MDS NETioB 900 & MDS NETioB 2400 Series
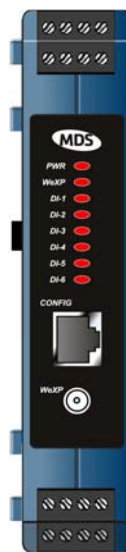
NETioB
Module

NETioE
Module

Wireless Communication Transceivers for Analog & Digital I/O Signals

GE MDS
industrial wireless networks

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ISO 9001 Registration

GE MDS adheres to the internationally-accepted ISO 9001 quality system standard.

Related Materials on the Internet

Data sheets, frequently asked questions, application notes, information on firmware upgrades, and other valuable information can be found on the GE MDS Web site at www.GEmds.com.

About GE MDS

Over two decades ago, GE MDS began building radios for business-critical applications. Since then, we've installed more than 500,000 radios in over 110 countries. To succeed, we overcame impassable terrain, brutal operating conditions and disparate, complex network configurations. We also became experts in wireless communication standards and system applications worldwide. The result of our efforts is that today, thousands of utilities around the world rely on GE MDS-based wireless networks to manage their most critical assets.

OPERATIONAL & SAFETY NOTICES

FCC Transmitter Identifications

An MDS NETioB Module can contain two internal FCC-approved transmitters:

- FCC ID: E5MDS-EL806 "MDS OEM TransNET 900MHz FHSS transceiver"
  IC ID: 3738A-MDSEL806
- FCC ID: OUR-XBEEPRO "2.4 GHz Zigbee module"
  IC ID: 4214A-XBEEPRO

NETioE Modules equipped with wireless expansion services (WeXP) contain one FCC-approved transmitter:

- FCC ID: OUR-XBEEPRO "2.4 GHz Zigbee module"
  IC ID: 4214A-XBEEPRO

RF Exposure

U.S. Installations: Professional installation required. The radio equipment described in this guide emits radio frequency energy. Although the power level is low, the concentrated energy from a directional antenna may pose a health hazard. For 900 MHz units, do not allow people to come closer than 23 cm (9 inches) to the antenna. For 2.4 GHz units, do not allow people to come closer than 5 cm (2 inches) to the antenna. These distances apply whether the transmitter is operated in indoor or outdoor environments.

For units with the optional wireless expansion service (WeXP) installed, a minimum separation distance of 23cm (9.05") must be maintained between the two antennas (Link and WeXP) when mounted in their final locations.

More information on RF exposure is available on the Internet at **www.fcc.gov/oet/info/documents/bulletins**.

ETSI Installations: In regions where the European Telecommunications Standards Institute (ETSI) standards apply, 2.4 GHz units with a maximum output power of 100 mW EIRP are supplied. Do not allow people to come closer than 2.2 cm (1 inch) to the antenna.

CSA/US Notice

This product is available for use in Class I, Division 2, Groups A, B, C & D Hazardous Locations. Such locations are defined in Article 500 of the National Fire Protection Association (NFPA) publication NFPA 70, otherwise known as the National Electrical Code.

The transceiver has been recognized for use by the Canadian Standards Association (CSA). The certification for the transceiver is as a Recognized Component in hazardous locations, in accordance with the CSA Certification STD C22.2 No. 213-M1987.

CSA/US Conditions of Approval:

The transceiver is not acceptable as a stand-alone unit for use in the hazardous locations described above. It must either be mounted within another piece of equipment which is certified for hazardous locations, or installed within guidelines, or conditions of approval, as set forth by the approving agencies. The conditions of approval are as follows:

1. The transceiver must be mounted in a separate enclosure suitable for the intended application.

2. The antenna feedline, DC power cable and interface cable must be routed through conduit in accordance with the National Electrical Code.

3. Installation, operation and maintenance of the transceiver should be in accordance with the transceiver's installation manual, and the National Electrical Code.

4. Tampering or replacement with non-factory components may adversely affect the safe use of the transceiver in hazardous locations, and may void the approval.

5. When installed in a Class I, Div. 2, Groups A, B, C or D hazardous location, observe the following: **WARNING — EXPLOSION HAZARD—** Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Refer to Articles 500 through 502 of the National Electrical Code (NFPA 70) for further information on hazardous locations and approved Division 2 wiring methods.

FCC Part 15 Notice

The equipment described in this manual 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. This device is specifically designed to be used under Section 15.247 of the FCC Rules and Regulations. Any unauthorized modification or changes to this device without the express approval of the manufacturer may void the user's authority to operate this device. Furthermore, this device is intended to be used only when installed in accordance with the instructions provided in this manual. Failure to comply with these instructions may void the user's authority to operate this device.

Manual Revision and Accuracy

While every reasonable effort has been made to ensure the accuracy of this manual, product improvements may result in minor differences between the manual and the product shipped to you. If you have additional questions or need an exact specification for a product, please contact our Customer Service Team using the information at the back of this guide. In addition, manual updates can often be found on the GE MDS Web site at www.GEmds.com.

Environmental Information

The equipment that you purchased has required the extraction and use of natural resources for its production. Improper disposal may contaminate the environment and present a health risk due to hazardous substances contained within. To avoid dissemination of these substances into our environment, and to diminish the demand on natural resources, we encourage you to use the appropriate recycling systems for disposal. These systems will reuse or recycle most of the materials found in this equipment in a sound way. Please contact GE MDS or your supplier for more information on the proper disposal of this equipment.

1 INTRODUCING THE MDS NETio SYSTEM

1.1   ABOUT THIS MANUAL

This guide provides installation and operating instructions for MDS
NETioB products. It is arranged into the following chapters:

1.1.1 Conventions Used

***Quick Start Steps—
How to Use Them...***

You will find numbered ***Quick Start Step*** headings presented in the
left-hand margins of Chapters 2 and 3. These headings indicate essential
steps for getting the NETio system up and running. If you only need to
perform basic setup and configuration, look for these headings and
follow the instructions given. The steps should be performed in
sequence.

Additional detail is provided for each menu screen to assist those
requiring more information.

