

NDS/1000

Hardware

Manual



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NDS/1000

Hardware

Manual

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Revision History

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12/16/2005	E-1	First draft
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x/x/x	E-3	Third draft – added embedded info

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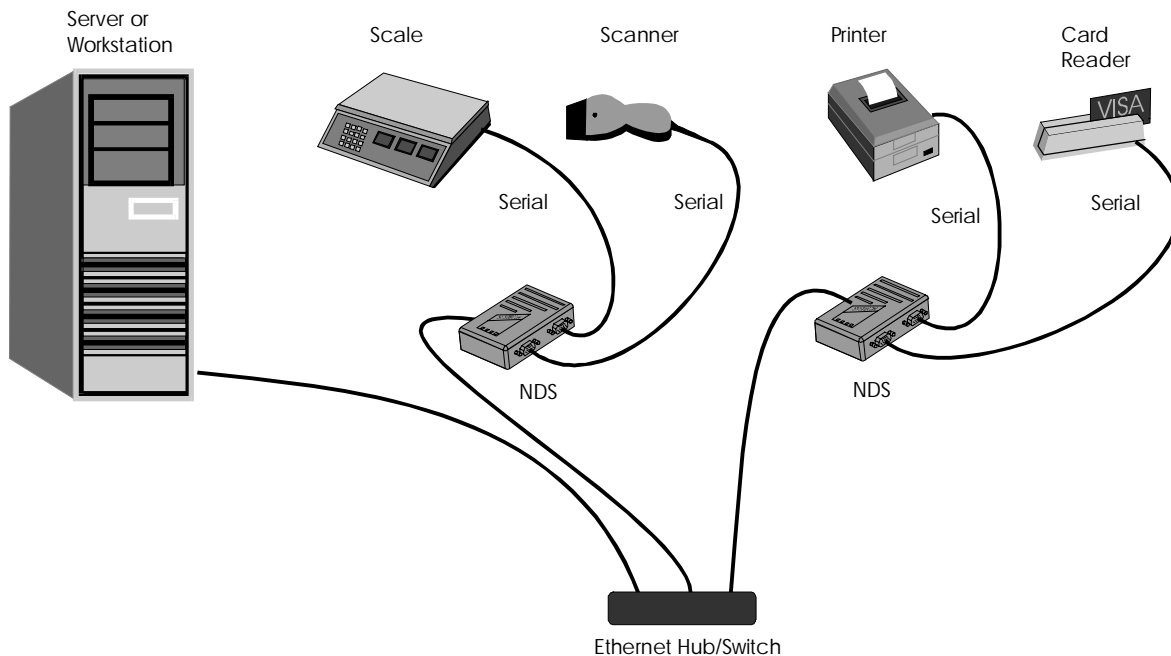
Agency Notifications

Table of Contents

CHAPTER 1: OVERVIEW	3
NDS Features	3
Description of NDS Models	5
Using the NDS	5
CHAPTER 2: INSTALLING THE HARDWARE	7
Overview	7
Planning the installation	7
NDS Panel Connectors	8
Connecting Devices to the NDS	10
NDS/1000 DB-9 Serial Operation	10
NDS/1000 RJ-45 Serial Operation	13
Ethernet LAN	17
Starting the NDS	18
Mounting the NDS	19
CHAPTER 3: TROUBLESHOOTING	25
Status LED	25
Serial Port LEDs	26
Ethernet LED	26
APPENDIX: SPECIFICATIONS	27
NDS Hardware Specifications	27
Environmental Specifications	27
Product Dimensions	27
Model Numbers	28
Ethernet cabling specifications	28

Chapter 1: Overview

The NDS/1000 port server provides communication between peripheral devices and computers connected to a network. When the NDS is connected to your LAN and to one or more peripherals, it manages network traffic, routing it to the correct device. For example, the network diagram below shows how the NDS might be used to allow one or more PCs to share expensive peripherals or to access peripherals that are located elsewhere on the local or remote network.



NDS Features

The NDS offers the following features and benefits:

- Easy web-based set up and configuration
- Open systems communications for multi-site data networks
- Can be used in a variety of data communications applications
- 1 or 2 DB-9 (with screw-down connectors) or RJ-45 serial ports
- RS-232 serial communication

- Standard single RJ-45, 10 BaseT Ethernet port
- High-speed serial connections (up to 115.2K baud)
- Operating system independent
- Complete remote diagnostics
- LEDs for each port, signaling port status and error conditions
- Industry standard interoperability
- Supports NativeCOM, allowing serial ports to appear as local Windows COM ports
- Supports generic (raw) TCP/IP access to serial ports without requiring special protocols or processing
- Reverse-telnet support for a variety of UNIX operating systems

Description of NDS Models

The NDS/1000 is available in several models. These products are functionally equivalent except for the number and type of serial port connectors.

Model	Number of Serial Ports	Type of Serial Connector
NDS/1111	1	DB-9
NDS/1112	2	DB-9
NDS/1114	4	DB-9
NDS/1121	1	RJ-45
NDS/1122	2	RJ-45
NDS/1124	4	RJ-45



Using the NDS

Using the NDS requires three steps:

1. Hardware installation
2. Configuration
3. Operation

Hardware installation is documented in this manual.

Refer to the **NDS Administrator's Guide** for configuration and operation.

