iNS/3000 and ixNS/3000

Hardware

Manual

SYSTECH
CORPORATION

Document number 80-001083-0

Revision E-2

Document part number 80-001083-0

Revision History

Date	Revision	Description
3/28/08	E-1	Beta release
6/23/08	E-2	Updated panel drawings. Added screw terminal descriptions.

Created 2008, and Protected Under the U.S. Copyright Act of 1976.

Copyright © 2008 SYSTECH Corporation

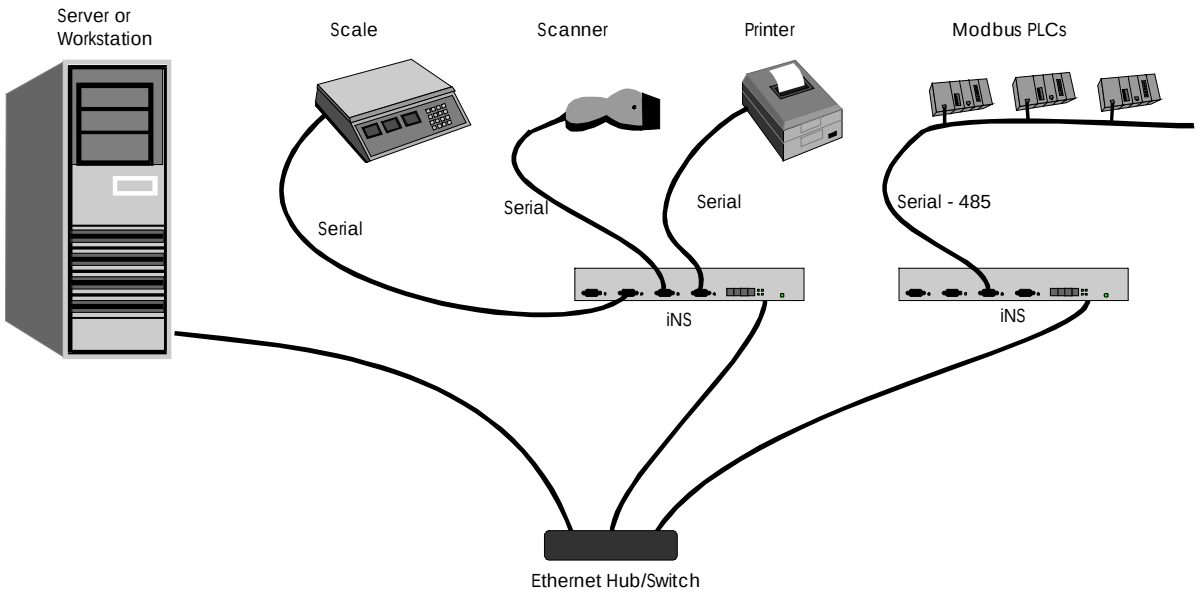
All Rights Reserved

This document is subject to change without notice.

Table of Contents

Chapter 1: Overview

The iNS Industrial Network port Server provides communication between peripheral devices and computers connected to a network. When the iNS 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 iNS 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.



iNS Features

The iNS 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, 2 or 4 serial ports
- DB9 connectors (with screw-down retainers) on all ports
- Removable screw terminal connectors on all ports
- RS-232 and RS-422/RS-485 software configurable on all ports
- Standard 15Kv ESD protection on ports
- Optional serial port 3Kv magnetic isolation (ixNS models)
- Extended temperature range: -40C to 85C
- Rugged, IP40-rated metal enclosure with multiple mounting options
- High-speed serial connections (up to 230.4K baud)
- Standard single RJ-45, 10/100 Base-TX Ethernet port
- 1Kv isolation on Ethernet ports
- Optional four-port RJ-45, 10/100 Base-TX Ethernet switch
- Operating system independent
- Complete remote diagnostics
- LEDs for each port, signaling port status and error conditions
- Industry standard interoperability
- Modbus TCP to Modbus RTU gateway capability
- Supports NativeCOM, allowing serial ports to appear as local Windows COM ports
- Supports generic TCP/IP access to serial ports without requiring special protocols or processing
- Standard support for LPR/LPD network printing under Windows and UNIX
- Telnet and reverse-telnet support for a variety of UNIX operating systems

---

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

Description of iNS/ixNS Models

The iNS is available with a variety of port and power configurations and with standard serial port protection (iNS) or extended serial port isolation (ixNS).