***Menu Navigation—
Finding the Menu
You Need...***

To show the path leading to a menu selection, navigation strings in a dis-
tinctive font are used in several places in this manual. For example, sup-
pose you wish to access the I/O Module Configuration Menu. The
navigation string shown in the text would appear as follows:

Main Menu>I/O Network>I/O Module Configuration

By following this order of menus, you will quickly reach the I/O Module
Configuration Menu.

1.2   PRODUCT DESCRIPTION

MDS NETio is an integrated, scalable family of wireless communica-
tion products for analog and discrete I/O signals. It supports three pri-
mary functions that can be implemented separately or concurrently:

- **I/O Extension**—This function allows acquiring, transmitting
  and regenerating I/O signals between control and monitoring
  devices such as PLCs or RTUs.
- **Protocol Addressability**—Allows direct addressing of I/O
  using a commercial protocol such as Modbus®, or DNP. Consult
  the factory for a complete list of the protocols supported in the
  NETio Protocol Library.
- **Payload Communication**—Accommodates the serial or
  IP/Ethernet connection of a separate PLC, RTU or other periph-
  eral device for wireless connectivity to host devices or systems.

**NETioE Expansion
Module (optional)**

NETioB Module

Figure 1-1. MDS NETio Remote Unit
(A Remote Unit consists of a NETioB & Optional NETioE Module)

***Basic NETio
Architecture***

A NETio Remote Unit consists of a NETioB Module and, if needed, one or more NETioE Modules to achieve the I/O capacity required at a given location.

The NETioB and NETioE Modules communicate with each other over an internal power and communication bus. Optionally, NETioE Modules may be wirelessly distributed up to 3,000 feet (914 meters) away from the NETioB Module if equipped with the *WeXP* option. WeXP is a completely separate 2.4 GHz 802.15.4 wireless network designed for short-range communication. Actual range depends on the quality of the 2.4 GHz transmission path.

Figure 1-2 illustrates the "NETio Remote Unit" concept in three different arrangements; NETioB Module alone, NETioB Module connected with an NETioE Module, and NETioE Modules linked to the NETioB via WeXP.

PLC or RTU devices can optionally be connected at the NETioB Module's serial port (COM1) or the LAN port for payload communication to host devices or systems. (Note that this does not apply with NETioE.)

A NETio Unit...
- Always has a NETioB Module.
- Optionally, has one or more NETioE Modules to meet users I/O count.
  - ➢ NETioE Modules can either connect physically to NETioB Module or via WeXP.
- Is always a Remote to a Master Radio or Access Point.
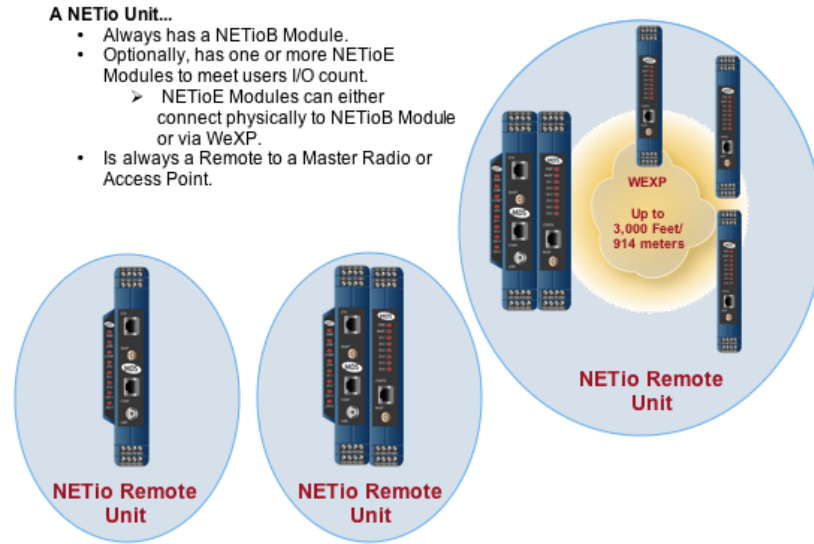
Figure 1-2. NETio "Unit Concept"

1.3   HOW IT WORKS

NETio reads analog and discrete input signals and generates analog and discrete output signals. In this guide, any analog or discrete signal is generically referred to as a "Point" in the system.

1.3.1 I/O Operating Modes

I/O Extension

NETio supports two operating modes. The first is called **I/O Extension**. In this mode, an analog or discrete input point read by a NETio module at one location is transmitted to one or more NETio modules at other locations and regenerated as an output. An input point can be output at up to four different locations.

Protocol Addressability

The second operating mode is called **Protocol Addressability**. In this mode, input signals can be read and output signals can be sent using a protocol such as MODBUS, MODBUS TCP, or DNP3. The desired protocol can be selected from the NETio Protocol Library. The NETio Remote Unit then becomes "protocol aware" and can monitor inputs and generate outputs using the selected protocol.

Both modes can operate simultaneously. The only restriction is that NETio does not allow an output point to be generated by both protocol and signal extender modes. You must specify one or the other when configuring an output point.

NOTE: NETio only supports one protocol at a time for I/O while running in Protocol Node mode. Other protocols can be used however, for externally-attached devices.

1.3.2 Configuration Levels

There are several configuration levels associated with a NETio Remote Unit depending upon the functionality that needs to be implemented.

- **NETio entraNET-class Radio Parameters** *(Required if communicating with another NETioB Module or with a NETio Access Point)*
  - Configure the wireless Network Address at the Access Point and each NETioB. The Network Address must be *identical* for all radios in a network.
- **WeXP 2.4 GHz Parameters** *(As needed, if WeXP is used)*
  - WeXP Network Address—NETioB Module and Wireless NETioE Modules. WeXP Net Address must be identical on NETioB and all wireless NETioE modules.
- **NETio Module Activation** *(Required)*
  - Unit ID—NETioB Module ID
  - Module ID—NETioE Module ID *(if used)*
- **I/O Points** *(Required)*
  - I/O Point parameters such as signal type and range
- **Signal Extender Functions** *(As needed)*
- **Protocol Node Functions** *(As needed)*
- **Optional Payload Communication** *(As needed)*
- **Support for an external RTU or PLC** connected to NETio IP/Ethernet or serial communication port.

These Configuration Levels are further discussed in Chapters 2 and 3.