Chapter 2: Installing the Hardware

This chapter describes installing the NDS hardware, including:

- Planning the installation
- Checking cables and connectors
- Sample configurations

Overview

Installing the NDS hardware includes the following steps:

1. Plan the installation

2. Connect the NDS port server to your network

The most common connection method is through the 10 BaseT RJ-45 connector (which is labeled LAN) to your Ethernet LAN, using a standard straight-through Ethernet cable to a hub/switch.

3. Connect your peripheral device(s) to the NDS port server

Attach each peripheral device (e.g., cash register, card reader, modem) to a serial port (one of the DB-9 or RJ-45 connectors).

4. Plug the AC power supply adapter into the NDS

Planning the installation

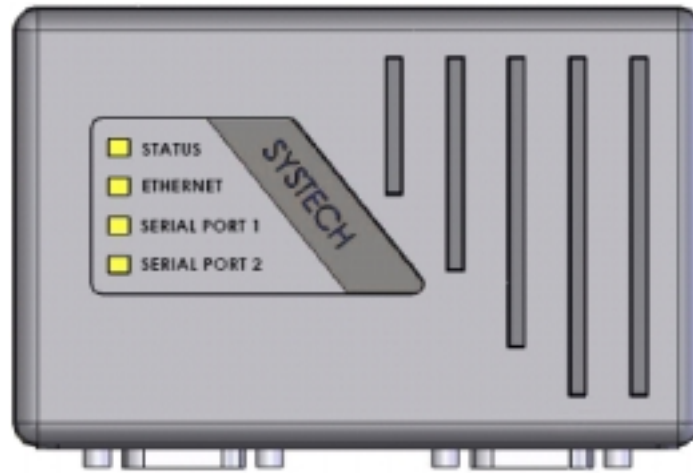
Before installing the NDS remote communications server, consider the following:

- How will you configure your network—what types of devices will you connect and where will they be located? Identify the distances at which each device will be located from the NDS server.
- Verify that the locations selected for devices do not exceed cable specifications.
- Is there an acceptable source of AC power available near each device's proposed location?

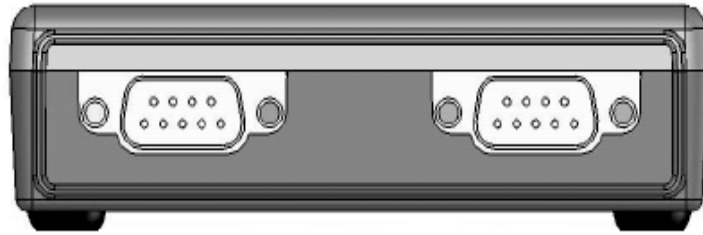
NDS Panel Connectors

The following figures show the connectors and LED locations for the NDS/1000 models. There are:

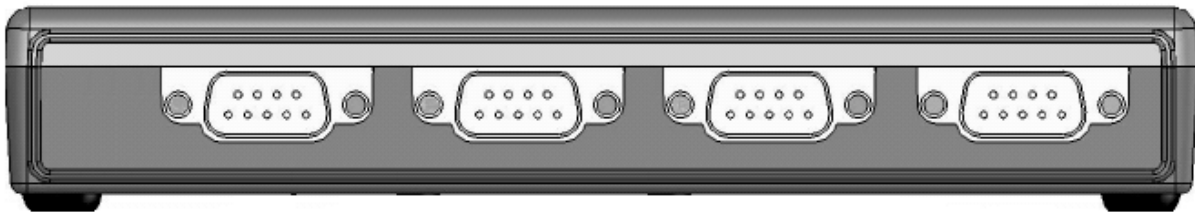
- three, four or six LEDs on the top of the unit
- one, two or four DB-9 or RJ-45 serial ports
- one RJ-45 Ethernet port



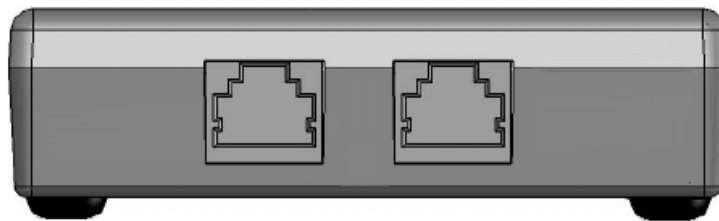
Top - LEDs



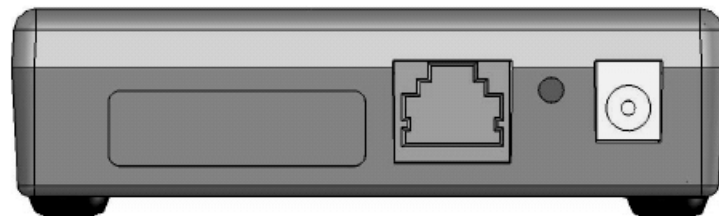
Front with DB-9 Serial Ports (2 ports)



Front with DB-9 Serial Ports (4 ports)



Front with RJ-45 Serial Ports



Back – Ethernet, Reset button and Power

The Status LED indicates the overall status of the device. The Serial Port LED(s) indicate the status of each serial port. The Ethernet LED indicates the status of the Ethernet connection(s). For information on interpreting the LED color and pattern displays, see **Troubleshooting**.

The reset button can be used to reboot the unit or to restore the factory default configuration on the unit. Depressing and releasing the button will reboot the unit.

Depressing and holding the "Reset" button in for about 5 seconds will restore the default (factory) configuration to the unit and then reboot the unit.

Connecting Devices to the NDS

NDS/1000 DB-9 Serial Operation

The NDS/1000 with DB-9 serial connectors uses an EIA-232 data terminal equipment (DTE) pinout. Table 2-1 lists the pinouts of the DB-9 ports used for EIA-232 serial communications.