The model number describes the options included:

Model	Number of Serial Ports	Serial Port Isolation	Ethernet Connectors
iNS/3101	1	No	One 10/100TX
iNS/3102	2	No	One 10/100TX
iNS/3104	4	No	One 10/100TX
iNS/3202	2	No	Four 10/100TX
iNS/3204	4	No	Four 10/100TX
----------	----------	----------	----------
ixNS/3101	1	Yes	One 10/100TX
ixNS/3102	2	Yes	One 10/100TX
ixNS/3104	4	Yes	One 10/100TX
ixNS/3202	2	Yes	Four 10/100TX
ixNS/3204	4	Yes	Four 10/100TX

In addition, a suffix on the model number specifies the power option:

Power Suffix	Description
-E	External, 2.1 mm connector, Systech provided power supply – Input: 100-240 VAC, 50-60 Hz Output: 5 VDC, 2A Connector can accept 5-59 VDC, minimum 10 watts
-I	Internal, wide range input, AC power supply Input: 100-240 VAC, 50-60 Hz, 0.8A
-S	Screw terminal input Accepts 5-59 VDC, minimum 10 watts

Chapter 2: Installing the Hardware

This chapter describes installing the iNS hardware, including:

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

Overview

Installing the iNS hardware includes the following steps:

1. **Plan the installation**
2. **Connect the iNS port server to your network**

   The most common connection method is through the 10/100 Base-TX RJ-45 connector to your Ethernet LAN, using a standard straight-through Ethernet cable to a hub/switch.
3. **Connect your peripheral device(s) to the iNS port server**

   Attach each peripheral device (e.g., PLC, card reader, modem, etc) to a serial port (one of the DB-9 or screw terminal connectors).
4. **Plug the AC power supply adapter into the iNS**

Planning the installation

Before installing the iNS 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 iNS 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?

iNS Panel Connectors

The following figure shows the connectors and LED locations for the iNS models. There are:

- 1 to 4 serial ports with DB9 and screw terminal connectors
- 1 or 4 RJ-45 Ethernet ports

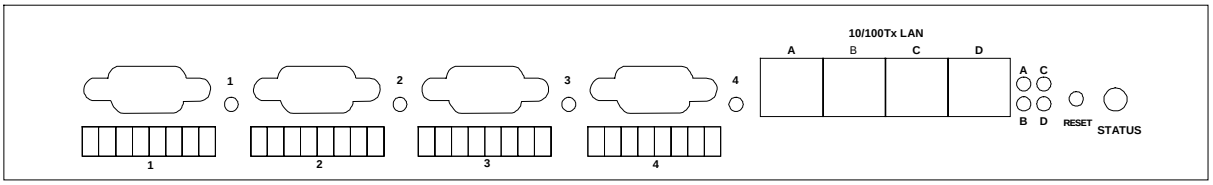


Figure 2-1: iNS Front Panel Connectors

The Status LED indicates the overall status of the device. The Port Status LEDs indicate the status of each serial port. The LAN LED(s) indicate 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 iNS

The iNS serial ports may each be independently configured via software, to operate in RS-232, RS-422 or RS-485 mode. The following sections describe the pinouts and cabling options associated with these different modes.

iNS/3000 RS-232 Operation

The iNS/3000 port server family uses an EIA-232 data terminal equipment (DTE) pinout on the serial ports. Table 2-1 lists the pinouts of the DB-9 and screw terminal ports used for EIA-232 serial communications.

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 iNS
3	TX	O	Serial data out, from iNS to remote device
4	DTR	O	Signals remote device that iNS is attached and powered on
5	GND		Signal ground
6	DSR	I	Signals module that remote device is attached and powered on
7	RTS	O	Flow control, to enable remote device to send data
8	CTS	I	Flow control, to enable iNS to send data on TX
9	RI	I	Ring Indicator (except on screw terminal connector)

Table 2-1: EIA-232 Pinouts

The screw terminal connectors for each port bring out the same signals as the DB-9 connectors with the exception of the RI signal that is only present on the DB-9. The screw terminal pins are numbered left-to-right, 1 through 8.

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 iNS/3000. 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 iNS/3000 terminates user sessions when they disconnect. The cable shown in Figure 2-2 can be used to connect a DB-9 terminal (or standard PC COM) port directly to the iNS/3000. 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.