1.3.3 Module Profiles

NETioB Module

The NETioB Module operates in the license-free 900 MHz or 2.4 GHz bands. The frequency ranges of operation are as follows:

NETioB 900: 902-928 MHz
NETioB 2400: 2.4016-2.4778 GHz

The NETioB Module has the following I/O capacity:

- 1 Analog Input (AI) @ 4–20 mA, 0-5 V, 0-10 V
- 1 Analog Output (AO) @ 4–20 mA
- 2 Discrete Inputs (DI) @ 5–36 Vdc
- 2 Discrete Outputs (DO) 36 Vdc rated at 2 A continuous load.
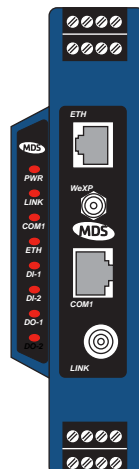
Figure 1-3. NETioB Module with WeXP Functionality

NETioE Module   Multiple NETioE Modules (up to eight) can optionally attach to the NETioB Module if a higher I/O count is needed. No additional power or interconnection wiring is required for NETioE Modules that are physically attached to the NETioB Module. NETioE Modules can also be equipped with WeXP 2.4 GHz functionality, which allows them to be installed up to 3,000 feet (914 meters) from a NETioB Module. There are presently six NETioE Module configurations as summarized in Table 1-1. NETioE Modules are available with or without WeXP capability.

NOTE: The maximum number of NETioE Modules that can be attached to a NETioB Module is 50. However, when over 8 Modules are used, power should be connected directly to the NETioE power terminals (#1 and #2) for every 8 additional modules. Powering more than 8 modules from a single NETioB module will likely cause the fuse in the NETioB Module to fail.

NOTE: When an NETioE Module is attached to a NETioB Module and its software version is different than what is currently installed in the NETioB Module, the NETioE Module will be automatically programmed to match the version in the NETioB Module. This happens regardless of whether the NETioB Module's software is older or newer than what is installed in the NETioE Module. This process may take up to 20 minutes to complete.

Table 1-1. NETioE Module Configurations

(Shown with the WeXP Option present. Note that a Type 5 Module is not available.)

Type 1 NETioE-1W	Type 2 NETioE-2W	Type 3 NETioE-3W	Type 4 NETioE-4W	Type 6 NETioE-6W	Type 7 NETioE-7W

Type 1 NETioE-1W	Type 2 NETioE-2W	Type 3 NETioE-3W	Type 4 NETioE-4W	Type 6 NETioE-6W	Type 7 NETioE-7W
• 1 Analog Input (0–5 V, 0–10 V, 4–20 mA) • 1 Analog Output (4–20 mA) • 2 Discrete Inputs • 2 Discrete Outputs	• 6 Discrete Inputs	• 6 Discrete Outputs	• 2 Analog Inputs (0–5 V, 0–10 V, 4–20 mA) • 4 Discrete Inputs	• 2 Analog Inputs— non-isolated (0.1–5 V) • 2 Analog Outputs— non-isolated (0.1–5 V) • 2 Discrete Inputs • 2 Discrete Outputs	• 2 Analog Inputs— (4–20 mA) • 1 Discrete Input • 3 Discrete Outputs

NOTE: All Inputs/Outputs are isolated, except where noted.

1.4 CONNECTOR OVERVIEW

Figure 1-4 shows all of the interface connectors and LEDs present on a NETioB Module. Figure 1-5 shows this information for a NETioE Module. A review of these items will assist you in making the connections described later in this section.

PRIMARY POWER
- 13.8 Vdc @ 350 mA (6–30 Vdc)
- Negative Ground
- 1 **+** / 2 **–**

TERMINATIONS
- 1–4 →
- 5–8 →

24 VDC POWER OUTPUT
- 24.0 Vdc @ 40 mA
- Isolated from Ground
- Pins 3 (**+**) & 4 (**–**)

ETH—ETHERNET
- 10BaseT
- IP/Ethernet Port

WeXP RF CONNECTOR
- Wireless Expansion Antenna
- 2.4 GHz (IEEE 802.15.4)

LED PANEL
- PWR —Primary Power
- MDS entraNET Radio Link
- COM1 —COM Port Activity
- ETH —ETHERNET Port Activity
- DI-1 —Digital Input 1 Active
- DI-2 —Digital Input 2 Active
- DO-1 —Digital Output 1 Active
- DO-2 —Digital Output 2 Active

COM1
- DCE Console/Terminal
- 19,200 bps/8N1 (Default)
- No Handshaking
- RS/EIA-232

MDS entraNET RF CONNECTOR
- 50Ω TNC connector
- +30 dBm/1W Output (Max.)
- –30 dBm Input (Max.)

TERMINATIONS
- 9–12 →
- 13–16 →

Figure 1-4. NETio NETioB Module Interface Connectors & LEDs

NOTE: Be sure to observe proper polarity as marked on the Primary Power input terminals; **(+) positive and (-) negative**. On early units, these terminals are simply marked 1 and 2, whereas 1 is the positive terminal and 2 is the negative terminal. Reversed polarity may cause serious damage, requiring factory repair.

If high voltage isolation is *not* required, it is recommended that a jumper be placed between terminals 2 and 4 to ensure proper ESD protection of terminals 5 through 16.

Figure 1-5 shows the interface connectors for a typical NETioE Module. The number and function of LEDs, as well as the presence of the WeXP antenna connector and the 24 Vdc power output, is dependent on the model.