DB-9 Pin Number	RS-232 Name	Direction	Signal Function
1	DCD	I	Signals module that remote device has a valid connection
2	RX	I	Serial data in, from remote device to NDS
3	TX	O	Serial data out, from NDS to remote device
4	DTR	O	Signals remote device that NDS is attached and powered on or may be used for flow control
5	GND		Signal ground
6	DSR	I	Signals module that remote device is attached and powered on or may be used for flow control
7	RTS	O	Flow control, to enable remote device to send data
8	CTS	I	Flow control, to enable NDS to send data on TX
9	RI	I	Ring Indicator

Table 2-1: EIA-232 DB-9 Pinouts

Figure 2-2, Figure 2-3, and Figure 2-4 show cable diagrams for three common configurations. The cable shown in Figure 2-3 may be used to connect modems to the NDS/1000. Modems should be configured to switch their carrier detect signal (CD) on and off in response to making and breaking telephone connections. This insures that the NDS/1000 terminates user sessions when they disconnect. The cable shown in Figure 2-4 can be used to connect a DB-9 terminal (or standard PC COM) port directly to the NDS/1000. The DB-9 to DB-9 terminal cable diagrammed in Figure 2-4 is a standard NULL modem connector, readily available in retail outlets. DB-9 to DB-9 modem cables (not diagrammed) require no special pinouts and use a straight-through cable. A 3-wire cable is shown in Figure 2-5.

DB-9 Pin Number		DB-25 Pin Number/Signal
1 DCD	← ● →	8 DCD
2 RX	← ————— →	2 TX
3 TX	————— →	3 RX
4 DTR	————— ● →	6 DSR
5 GND	—————	7 GND
6 DSR	← ● —————	20 DTR
7 RTS	————— →	5 CTS
8 CTS	← —————	4 RTS
9 RI	← —————	22 RI

Figure 2-2: DB-9 to DB-25 Terminal Cable

DB-9 Pin Number		DB-25 Pin Number/Signal
1 DCD	← —————	8 DCD
2 RX	← —————	3 RX
3 TX	————— →	2 TX
4 DTR	————— →	20 DTR
5 GND	—————	7 GND
6 DSR	← —————	6 DSR
7 RTS	————— →	4 RTS
8 CTS	← —————	5 CTS
9 RI	← —————	22 RI

Figure 2-3: DB-9 to DB-25 Modem Cable

DB-9 Pin Number		DB-9 Pin Number
1 DCD		4 DTR
2 RX		3 TX
3 TX		2 RX
4 DTR		1 DCD
5 GND		5 GND
6 DSR		6 DSR
7 RTS		8 CTS
8 CTS		7 RTS
9 RI		9 RI

Figure 2-4: DB-9 to DB-9 Terminal Cable

The NDS/1000 does not require the use of all 9 wires. Only the RX, TX, and GND signals are essential. DTR/DSR and RTS/CTS are only necessary for flow control. DCD (pin 1) is normally not required and RI (pin 9) is only required for modems that need a ring indicator. Figure 2-5 shows a minimal 3-wire cable using only RX (pin 2, data in), TX (pin 3, data out), and GND (pin 5, ground).

DB-9 Pin Number		DB-25 Pin Number/Signal
1 DCD		8 DCD
2 RX		2 TX
3 TX		3 RX
4 DTR		6 DSR
5 GND		7 GND
6 DSR		20 DTR
7 RTS		5 CTS
8 CTS		4 RTS
9 RI		22 RI

Figure 2-5: DB-9 to DB-25 3-wire Terminal Cable

NDS/1000 RJ-45 Serial Operation

The NDS/1000 with RJ-45 serial connectors uses a symmetrical EIA-232/RS-232 data terminal equipment (DTE) pinout. Table 2-6 lists the pinouts of the RJ-45 ports used for EIA-232 serial communications.

RJ-45 Pin Number	RS-232 Name	Direction	Signal Function
1	DCD (or DSR)	I	Signals module that remote device is attached and powered on or may be used for flow control. This pin is software configuration to be treated as DCD or DSR.
2	RTS	O	Flow control, to enable remote device to send data
3	SG		Signal return (NOT chassis ground)
4	TXD	O	Serial data out, from NDS to remote device
5	RXD	I	Serial data in, from remote device to NDS
6	SG		Signal return (NOT chassis ground)
7	CTS	I	Flow control, to enable NDS to send data on TXD
8	DTR	O	Signals remote device that NDS is attached and powered on or may be used for flow control

Table 2-6: EIA-232 RJ-45 Pinouts

To connect your EIA-232 device to the serial port of an NDS/1000, you need to determine whether the device connector wiring follows the standard for data terminal equipment (DTE) or for data communication equipment (DCE). In general, modems are wired as DCE devices and all other devices are wired as DTE; however, some equipment manufacturers may deviate from the standard. The manual for your device will contain information on the pinouts for the device. Figure 2-7 through Figure 2-10 show cable diagrams for the most common configurations. Figure 2-11 shows a minimal cable using 3 wires.

The cable shown in Figure 2-7 or Figure 2-8 may be used to connect most ASCII terminals or serial printers to NDS/1000 serial ports. The cable shown in Figure 2-9 or Figure 2-10 may be used to connect modems to the NDS/1000. Modems should be configured to switch their carrier detect signal (CD) on and off in response to making and breaking telephone connections. This insures that the NDS/1000 terminates users' sessions when they disconnect. Figure 2-11 shows a 3-wire cable.