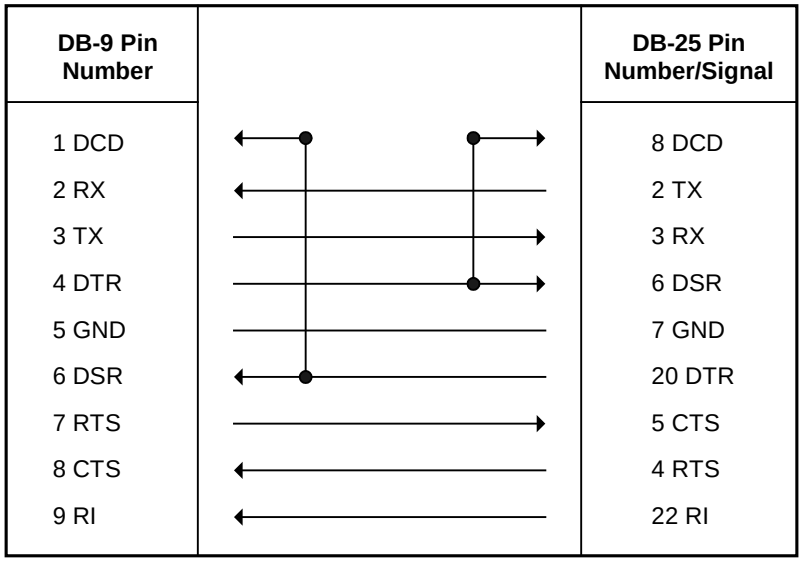


Figure 2-2: DB-9 to DB-25 Terminal Cable

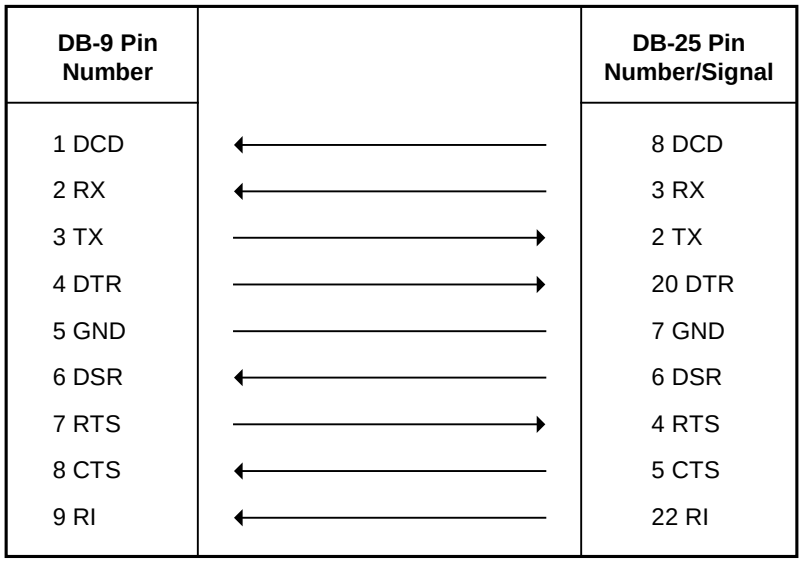


Figure 2-3: DB-9 to DB-25 Modem Cable

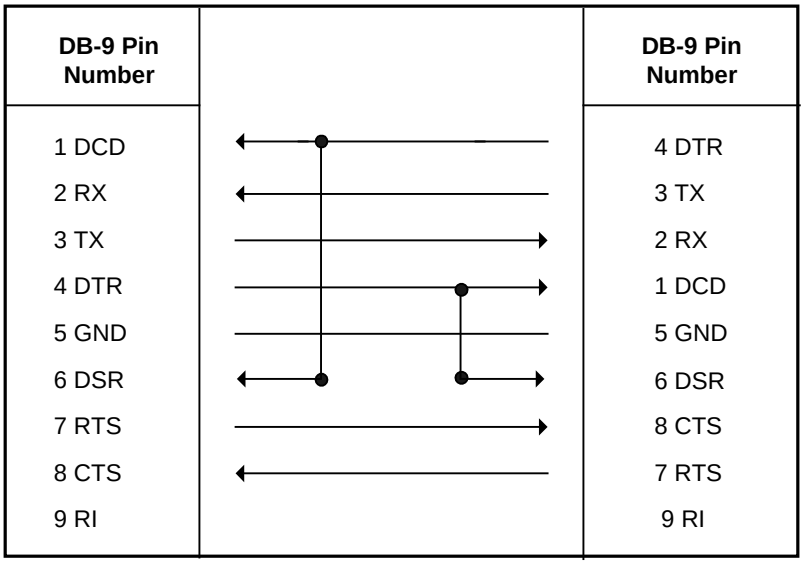


Figure 2-4: DB-9 to DB-9 Terminal Cable

The iNS/3000 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).

