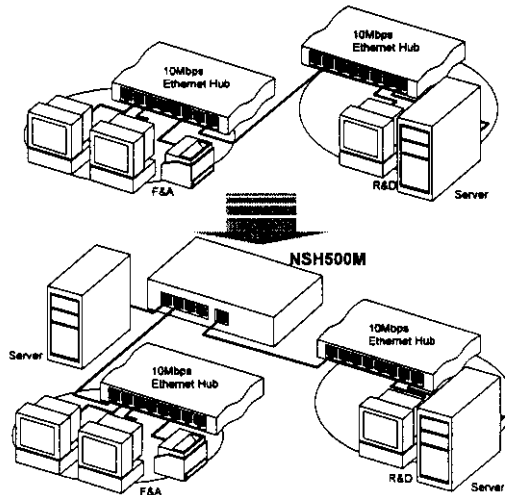### Example I: Shared 10Mbps LAN with near-term higher bandwidth requirements -

Figure 3. Near-Term Migration to a Switched 10Mbps LAN

Example I (**Figure 3**) illustrates a migration method from a traditional 10Mbps shared Ethernet LAN to a switched one. There is no change in the connections between the network nodes and hubs. A Plug-n-Switch™ switching hub is added to increase the bandwidth. Server connections are moved from a hub to a dedicated switching port.

Example II: Switched 10Mbps LAN to Mixed-10/100Mbps or Pure 100Mbps Fast Ethernet LAN –
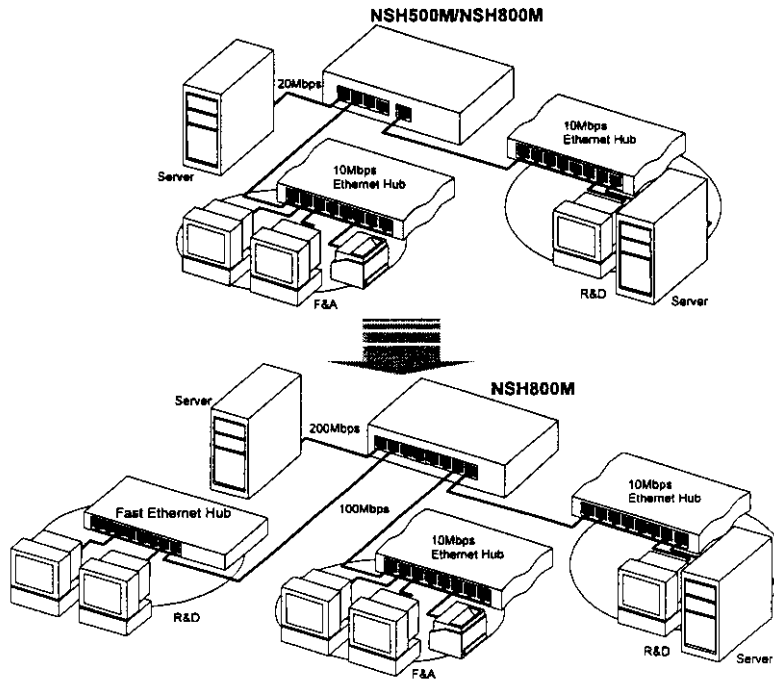

Figure 4. Mid-Term Mixed-10/100Mbps Switched LAN

Example II (**Figure 4**) illustrates a further migration, to a mixed 10/100Mbps LAN. Fast Ethernet hubs are added to provide shared 100Mbps bandwidth for power users. The placement of the Plug-n-Switch™ switches permits connection of both 10 and 100Mbps networks and creates a full-duplex 200Mbps connection to the company server. Most of the original hardware investments are preserved.

Note:
If your network does not support 100Mbps a change from 10Mbps to 100Mbps will necessitate the purchase of new hubs (and possibly cards unless the network interface cards installed on the network nodes are 10/100 cards).

Example III: Small/Medium-Business Company's Backbone –

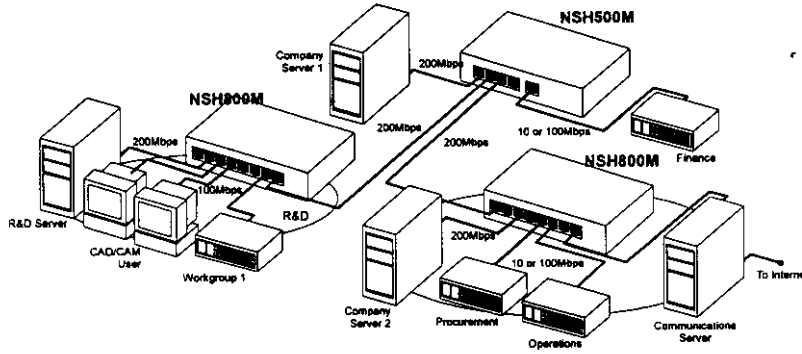**Figure 5. A Small Switched Mini Backbone**

In Example III (**Figure 5**) a small switched mini backbone running at 200Mbps is created. One or more servers can be added to meet the whole company's requirements. The previous hardware investments are still retained.