PRIMARY POWER
- 13.8 Vdc @ 350 mA
  (6–30 Vdc)
- Negative Ground
- 1 **+** / 2 **−**

TERMINATIONS
1–4 →
5–8 →

24 VDC POWER OUTPUT
- 24.0 Vdc @ 40 mA
- Isolated from Ground
- Pins 3 (**+**) and 4 (**−**)

LED PANEL
- Power
- WeXP
- Digital Input or Output Active

CONFIGURATION
- DCE Console/Terminal
- 19,200 bps/8N1 (Default)
- No Handshaking
- RS/EIA-232

WeXP RF CONNECTOR
- Wireless Expansion
  Antenna
- 2.4 GHz
  (IEEE 802.15.4)

TERMINATIONS
← 9–12
← 13–16
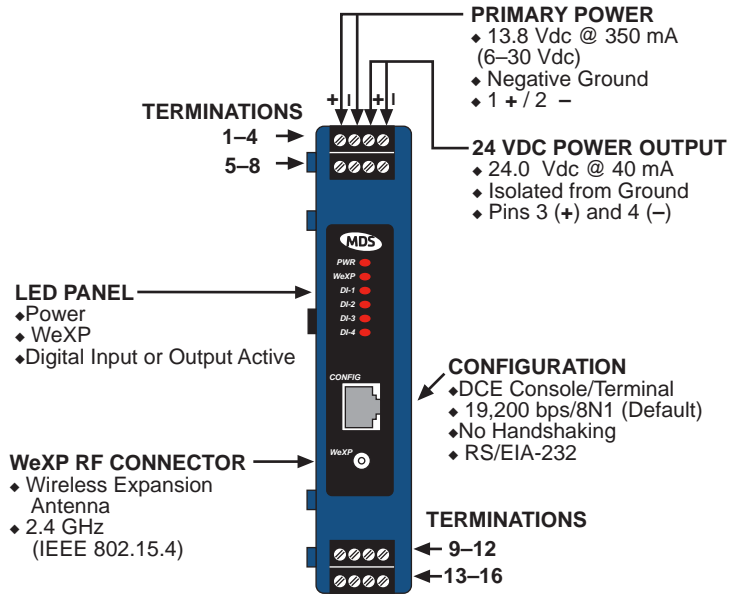
Figure 1-5. NETioE Module Interface Connectors & LEDs
(Typical Model Shown)

Together, the NETioB and NETioE Modules offer deployment alternatives that are uniquely scalable to a user's I/O count, distance and location requirements.

The standard NETioB Module supports I/O Extension and Protocol Addressability using one of the protocol options. Protocols currently supported are Modbus RTU, Modbus TCP, DNP3 Serial, and DNP3 Ethernet.

The NETioB Module can also be ordered with the WeXP option, providing additional connectivity to wireless NETioE Modules installed within a range of up to 3000 feet (914 meters).

Key Operating Features

- Ability to read analog inputs and discrete inputs
- Ability to generate analog outputs and discrete outputs
- Protocol-addressable analog and discrete points via a serial or Ethernet protocol
- Analog and discrete signal regeneration between devices
- Wireless Expansion capability—WeXP
- Serial or IP/Ethernet Payload communication for an external RTU or PLC

Rugged Packaging

MDS NETio modules are housed in compact and rugged high-impact cases that need only be protected from direct exposure to the weather. The modules are supplied with 35 mm DIN-rail brackets for quick and easy installation.

Robust Radio Operation

The transceivers are designed for frequency-hopping spread-spectrum operation in the license-free 900 MHz or 2.4 GHz band. They provide

reliable long distance communications over line-of-sight signal paths. They employ digital signal processing (DSP) techniques for high performance operation, even in the presence of weak signals or interference.

Multiple Services Users with a mixture of equipment requiring Ethernet and serial data interfaces can employ a combination of both NETio modules and MDS entraNET Remotes communicating with a common MDS entraNET Access Point.

1.5   DIN RAIL MOUNTING & REMOVAL

NETioB and NETioE Modules are designed for direct mounting to a 35 mm DIN rail without the need for tools. To mount a module, simply hook the bracket over the top portion of the DIN rail, and then push the bottom of the radio in until it locks in place. Figure 1-6 shows the NETio being attached to a DIN rail.

Figure 1-6. Mounting NETio Equipment to DIN Rail
(Hook unit over top of rail, and push in at bottom)

Removal from the DIN rail requires only a flat-blade screwdriver or other tool to pull down on the spring-loaded tab at the bottom of the radio's mounting bracket (see Figure 1-7). With the tab held down, swing the bottom of the radio away from the rail, and lift it up slightly to fully release it from the mount.

Figure 1-7. Removal of NETio Equipment from DIN Rail
(Pull down on tab and swing bottom of unit away from rail)

1.6   ACCESSORIES

MDS NETio equipment may be used with one or more of the accessories listed in Table 1-1. Contact the factory for ordering details.

Table 1-1. Accessories

Accessory	Description	MDS Part No.
AC Power Adapter Kit	A small power supply designed for continuous service. UL approved. Input: 120/220; Output: 13.8 Vdc @ 2.5 A	01-3682A02
Omni-Directional Antennas	Rugged antennas well suited for use at Access Point installations. Consult with your factory Sales Representative for details	Contact factory
Yagi Antenna (Directional)	Rugged antennas well suited for use at Remote installations. Consult with your factory Sales Representative for details.	Contact factory
TNC Male-to-N Female Adapter	One-piece RF adaptor plug.	97-1677A161
TNC Male-to-N Female Adapter Cable	Short length of coaxial cable used to connect the module's TNC antenna connector to a Type N connector commonly used on large diameter coaxial cables.	97-1677A159 (3 ft./1m) 97-1677A160 (6 ft./1.8m)
Ethernet RJ-45 Straight-thru Cable (CAT5)	Cable Assy, 84" RJ-45 to RJ-45	03-2198A10
Ethernet RJ-45 Straight-thru Cable (CAT5)	Cable assembly normally used to connect an Ethernet device or LAN to the transceiver. Both ends of the cable are wired identically. (Cable length ≈ 3 ft./1 m)	97-1870A20
Ethernet Surge Protector	Protects against voltage spikes or surges on Ethernet lines. These conditions may be caused by nearby lightning strikes or transient conditions.	29-4018A01

Table 1-1. Accessories

Accessory	Description	MDS Part No.
RJ-12 to DB-9 Female Adapter	Allows access to CONFIG port on NETioE Modules. Used if your configuration device is equipped with DB-9 connectors instead of RJ-12.	73-2434A02
RJ-45 to DB-9 Female Adapter	Allows access to COM1 on NETioB Modules. Used if your configuration device is equipped with DB-9 connectors instead of RJ-45.	73-2434A12
EIA-232 Shielded Data Cable	Shielded cable terminated with a DB-9 male connector on one end, and a DB-9 female on the other end, 6 ft./1.8 m long.	97-1971A03
Fuse	Small, board-mounted fuse used to protect against over-current conditions.	29-1784A03
Coaxial Cable Assembly	SMA Male to N Male 50 Ohm RG-142B Coax Assy. 12 in./30.48 cm	97-2036A23
Coaxial Cable Assembly	SMA Male to N Male 50 OHM RG142B Coax Assy. 24 in./61 cm	97-2036A24
Coaxial Cable Assembly	SMA Male to N Male 50 OHM RG142B Coax Assy. 36 in./.91 m	97-2036A25
Coaxial Cable Assembly	SMA Female to SMA Right Angle Coax Adapter	97-2036A26
Whip Antenna	2.4 GHz Antenna with SMA Male Connector	97-4278A10

GE MDS publishes an *Accessories Selection Guide* which lists a complete array of additional items available for use with this product. Please contact your factory representative or visit www.GEmds.com to obtain a copy of this guide.