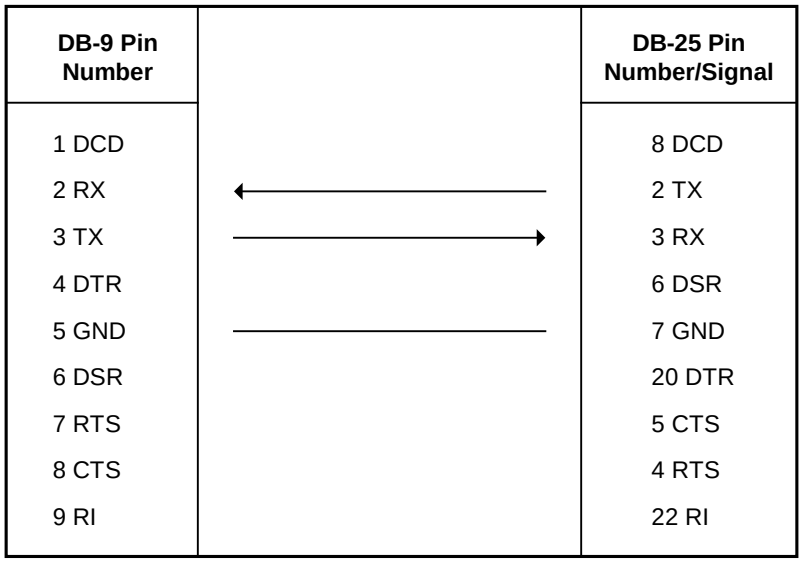


Figure 2-5: DB-9 to DB-25 3-wire Terminal Cable

RS-422/485 Operation

Unlike RS-232, the RS-485 and RS-422 specifications do not have a standard set of pinouts. In general, whenever you use RS-422/485 devices you will need to make custom cables. The iNS pinouts for RS-422 /RS-485 mode are shown in Table 2-6.

Pin #	Name	Direction
1	Not used	
2	RXB/RX+	Input
3	TXB/TX+	Output
4	Not used	
5	GND	
6	Not used	
7	TXA/TX-	Output
8	RXA/RX-	Input
9	Not used	

Table 2-6: DB-9 Pinouts for RS-422 and RS-485

RS-485 2-wire mode uses the same pinouts, but the receive and transmit pairs should be externally shorted together in the connector (TXA shorted to RXA and TXB shorted to RXB).

Note that some RS-422 and RS-485 devices refer to the differential pair of signals that make up the transmit and receive lines as "-" and "+" instead of the standard "A" and "B". In most cases, the "-" signal corresponds to the "A" signal and the "+" signal corresponds to the "B" signal, but some devices reverse this. Refer to the chapter on **Using RS-422 and RS-485 Devices** for more information on wiring and using 2-wire and 4-wire RS-422/485 networks with the iNS.

Ethernet LAN

The iNS is connected to your LAN using an Ethernet port. The Ethernet port on the iNS is a standard 10/100 Base-TX RJ-45 jack. It can be connected to an Ethernet hub/switch via a standard, straight-through Ethernet cable.