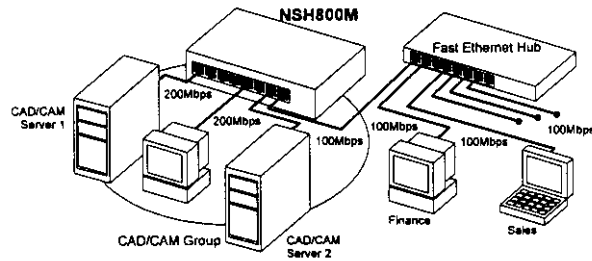# Example IV: Accelerator to Graphics-Oriented Environment –

Figure 6. Switching Hub Application for Graphics-Oriented Environments

In Example IV (**Figure 6**) heavy traffic is generated mainly inside the CAD/CAM workgroup. Other workgroups, like Sales or Finance, usually generate only a small part of the network traffic. The traffic from the CAD/CAM group to the company server is relatively small. Therefore the company server could be placed to share 100Mbps bandwidth with all groups without any problem.

In this scenario the CAD/CAM workgroup, the source of the heavy network traffic, is enclosed by the switching hub and CAD/CAM users can enjoy much faster speeds within their workgroup (200Mbps) whilst the rest of the network will enjoy faster speeds due to having the CAD/CAM traffic confined to the CAD/CAM workgroup. Productive efficiency is raised along with overall network performance.

Chapter 4: Installation Procedure

Plug-n-Switch™ Autosense 10/100Mbps 5-port and 8-port switches are fully self-managing and require no configuration setting. They dynamically learn the addresses of devices installed or added to the network and automatically detect the maximum speed the devices can support. Installation is as easy as connecting a few cables and switching the unit on.

Installation is a simple three-step procedure:

1. Connect one end of the included AC adapter to an AC outlet and the other end to the rear panel of the Plug-n-Switch™
2. Power on the Plug-n-Switch™ by pressing the power switch on the rear panel. The POWER LED will light
3. Connect the network cables from the 10Base-T/100Base-TX hubs or network devices. The cables can reach up to a maximum distance of 100 meters.

Note:
1. *The uplink port (see page 3) is used only when connecting to a hub or to another switch that does not have Uplink selected. That is, only one device of the two connecting devices need be switched to the "Uplink" position. When a Server/Uplink port is used to connect a switch to a server, do not select the Uplink option.*
2. *Plug-n-Switch™ does not support Spanning Tree Algorithm. Be sure that no loops are made in the network.*

Chapter 5: Troubleshooting

Should you experience a problem with the Plug-n-Switch™, the LED status will help you determine the problem. Follow the steps below according to the nature of the problem you encountered.

General Problems

The main power switch appears not to function

1. Make sure the power adapter is properly connected
2. Make sure the cables are wired correctly, and that you are using the correct cable type for 10Base-T or 100Base-TX (see cabling, page 6)
3. When connected to a working device, the LINK/ACT LED should be either lit or blinking
4. Check that the connecting device is functioning
5. If the switch is still not working after checking the previous points, use a pencil or similar object to press the RESET button on the rear panel.

Diagnostic status LED light is lit but the switch fails to function(For NSH500(M))

1. Unplug all network cables from the switch ports
2. Use a pencil or similar object to press the RESET button on the rear panel
3. One by one reconnect the device cables in order to find the one (a device attached to the port or the cable itself) that is causing the problem
4. Remove/replace the faulty item

A physical link is made but the status LED does not light

1. Check the cable connections are secure and undamaged
2. Check that both the devices are powered on

Traffic Busy LED blinks on some port(s) not on others(For NSH500(M)) only)

This situation often occurs because of inefficient network layout. To resolve the problem re-plan your network to allocate resources to where they are most needed in order to more evenly spread the networking load. Tune throughput by analyzing traffic flow. Then reallocate switch ports accordingly. See Chapter 3: Using The Switch, on page 7.

If the port is connected to a server via a dedicated Fast Ethernet connection, the problem indicates the server is being heavily accessed and that it's time to add another (local) server in order to remove the bottleneck.