2 CONFIGURING WIRELESS SYSTEM PARAMETERS

2.1 INTRODUCTION

Prior to installation, it is recommended that the equipment be set up in a benchtop environment to become familiar with its operation and features. This also allows tests of various network designs and configurations prior to installation. A benchtop test can be performed with any number of modules.

This section describes the hardware setup and software configuration of NETio. Quick Start steps (1-29)are provided to assist installers who only wish to perform basic setup and configuration tasks. Additional detail is provided below each step, for those wishing to obtain more background information.

2.2 INITIAL SETUP

The following steps explain how to make connections to the NETio, power it up, and set basic configuration.

Quick Start Step #1:

Review power and module interconnection discussion below, then proceed to Section 2.3.

Figure 2-1 is a drawing of a benchtop arrangement for configuration and staging of NETio equipment. The NETio modules may also be installed on DIN rails if desired (see *"DIN RAIL MOUNTING & REMOVAL"* on Page 11).
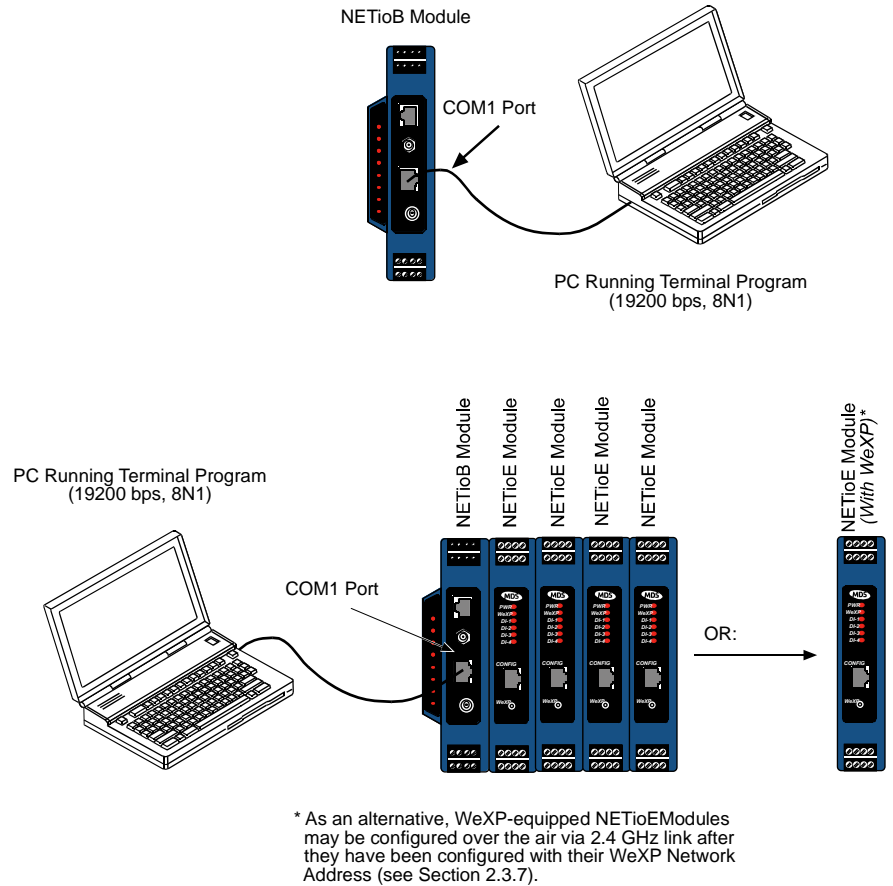
Figure 2-1. Typical Benchtop Arrangement

2.2.1 NETio Backplane Communication

NOTE: Backplane modules can *only* be connected to a NETioB Module.

When a NETio Remote Unit consists of a NETioB Module and NETioE Modules, as shown in Figure 2-1, all NETioE Modules can only be connected to the NETioB Module using the Backplane/power connector on the side of the modules. The configuration process is easiest if all modules are attached together via their Backplane/power connector.

2.2.2 Measure & Connect DC Power

Input power applied to NETio must be within 7-30 volts DC and be capable of continuously providing a minimum of 11 Watts. (Typical current consumption is: 350mA @13.8 Vdc for NETioB Modules.)

Each module has screw terminations for power and I/O signals. The terminations marked + and **-** are for power as shown in Figure 2-3. Strip the wire leads to 6 mm (0.25"). *Be sure to observe proper polarity.*

NOTE: When multiple modules are connected via the Back-plane/power connector, all modules are powered via the NETioB Module only. It is not necessary to connect power to each of the NETioE Modules.

NOTE: It will take about 15-30 seconds for the NETio modules to be ready for operation after power is connected.