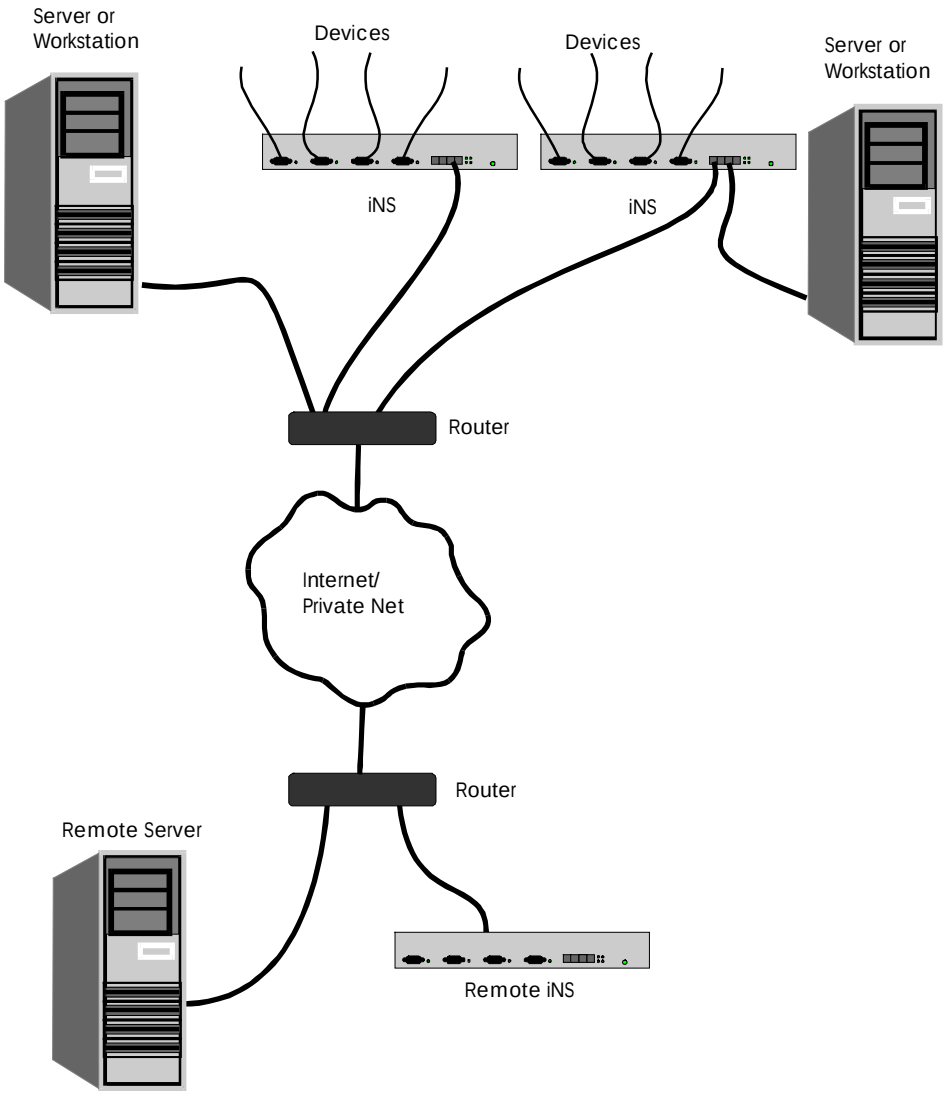


Figure 2-7: Network Topology Example

The switch versions of the iNS have four 10/100 Base-TX Ethernet ports. These ports are all interchangeable. Any port can be used to either connect to a hub/switch or to a network device (auto MDI/MDIX).

Starting the iNS

When the iNS 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 iNS 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 iNS has obtained an IP address and is ready to use. Red indicates a fatal error.
- **Ethernet LEDs** – these LEDs will either be off or green. A green LED means that a good Ethernet link has been established and the unit is on the network. The LED will blink green to show network activity.
- **Serial port LEDs** – these LEDs will normally be either off or green. Off 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**.

Chapter 3: Using RS-422 and RS-485 Devices

The iNS can be used to communicate with RS-422 and RS-485 devices. This chapter describes connecting these devices and configuring the iNS to communicate in this mode.

Connecting RS-422/485 Devices

RS-422 and RS-485 modes are very similar, except that in RS-422 mode the transmitter remains enabled at all times; in RS-485 mode, the transmitter is disabled automatically when no data is being transmitted. Consequently, RS-422 devices must be connected using a four-wire cable (i.e. with separate transmit and receive pairs). RS-485 devices may be connected with either two-wire or four-wire cables.

You can connect two RS-422/485 devices with a point-to-point connection, or more than two RS-485 devices in a bus configuration.