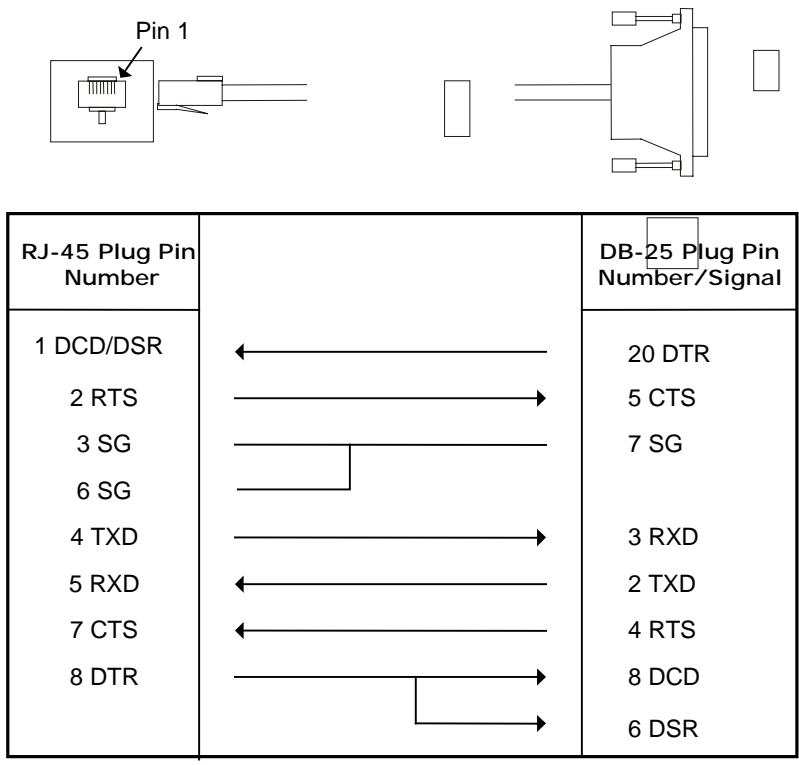


Figure 2-7: RJ-45 to DB-25 Terminal Cable

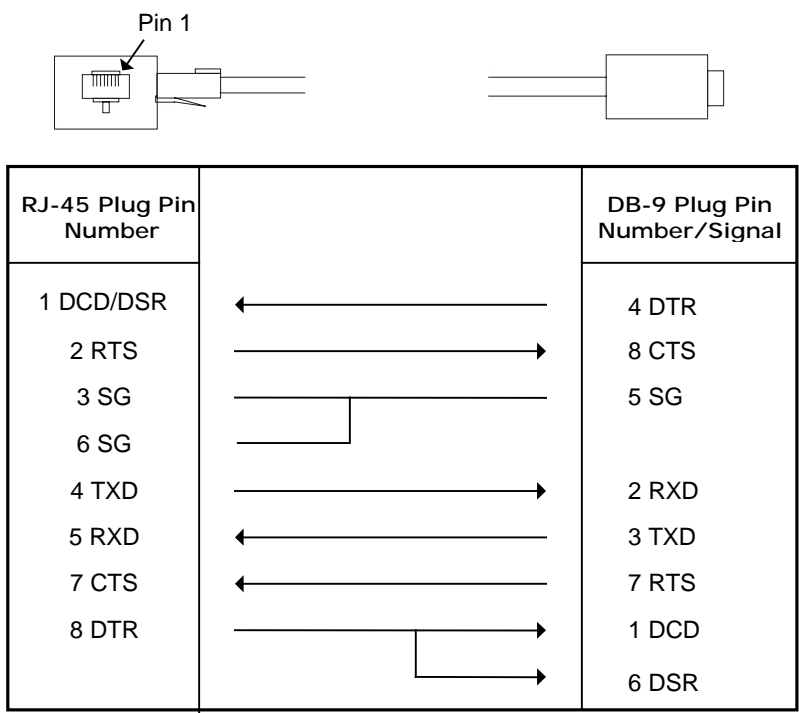
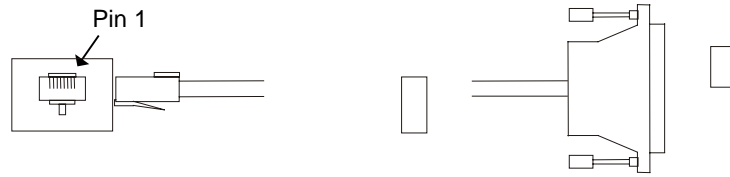


Figure 2-8: RJ-45 to DB-9 Terminal Cable



RJ-45 Plug Pin Number		DB-25 Plug Pin Number/Signal
1 DCD/DSR	←	8 DCD
2 RTS	→	4 RTS
3 SG	→	7 SG
6 SG	→	
4 TXD	→	2 TXD
5 RXD	←	3 RXD
7 CTS	←	5 RTS
8 DTR	→	20 DTR

Figure 2-9: RJ-45 to DB-25 Modem Cable



RJ-45 Plug Pin Number		DB-9 Plug Pin Number/Signal
1 DCD/DSR	←	1 DCD
2 RTS	→	7 RTS
3 SG	→	5 SG
6 SG	→	
4 TXD	→	3 TXD
5 RXD	←	2 RXD
7 CTS	←	8 RTS
8 DTR	→	4 DTR

Figure 2-10: RJ-45 to DB-9 Modem Cable

The NDS/1000 does not require the use of all 8 wires. Only the RX, TX, and GND signals are essential. DTR/DSR and RTS/CTS are only necessary for flow control. DCD (pin 1) is normally not required. Figure 2-11 shows a minimal 3-wire cable using only RX (pin 5, data in), TX (pin 4, data out), and GND (pin 3, ground).