NOTE: Automatic upgrade will occur on power-up when a module's firmware is different than what is installed in the NETioB Module. This process will require up to 30 minutes, via back-plane or WeXP. The unit will appear to be inoperative during this time and the module will be inaccessible. It will return to normal operation when the upgrade is complete. Also, a message will appear on the I/O Network Menu as shown in Figure 2-2. Future firmware versions will have the option to disable auto-upgrading.
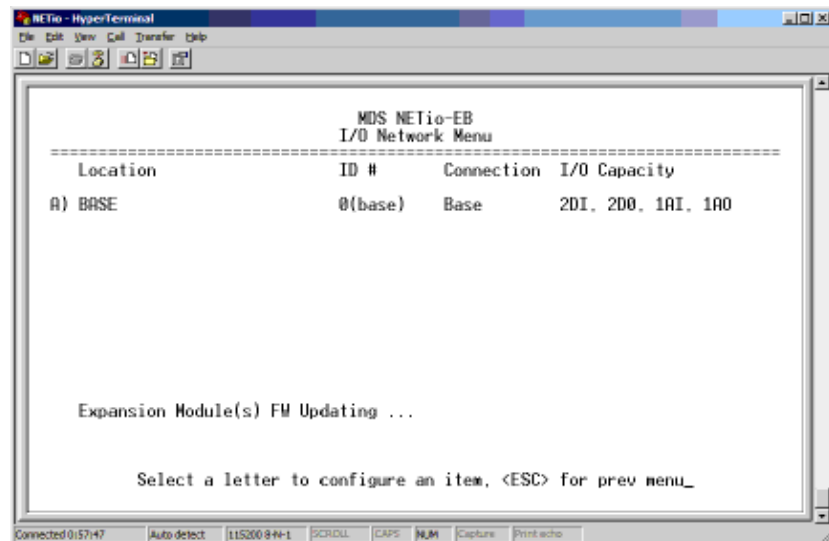
Figure 2-2. I/O Network Menu with Expansion Upgrade Message

PRIMARY POWER
• Nominal 13.8 Vdc @ 350 mA
  (Range: 7–30 Vdc)
• Negative Ground Only
• Terminal 1 is Positive (+)
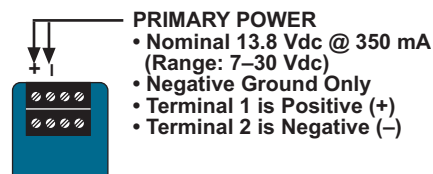• Terminal 2 is Negative (–)

Figure 2-3. DC Power Input for NETio Modules

CAUTION POSSIBLE EQUIPMENT DAMAGE	The modules must be used only with negative-ground systems. Make sure the polarity of the applied power source is correct.

2.3 SET BASIC CONFIGURATION OF THE NETioB MODULE

The following is a summary of the key settings for a NETioB Module.

NOTE: All NETio configuration can be performed over-the-air through an MDS entraNET AP, if one is present. Section 2.6 explains the menu selection needed. If this method is used, the Network Address and Unit ID must first be set in each NETioB Module. An entraNET AP is not always necessary.

Quick Start Step #2:

Start a HyperTerminal session to COM1 on the NETioB Module, and log into the NETio. Proceed to Section 2.3.1.

Console Terminal Connection

The NETioB Module is configured using a PC running Hyper Terminal or a console terminal (see Figure 2-4). Connect a PC to the NETioB Module's COM1 port and establish a HyperTerminal session using the following parameters: **19200 bps, 8 bits, no parity, one stop bit (8N1), flow control disabled, VT100 emulation**.

The COM1 port uses an RJ-45 connector. A DB-9 to RJ-45 adaptor with cable is supplied with each NETioB Module. COM1 pinout information is provided in *NETioB Module COM1 Port* on Page 74.

NOTE: The *exact* parameters given above must be used for console terminal communication. Improper settings are a common cause of difficulty.
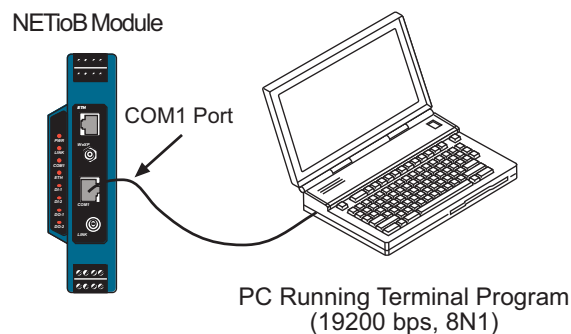

Figure 2-4. Local NETio Configuration Setup

With a PC connection made, log into the NETioB Module as follows:

1. Press the ENTER key to receive the **Login** prompt. The COM1 LED flashes to indicate data communications.

2. At the **Login** prompt, enter the username (**admin** is the default user-name). Press ENTER.

3. At the **Password** prompt, enter the password. (**admin** is the default password). Press ENTER. Upon successful log-in, the Starting Information Screen appears.

2.3.1 Starting Information Screen

Upon successful log-in the *Starting Information Screen* (Figure 2-5) appears. This screen provides a read-only overview of the NETioB Module's current operating conditions.

Quick Start Step #3:

Select G to go the Main Menu. Refer to Section 2.3.2, *Main Menu* for detailed information.
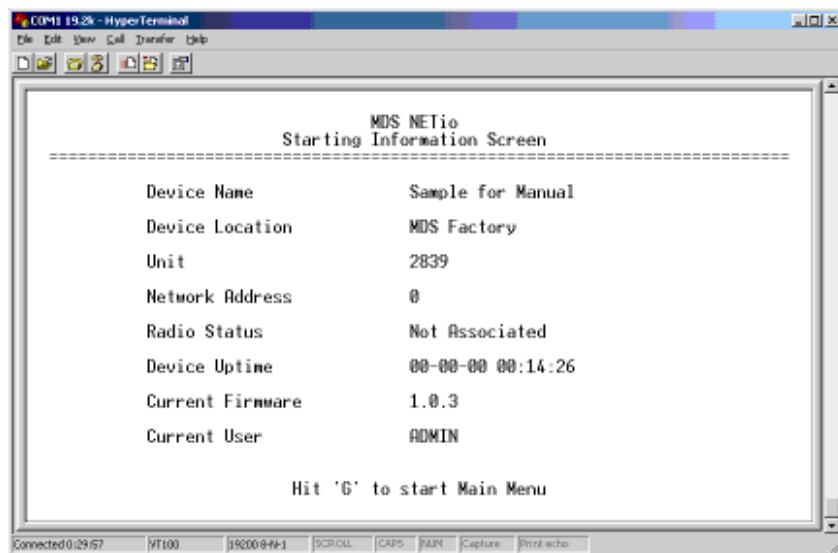
Figure 2-5. Starting Information Screen—Local Console Session

- **Device Name**—User-defined name for the unit (40 characters maximum).
- **Device Location**—User-defined string commonly used to identify the module's location (40 characters maximum).
- **Unit**—Shows the NETioB's unique Unit ID. This value defaults to the last four digits of the NETioB Module's serial number, but it can be modified as desired.
- **Network Address**—Shows the Network Address of the MDS entraNET network to which this Unit belongs. The Network Address is essential for association to an MDS entraNET Access Point. All Units in a system must have the *identical* Network Address.