The only legal RS-485 cabling topology is a bus topology (including point-to-point connections)! All other topologies are expressly forbidden by the RS-485 specification. This includes the following illegal configurations:

- Connecting cables in any type of star topology (regardless of whether or not devices are attached to the ends of the cables). This includes using star-based patch panels or any other method that splits the physical cable off into multiple segments.
- Connecting RS-485 devices to the bus using cable stubs of any length

Due to the resilience of the RS-485 signaling specification, some of these illegal topologies may work in certain configurations. However, changing factors such as cable length, baud rate, number of devices, bus loading, etc. may cause such configurations to fail sporadically or to stop communicating entirely. **The only topology guaranteed to work in all cable configurations is a properly terminated bus topology.**

RS-422/485 Point-to-point Configuration

Point-to-point connections can be established between two RS-422 devices, an RS-422 and an RS-485 device, or two RS-485 devices. Figure 3-1 shows a four-wire, point-to-point connection between two devices.

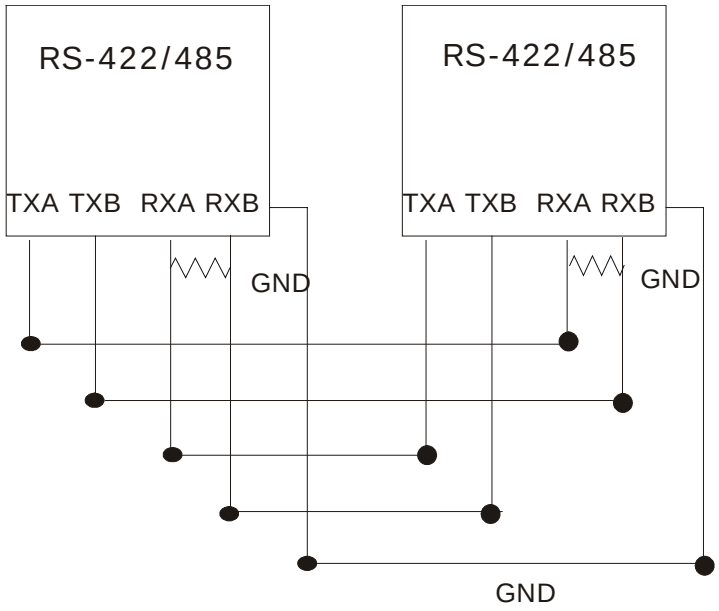


Figure 3-1: RS-422/485 point-to-point connection

Notice the termination on each end of the connection. The receiving end of the wire should be terminated with a resistance equal to the wire's characteristic impedance, generally 100-120 ohms.

RS-422/485 Bus Configurations

More than two RS-422/485 devices can be connected in a bus configuration. You can connect one RS-422 and several RS-485 devices on a bus or you can connect several RS-485 devices on a bus, but you cannot connect more than one RS-422 device on a single bus. If your configuration includes an RS-422 device, you must use a four-wire connection. Configurations including only RS-485 devices can use either two-wire or a four-wire communication.

When RS-422 and/or RS-485 devices are connected to a bus, they operate as one master and one or more slaves. In all configurations that include an RS-422 device, the RS-422 device is the master and the RS-485 devices are slaves.

Two-Wire System

In two-wire communication, all devices share the same pair of wires to both transmit and receive. All the devices connected to a two-wire system must be RS-485 devices. Figure 3-2 shows a typical two-wire system.