RJ-45 Plug Pin Number		DB-25 Plug Pin Number/Signal
1 DCD/DSR		
2 RTS		
3 SG	—————→	7 SG
6 SG		
4 TXD	—————→	3 RXD
5 RXD	←—————	2 TXD
7 CTS		
8 DTR		

Figure 2-11: RJ-45 to DB-25 3-Wire Terminal Cable

RJ-45 to DB-25 or DB-9 adapters may be used with RJ-45 cables to create the cable configurations shown in Figure 2-7 through Figure 2-11. In most cases, you use “straight through” RJ-45 cables. If you use “crossover” RJ-45 cables, the RJ-45 pins will be reversed. Figure 2-12 and Figure 2-13 illustrate the difference between the two types, when constructed with flat 8-conductor wire.

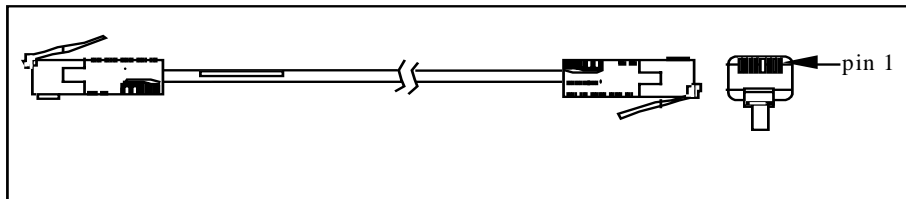


Figure 2-12: RJ-45 to RJ-45 Straight-through Cable

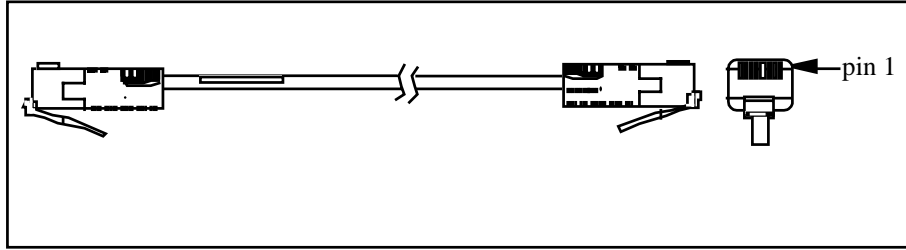


Figure 2-13: RJ-45 to RJ-45 Crossover Cable

Ethernet LAN

The NDS is connected to your LAN using an Ethernet port. The Ethernet port on the NDS is a standard 10 BaseT RJ-45 jack. It can be connected to an Ethernet hub/switch via a standard, straight-through Ethernet cable.

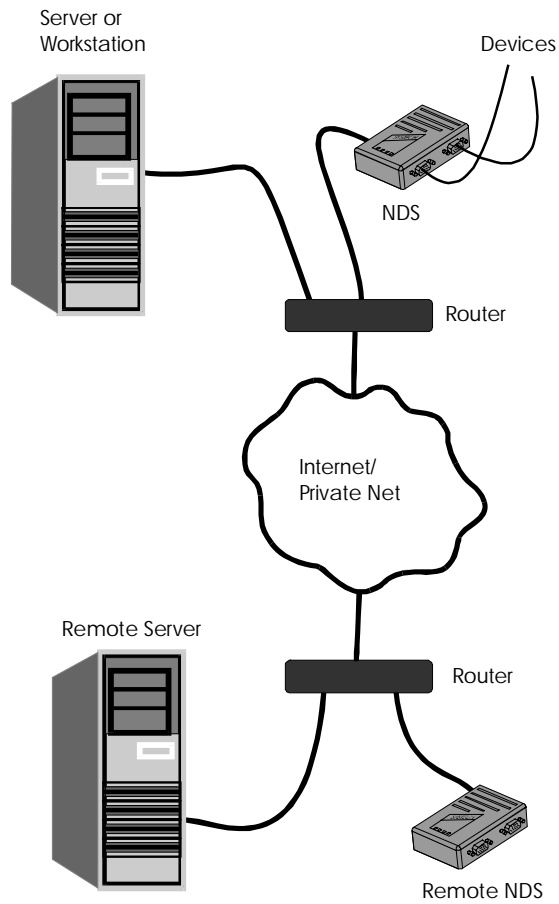


Figure 2-14: Network Topology Example

Starting the NDS

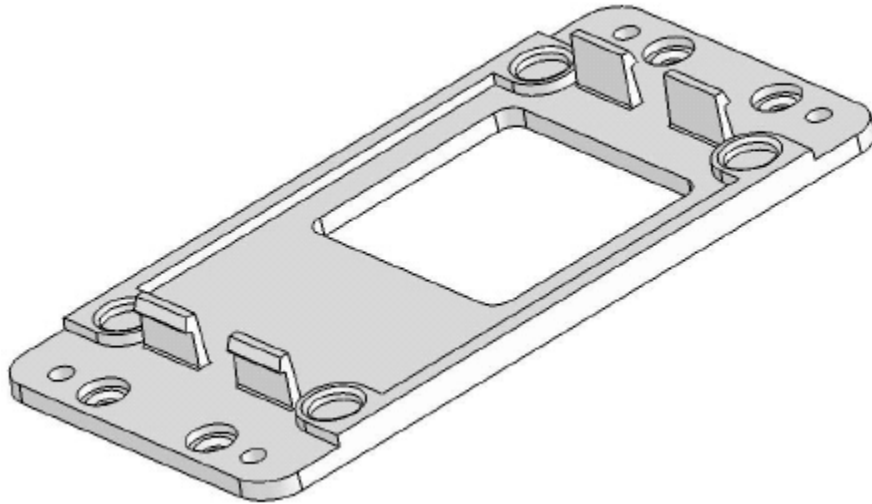
When the NDS is powered up, the LEDs will flash to indicate normal operation. The following LED colors and patterns will be displayed during normal startup, if no errors are detected.