- **Radio Status**—Shows the module's entraNET radio association status as follows:
  - **Associated**—Unit is operating normally and associated (communicating) with the Access Point AP.
  - **Alarmed**—A alarming event has been logged and not cleared. Note: If an alarm is present when this screen is displayed, an "**A**)" appears to the left of the **Radio Status** field. (The PWR LED also flashes.) Pressing **A** on your keyboard takes you directly to the **Current Alarms** screen.
  - **Not Associated**—Unit is not communicating with an AP.
- **Device Uptime**—Elapsed time since the transceiver was powered on.
- **Current Firmware**—Version of firmware that is currently active in the Unit.
- **Current User**—The privilege level at which you are logged in.

2.3.2 Main Menu

The Main Menu is the gateway to all NETio features. A summary of available selections is given below.

Quick Start Step #4:   **Select C to go to the Wireless Configuration Menu (Section 2.3.3).**
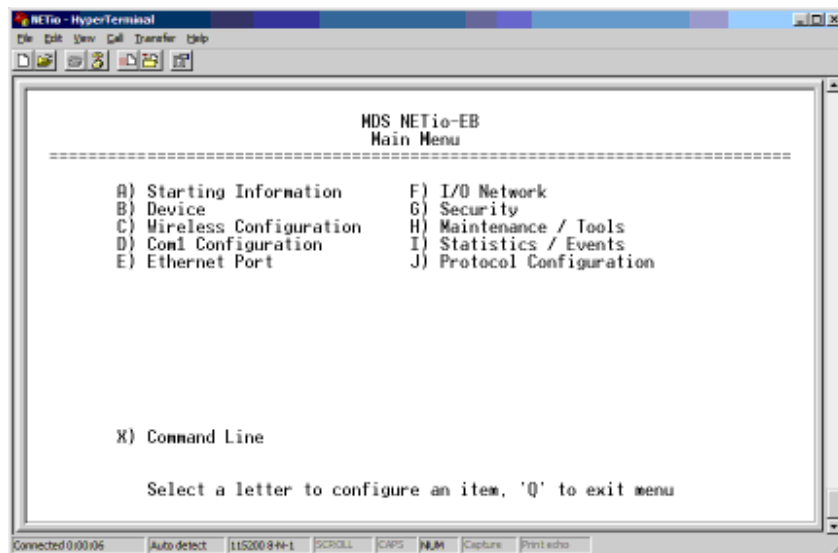

Figure 2-6. Main Menu

- **Starting Information**—Select this item to return to the Startup Screen described above.
- **Device**—Provides access to NETioB Module information and various configurable parameters.
- **Wireless Configuration**—Menu for NETio, entraNET and WeXP wireless configuration and data.

- **Com1 Configuration**—Options to configure the COM1 serial port. (See *"CONFIGURING SERIAL AND IP/ETHERNET COMMUNICATIONS" on Page 83*).
- **Ethernet Port**—Options to configure the IP Ethernet port.
- **I/O Network**—Used for configuring I/O points for the NETioB Module and NETioE Modules directly connected or associated wirelessly using WeXP.
- **Security**—Tools to configure access security parameters.
- **Maintenance/Tools**—Tools for modifying firmware.
- **Statistics/Events**—Shows a log of various operational parameters and performance data.
- **Protocol Configuration**—Provides access to submenus for configuring the protocol addressability of I/O points using Modbus® protocol.

2.3.3 Wireless Configuration Menu

The configuration tasks to be performed here depend on whether you will use the NETio's internal entraNET radio and/or the unit's WeXP radio.

___

Quick Start Step #5:

To configure Access Point communications or NETio Remote-to-Remote communications, select A to go the NETio entraNET Configuration Menu (Section 2.3.4). Otherwise, proceed to Section 2.3.6.
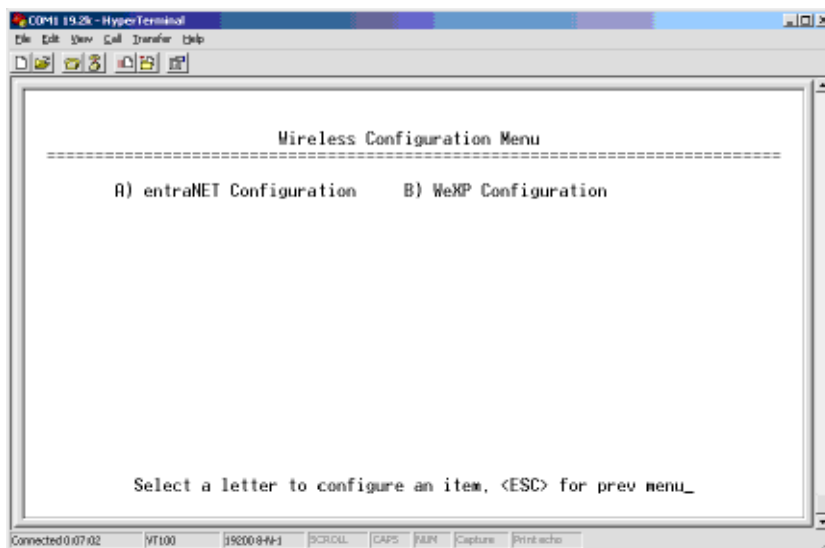

Figure 2-7. Wireless Configuration Menu

- **entraNET Configuration**—Select options for NETio entraNET-class radio parameters.
- **WeXP Configuration**—Select options for WeXP operation (if equipped with this feature).

2.3.4 entraNET Configuration Menu

The entraNET Configuration Menu allows access to all NETio entraNET radio-class parameters and provides a review of radio performance data.