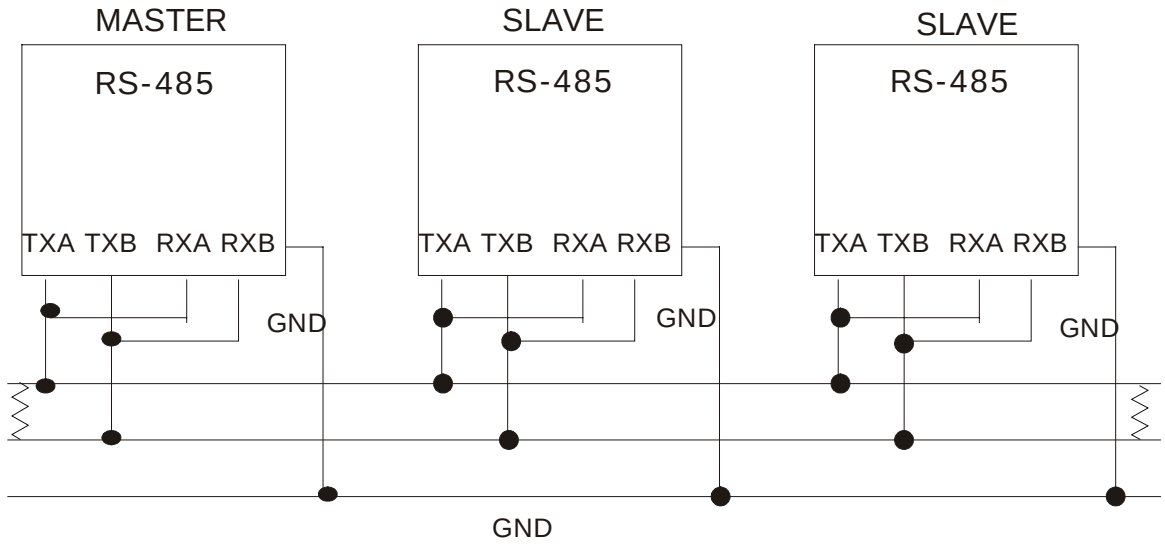


Figure 3-2: Two-wire RS-485 System

In the two-wire system diagrammed in Figure 3-2, one pair of transmit and receive lines (TXA and RXA) are connected to a single wire and the other pair of transmit and receive lines (TXB and RXB) are connected to the second wire. The device that is designated as the master manages the traffic on the lines.

As shown in the above diagram, the pair of transmit / receive lines needs to be terminated with 120 ohms at each end of the bus.

Four-Wire Systems

In four-wire communication, there are two pairs of transmit and receive lines, allowing full duplex communication. In most four-wire systems, an RS-422 device will serve as the master with several RS-485 devices as slaves. However, an RS-422 device is not required; an RS-485 device can serve as the master. Figure 3-3 shows a typical four-wire system.

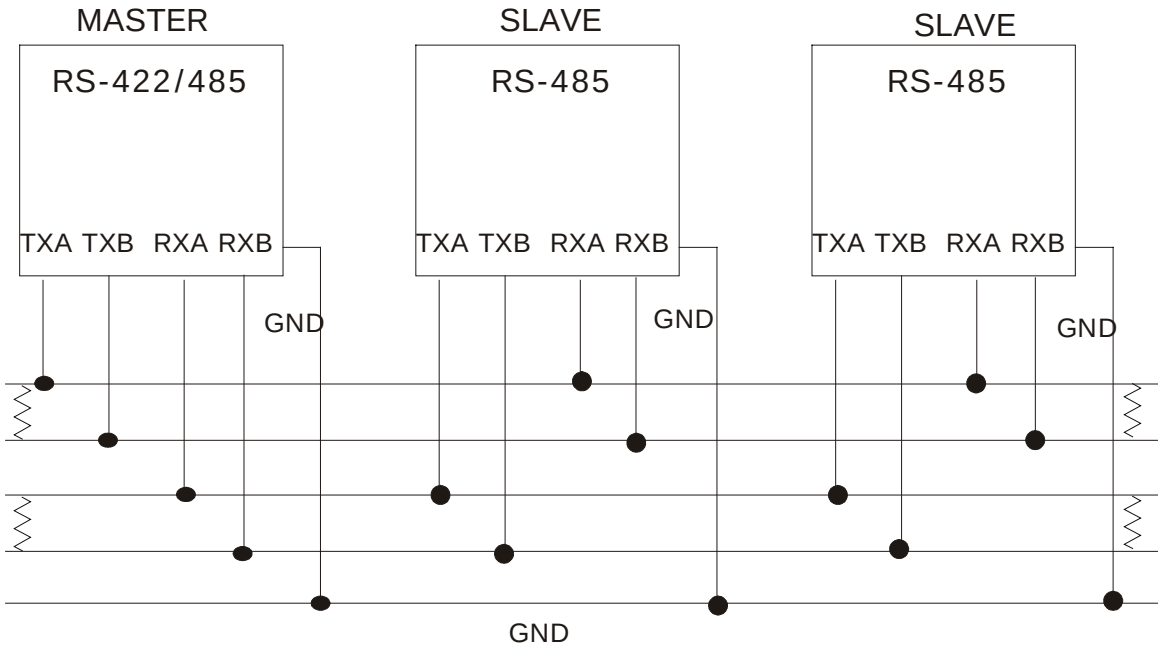


Figure 3-3: Four-wire RS-422/485 System

In most configurations, the device that is designated as the master will be an RS-422 device that constantly drives the transmit lines.