- **Status LED** – initially this LED will be yellow, but will quickly turn green. If the status LED is solid green, then the NDS doesn't have a permanent IP address and is trying to obtain one from a DHCP server. If the LED is blinking green, it means the NDS has obtained an IP address and is ready to use. Red indicates a fatal error.
- **Ethernet LED** – this LED will either be off, green or blinking green/yellow. A green LED means that a good Ethernet link has been established and the unit is on the network. The LED will blink green/yellow to show network activity.
- **Serial port LEDs** – these LEDs will normally be either yellow or green. Yellow indicates a port that is not in use. Green indicates a port that is in use. The green LED will blink when data is transmitted or received. It will blink 2 times per second when data is continuously transmitted or received.

If any of the LEDs turn red, an error condition was detected. For a full description of the LED patterns, see **Troubleshooting**.

Mounting the NDS

The NDS includes a bracket that can be used to mount the NDS to a wall or shelf or to a DIN rail.

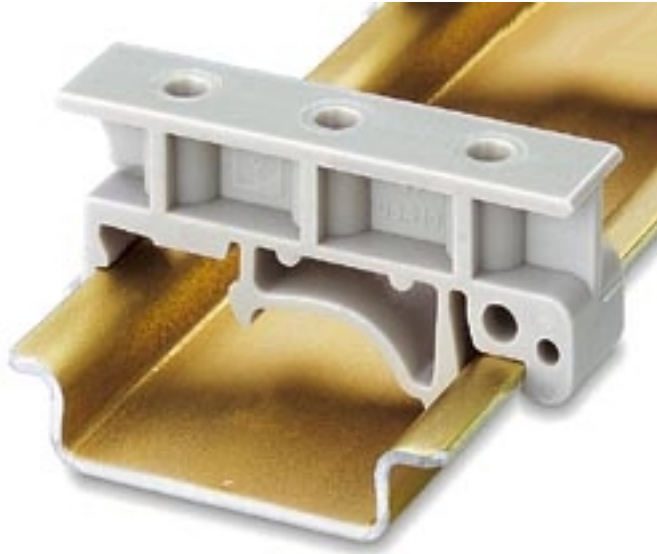


To mount the NDS to a wall or shelf:

- use the bracket as a template to mark the holes on the mounting surface
- drill pilot holes (metal or wood surface)
- or drill dry wall anchor holes and install anchors
- mount the bracket in the holes
- snap the NDS into the bracket

To mount the NDS to a DIN rail

- attach two of the optional DIN rail adapters to the recessed mounting holes in the bracket:



- snap the bracket to the DIN rail
- snap the NDS to the bracket

To remove the NDS from the bracket, apply pressure on one of the mounting tabs at a time using a flat object (for example a credit card or screw driver) and gently pry the NDS from each tab.

Chapter 3: Embedded Models

The NDS/1000 is available as an embedded product designed to be mounted inside a serial device, providing internal serial to IP conversion, effectively adding network capability to a device.

The embedded product connects via two 26-pin 2mm connectors to the host device and gets power from the host. The serial signals connect directly to the device's serial hardware, not using "drivers and receivers" but direct logic levels (available in either 3.3V or 5V).

Models

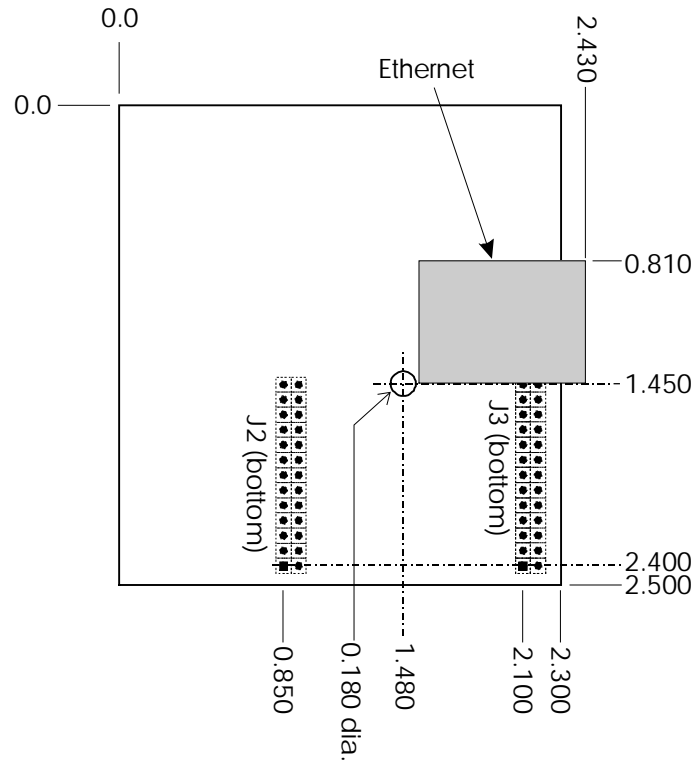
The embedded product is available with the following options:

- 1 or 2 port
- 3.3V or 5V power and logic

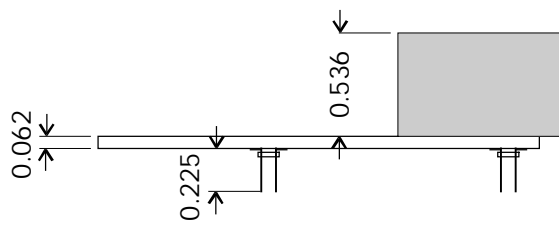
Model	Number of Serial Ports	Voltage
NDS/1101	1	5V
NDS/1102	2	5V
NDS/1161	1	3.3V
NDS/1162	2	3.3V

Physical

The embedded product board is 2.3 x 2.5 inches and a total of 0.823 tall. The host device connectors are two 26-pin 2mm connectors. There is a single mounting hole to fasten the board into the host device.



Viewed from Top



Viewed From Side

Electrical

The embedded product requires 425mA at 5.0 volts or 640mA at 3.3V.

Pinouts - Connector J2

Pin	Pin Name	I/O	Description
J2-1	GND		Signal Ground
J2-2	DC_VIN		+5V or +3.3V (depending on model) regulated power input
J2-3	P2TXD	O	Port 1 Transmit Data
J2-4	EP1_RXD	I	Port 1 Receive Data
J2-5	*P1_RTS	O	Port 1 Request to Send
J2-6	EP1_*CTS	I	Port 1 Clear to Send
J2-7	NC		NC
J2-8	*MR	I	Master Reset
J2-9	*LINKLED	O	Ethernet Link LED
J2-10	*ACTLED	O	Ethernet Activity LED
J2-11	*P1_DTR	O	Port 1 Data Terminal Ready
J2-12	EP1_*DSR	I	Port 1 Data Set Ready
J2-13	NC		NC
J2-14	NC		NC
J2-15	EP1_*RI	I	Port 1 Ring Indicator
J2-16	EP1_*DCD	I	Port 1 Data Carrier Detect
J2-17	SCL	I/O	I2C Serial Clock (do not use)
J2-18	SDA	I/O	I2C Serial Data (do not use)
J2-19	STAT_RED	O	Unit Status Red LED
J2-20	STAT_GRN	O	Unit Status Green LED
J2-21	P1RED	O	Port 1 Status Red LED
J2-22	P1GRN	O	Port 1 Status Green LED
J2-23	TX+_LAN	O	Ethernet TX Plus
J2-24	RX+_LAN	I	Ethernet RX Plus
J2-25	TX-_LAN	O	Ethernet TX Minus
J2-26	RX-_LAN	I	Ethernet RX Minus

Pinouts – Connector J3

Pin	Pin Name	I/O	Description
J3-1	NC		NC
J3-2	NC		NC
J3-3	P2TXD	O	Port 2 Transmit Data
J3-4	EP2_RXD	I	Port 2 Receive Data
J3-5	*P2_RTS	O	Port 2 Request to Send
J3-6	EP2_*CTS	I	Port 2 Clear to Send
J3-7	NC		NC
J3-8	NC		NC
J3-9	NC		NC
J3-10	NC		NC
J3-11	*P2_DTR	O	Port 2 Data Terminal Ready
J3-12	EP2_*DSR	I	Port 2 Data Set Ready
J3-13	NC		NC
J3-14	NC		NC
J3-15	EP2_*RI	I	Port 2 Ring Indicator
J3-16	EP2_*DCD	I	Port 2 Data Carrier Detect
J3-17	NC		NC
J3-18	NC		NC
J3-19	NC		NC
J3-20	NC		NC
J3-21	P2RED	O	Port 2 Status Red LED
J3-22	P2GRN	O	Port 2 Status Green LED
J3-23	NC		NC
J3-24	NC		NC
J3-25	DC_VIN		+5V or +3.3V (depending on model) regulated power input
J3-26	GND		Signal Ground

Chapter 4: Troubleshooting

The NDS has several LED indicators: **Status**, **Serial ports**, and **Ethernet**.

The LEDs use red, yellow, and green blinking combinations to indicate the status of each of the NDS's major components.

Status LED

The status LED indicates the overall status of the NDS. See Table 4-1.

Status LED Condition	Meaning
Solid Green	The unit is running, but it needs an IP address. It is trying to obtain one from DHCP/BOOTP.
Blinking Green	The unit has an IP address and is operating normally
Alternating Green/Red	If the "reset" button is being held in, this LED sequence means that the factory default configuration is about to be restored. If you do not want to restore the factory default, release the button before the sequence changes to Green/Yellow. Otherwise this means a serious system error occurred. See the system log for more details.
Alternating Green/Yellow	If the "reset" button is being held in, this LED sequence means that the factory default configuration was restored. You may release the button. Otherwise, this means that the current configuration is corrupt and that the factory default configuration is being used.
Blinking Yellow	The unit is booting.
Solid Red	Fatal error.
Off	No power, or the unit is inoperative

Table 4-1: Status LED Conditions

Serial Port LEDs

Each serial port has a Port LED that describes port activity. Table 4-2 describes the various Port LED states.