Support From Your Network Supplier

If additional assistance is required call your Plug-n-Switch™ supplier for help. Please have the following information ready before you make the call.

1. LED status
2. A list of the product hardware (including revision levels), and if possible, a brief description of the network structure
3. Details of recent configuration changes, if applicable

Support from NDC

If you are unable to receive support from your Plug-n-Switch™ supplier, technical support is available from NDC. Contact your local NDC sales office.

USA:
Telephone: 1-408-7300888
Toll-Free (US only): 800-632-1118
FAX: 1-408-7300889
E-mail address: support@ndclan.com

Europe and Asia Pacific:
Telephone: 886-3-5783966
FAX: 886-3-5777989
E-mail address: techsupt@ndc.com.tw

Technical Specifications

Standards Compliance	IEEE 802.3 (10Base-T) IEEE 802.3u (100Base-TX) IEEE 802.3x pause packet flow control(for NSH810/NSH810SP) IEEE 802.1D Spanning Tree protocol(for NSH810SP)
Network Interfaces	NSH500(M): Five 10/100Mbps auto-negotiating ports NSH810: Eight 10/100Mbps auto-negotiating ports with 802.3x Flow control NSH810SP: Eight 10/100 Mbps auto-negotiating ports with 802.3x flow control and Spanning Tree protocol
Data Transmission Speeds	10Base-T: 10Mbps (20Mbps full-duplex) 100Base-TX: 100Mbps (200Mbps full-duplex)
Filter Forward Rate	10Base-T: 14,880 packets per second 100Base-TX: 148,810 packets per second
Packet Forward Mode	NSH500(M): Adaptive switching between Cut-Through, Store-and-Forward, and Safe Cut-Through NSH810/NSH810SP: Store-and-Forward
Latency	Less than 5 microseconds in Cut-Through mode
MAC Address	NSH500(M)- 8K NSH810/NSH810SP-16K
MAC address Learning and Aging	Automatic
LEDs	NSH500(M): One Power LED,One Diagnostic Status LED, Three status LEDs per port for LINK/ACT, Traffic Busy, and 10/100Mbps speed indication NSH810/NSH810SP: One Power LED, three status LEDS per port for LINK, SPEED, DUPLEX MODE indixation.
External Power Supply	Auto-switching. Input 110V/240V Output 5.4V/6A
Maximum Power Consumption	5-port - 2.2A/5.4V Max. 8-port - 3.2A/5.4V Max.
Physical Dimensions	*NSH500* Width - 9.60 inches (244 mm) Height - 1.73 inches (43.9 mm) Depth - 6.69 inches (170 mm) Weight - 21 oz (595 grams) *NSH500M* Width - 9.60 inches (244 mm) Height - 1.73 inches (43.9 mm) Depth - 6.50 inches (165 mm) Weight - 45.26 oz (1283 grams) NSH810/ Width - 8.71 inches (221.3 mm) NSH810SP Height - 1.18 inches (30.0 mm) Depth - 4.70 inches (119.25 mm) Weight - 29.2 oz (828.5 grams)
Standard Operating	Temperature: 0°C to 45°C

Environment	Non-condensing Humidity: 5% to 90%
Certification	FCC Class A
	CE Commercial
	VCCI Class A

EC DECLARATION OF CONFORMITY

For the following equipment:

Product Name : Plug-n-Switch
Model Number : NSH500/ NSH500M/ NSH810/NSH810SP

Produced by:

Manufacturer's : NATIONAL DATACOMM CORPORATION
Name
Manufacturer's : 2F, NO. 28, INDUSTRY EAST 9™ ROAD
Address   SCIENCE PARK, HSIN-CHU
                 TAIWAN, R.O.C.

is hereby confirmed to comply with the requirements set out in the Council Directive
on the Approximation of the Laws of the Member States relating to Electromagnetic
Compatibility (89/ 336/ EEC).
The product meets or exceeds the following EMC standards:

EN 50081-1: 1992
EN 50082-1: 1992

EN 60555-2: 1987
EN 55022: 1987/ CISPR 22:1996

EN 61000-4-2: 1995/ IEC 1000-4-2
EN 61000-4-3: 1996/ IEC 801-3: 1984
EN 61000-4-4: 1995/ IEC 1000-4-4

The manufacturer/importer is responsible for this declaration:

Company Name   : NDC (EUROPE) CO., LTD
Company Address : 1, EARLSFORT CENTRE,
                  HATCH STREET,
                  DUBLIN 2, IRELAND

Person authorized to make this declaration:

Name   : CHIN-TU WU
Position/Title : MANAGING DIRECTOR

_____   _____
Date   Legal Signature