Both pairs of lines on the multi-drop wire must be terminated at each end of the bus with a resistance equal to the wire's characteristic impedance, generally 120 ohms. If the RX data pins are not terminated at all and have nothing attached, they may be susceptible to cross talk. Data from other lines on this serial port, or from other nearby ports, may be coupled back onto the unterminated receive lines. You should attach a simple 100- or 120-ohm termination resistor between the lines to avoid this.

Using the iNS in RS-422 or RS-485 Mode

The iNS ports can function as any of the devices in any of the configurations described above. The iNS can be connected to either an RS-422 or an RS-485 device in a point-to-point configuration. Or the iNS can be connected to a two-wire or four-wire bus, as either a master or a slave, and can communicate in either RS-422 or RS-485 mode. Typically, a single iNS is connected to the bus and functions as the master, but this is determined by the application. The ports are configured for RS-232, RS-485 or RS-422 via software. Refer to the NDS Administrator's Guide.

Chapter 4: Troubleshooting

The iNS 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 iNS's major components.

Status LED

The status LED indicates the overall status of the iNS. 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
Off	Port is closed or no power.
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

Table 4-2: Port LED Conditions

Ethernet LEDs

Each 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 Blink	Network traffic was detected
Off	The Ethernet cable is bad or not connected

Table 4-3: Ethernet LED Condition

Appendix: Specifications

iNS Hardware Specifications

- ARM7 50MHz CPU
- 4Mbytes in-circuit boot flash and program memory
- 16 Mbytes SDRAM
- 10/100 Mbps Ethernet connection over 10/100 Base-TX physical lines
- One to four asynchronous serial ports with modem control and surge suppression
- Standard 15Kv ESD surge protection on serial ports
- Optional 3Kv magnetic isolation on serial ports
- Standard 1Kv isolation on Ethernet ports
- Asynchronous port data rates of up to 230.4 Kbps
- DB-9 serial connectors on serial ports
- Screw Terminal connectors on serial ports
- Serial ports software configurable for RS-232 or RS-422/RS-485
- External or Internal 110-240 VAC power supply or 5-59VDC screw terminals
- Status LEDs for each port
- RoHS compliant

Environmental Specifications

- Operating temperature range: -40 to 85°C
- Storage temperature range: -40 to 85°C
- Humidity range: 10% to 90% noncondensing

Product Dimensions

The iNS models have a 1.2mm steel, powder coated, IP40-rated enclosure that measures:

11.5 inches x 8.5 inches x 1.75 inches (292 mm x 216 mm x 44 mm)

The unit may be mounted, without modification, on a shelf or desk top. Attach the supplied rackmount brackets to the sides of the unit to mount it in a standard 19" equipment rack. Optional DIN rail mounting kits are available to mount the unit on a standard DIN rail.

Model Numbers

iNS/3101	One serial port, one 10/100 Base-TX port, standard serial protection
iNS/3102	Two serial ports, one 10/100 Base-TX port, standard serial protection
iNS/3104	Four serial ports, one 10/100 Base-TX port, standard serial protection
iNS/3202	Two serial ports, four 10/100 Base-TX ports, standard serial protection
iNS/3204	Four serial ports, four 10/100 Base-TX ports, standard serial protection
ixNS/3101	One serial port, one 10/100 Base-TX port, isolated serial ports
ixNS/3102	Two serial ports, one 10/100 Base-TX port, isolated serial ports
ixNS/3104	Four serial ports, one 10/100 Base-TX port, isolated serial ports
ixNS/3202	Two serial ports, four 10/100 Base-TX ports, isolated serial ports
ixNS/3204	Four serial ports, four 10/100 Base-TX ports, isolated serial ports

Ethernet cabling specifications

Guidelines for using 10/100 Base-TX twisted-pair cabling:

- Recommended cable is category 5 (CAT5 or CAT5E) or category 6 (CAT6) 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

Power Requirements

Internal Power Supply – Input: 100-240VAC, 50-60 Hz, 0.8A, IEC 320 modular power cord.

External 2.1mm AC adapter power supply – External, 2.1 mm connector, Systech-provided power supply – Input: 100-240 VAC, 50-60 Hz; Output: 5 VDC, 2A. Connector accepts 5-59 VDC, minimum 10 watts.

External Screw Terminal – Accepts 5-59 VDC, minimum 10 watts

Index