Port LED Condition	Meaning
Solid Green	Port is open, but idle
Blinking Green	Port is open, and data is being transmitted or received. When data is being continuously transferred, this LED will blink approximately 2 times per second.
Red Blinks	Data errors will cause periodic red blinks. Persistent red blinks may imply a configuration problem (incorrect baud rate, parity settings, etc.)
Solid Red	Port hardware has failed
Yellow	Port is closed
Off	No power

Table 4-2: Port LED Conditions

Ethernet LED

The Ethernet port has one LED that describes the state of the network connection on that port. Table 4-3 describes the various Ethernet LED states.

Ethernet LED Condition	Meaning
Solid Green	Ethernet link is good
Green/Yellow Blink	Network traffic was detected
Off	The Ethernet cable is bad or not connected or no power

Table 4-3: Ethernet LED Condition

Appendix: Specifications

NDS Hardware Specifications

- ARM7 50MHz CPU
- 4 Mbytes in-circuit boot flash and program memory
- 16 Mbytes SDRAM
- 10 Mbps Ethernet connection over 10 BaseT physical lines
- One or two asynchronous serial ports with modem control and surge suppression
- Asynchronous port data rates of up to 115.2 Kbps
- DB-9 or RJ-45 physical connectors
- RS-232 serial ports
- External 110 to 240 VAC power supply provides +5V DC regulated to NDS
- Status LEDs for each port

Environmental Specifications

- Operating temperature range: 0 to 50°C
- Storage temperature range: -10 to 70°C
- Humidity range: 10% to 90% noncondensing

Product Dimensions

The NDS models measure:

3.9 inches x 2.5 inches x 1.2 inches (100 mm x 64 mm x 30 mm)

Model Numbers

NDS/1111	One Port, DB-9
NDS/1112	Two Ports, DB-9
NDS/1121	One Port, RJ-45
NDS/1122	Two Ports, RJ-45

Ethernet cabling specifications

This section describes guidelines for using 10 Base-T twisted-pair cabling:

- Recommended cable is category 5 (CAT5 or CAT5E) unshielded solid copper twisted pair
- Ethernet cable pairs **must** be properly twisted: pins 1 and 2 must be a twisted pair, and pins 3 and 6 must be a twisted pair
- Maximum distance of a segment—from concentrator to node—is 100 meters (328 feet)
- Maximum of 5 segments between any two nodes

Index

1

10Base-T, cabling specifications, 26

3

3-wire diagram

NDS/1000, 12, 17

3-wire terminal, cable diagram, DB-9 to DB-25, 13

3-wire terminal, cable diagram, RJ-45 to DB-25, 17

A

asynch port

specifications, 25

C

cable diagram

3-wire terminal, DB-9 to DB-25, 13

3-wire terminal, RJ-45 to DB-25, 17

modem, DB-9 to DB-25, 11

modem, RJ-45 to DB-25, 16

modem, RJ-45 to DB-9, 17

NDS/1000, 17

terminal, DB-9 to DB-25, 11

terminal, DB-9 to DB-9, 12

terminal, RJ-45 to DB-25, 15

terminal, RJ-45 to DB-9, 16

cables, 14

cables, RJ-45 to DB adapter, 17

cabling, specifications, 26

carrier detect signal (CD), 14

configuration planning, 7

connector wiring

NDS/1000, 10, 14

D

data communication equipment (DCE), 14

data terminal equipment (DTE), 14

DB-9 serial port

diagram, 8

DB-9 serial ports

pinouts, 10

DB-9 to DB-25 3-wire terminal cable diagram, 13

DB-9 to DB-25 modem cable diagram, 11

DB-9 to DB-25 terminal cable diagram, 11

DB-9 to DB-9 terminal cable diagram, 12

DCE, 14

default configuration, 9

DTE, 14

DTE pinout

NDS/1000, 10

RJ-45, 14

E

EIA-232, 10, 14

ethernet network

cabling specifications, 26

F

factory default configuration, 9

front panel, diagram, 8

I

installation, hardware, 7

L

LAN

connecting NDS to, 18

LAN port

description, 18

LED

diagram, 9

overview, 23

start up and self-test, 19

M

modem signals

CD, 10

CD, 14

modem, cable diagram, DB-9 to DB-25, 11

modem, cable diagram, RJ-45 to DB-25, 16

modem, cable diagram, RJ-45 to DB-9, 17

P

panel, diagram, 8

pinouts

 NDS/1000, 10

 RJ-45, 14

port, DB-9

 diagram, 8

 pinout, 10

port, RJ-45

 diagram, 8

 pinout, 14

R

red LED, 19

restoring default configuration, 9

RJ-45 cable diagram, 17

RJ-45 port

 diagram, 8

RJ-45 ports, pinouts, 14

RJ-45 serial port

 diagram, 8

RJ-45 to DB adapters cable, 17

RJ-45 to DB-25 3-wire terminal cable diagram, 17

RJ-45 to DB-25 modem cable diagram, 16

RJ-45 to DB-25 terminal cable diagram, 15

RJ-45 to DB-9 modem cable diagram, 17

RJ-45 to DB-9 terminal cable diagram, 16

RS-232, 10, 14

S

self-test, 19

sessions, terminating on modem disconnect, 10

specifications, 25

start up, 19

T

terminal, cable diagram, DB-9 to DB-25, 11

terminal, cable diagram, DB-9 to DB-9, 12

terminal, cable diagram, RJ-45 to DB-25, 15

terminal, cable diagram, RJ-45 to DB-9, 16

troubleshooting

 LED indicators, 23

twisted-pair, cabling specifications, 26

W

wiring, 14