Quick Start Step #6:

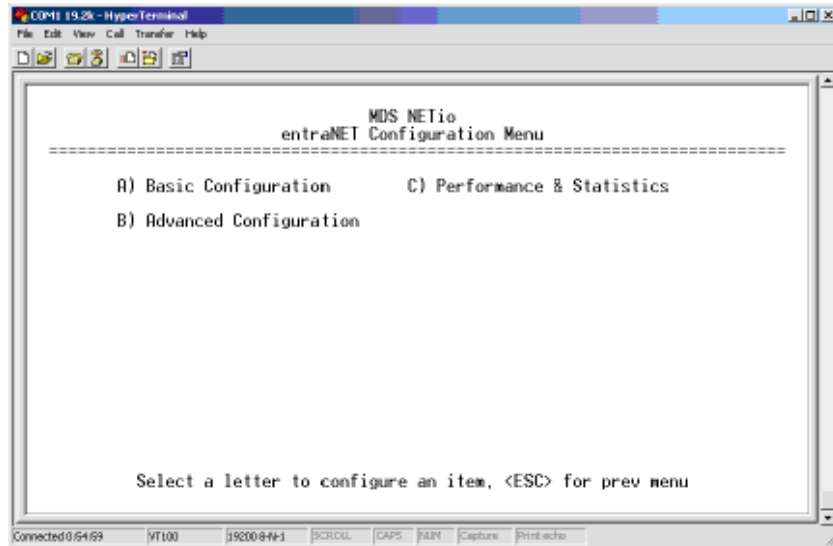**Select A to go to the Basic Configuration Menu (Section 2.3.5.)**

Figure 2-8. NETio entraNET-Class Configuration Menu

- **Basic Configuration**—Menu for setting Unit ID, Network Address, and RF Output Power.
- **Advanced Configuration**—Advanced configuration test parameters.
- **Performance & Statistics**—Status data and RSSI values.

2.3.5 Basic Configuration Menu

The Basic Configuration Menu allows setting of the Network Address in the NETioB Module to match that of the NETio AP. The Network Address is a critical parameter. All radios in a given network *must* share the same Network Address. Use **Unit** to set a Unit Address that is different from the factory default value. The factory default value is the last four digits of the NETioB Module's serial number.

Quick Start Step #7:

Select A to set the NETioB Module's Unit Address. GE MDS recommends that you set the Unit Address to the last four digits of the radio's serial number.

Select B to set the Network Address in the NETioB Module. This must be set to match the NET Address set in the NETio Access Point if one is used in the network.

Proceed to Section 2.3.6, (Quick Start Step # 8) if your NETioB

Module is equipped with WeXP communication; otherwise go to Section 2.4, Quick Start Step # 10.
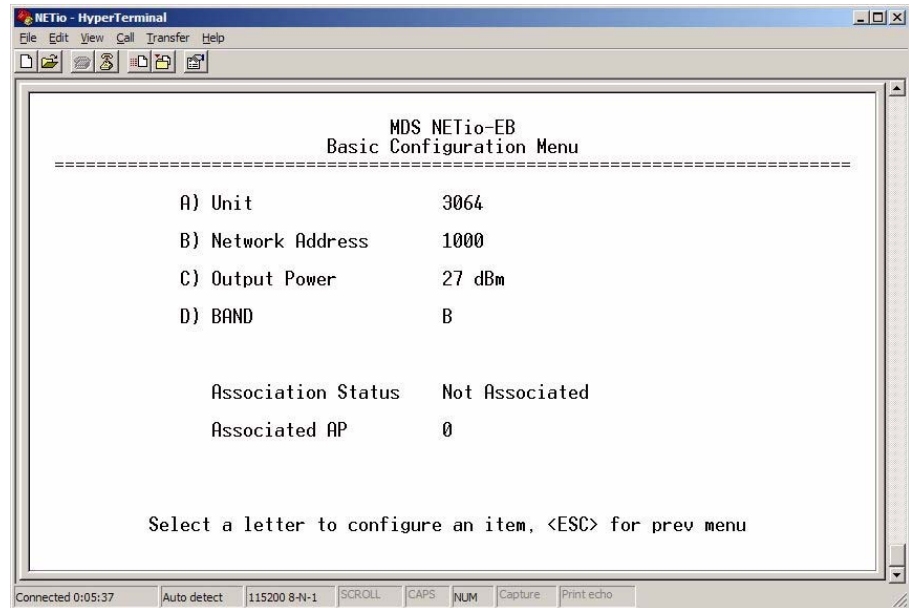
Figure 2-9. NETio entraNET-Class Basic Configuration Menu

- **Unit**—Unit ID for the NETioB Module.
- **Network Address**—Network Address that matches the Net Address in the NETio AP, if present.
- **Output Power**—Set/view the RF Output power for NETio entra-NET radio (in dBm). The range is as follows:
  - 20 to 30 dBm, in 1 dBm increments - (900 MHz)
  - 17 to 27 dBm, in 1 dBm increments - (2.4 GHz)
- **Band**—Sets the frequency band that the radio will use (only shown when using a 2.4 GHz radio). The band options are as follows:
  - A - 2.4016 GHz to 2.4270 GHz
  - B - 2.4272 GHz to 2.4526 GHz
  - C - 2.4528 GHz to 2.4782 GHz

NOTE: If the frequency band selection conflicts with the WeXP channel, the WeXP channel will be automatically moved to the nearest non-interfering channel.

- **Association Status**—Indicates whether or not NETioB Module is associated with an AP.
- **Associated AP**—Serial number of the NETio Access Point that this NETioB Module is associated with.

2.3.6 WeXP Configuration Menu

To configure the WeXP parameters, return to the main Wireless Configuration Menu (Figure 2-7), and select **B** to access the WeXP Configuration menu.

NOTE: The NETioB Module is the master WeXP radio. All Wireless NETioE Modules you wish to associate with it must share the same unique WeXP Network Address.

The WeXP Configuration menu is where you set the unique WeXP Network Address in the NETioB Module. This address will also be configured into each Wireless NETioE Module that you wish to associate with this NETioB Module. The WeXP channel, power level and timeout limit (for failsafe operation) may also be set here.

Quick Start Step #8: **Select B and enter the WeXP Network Address. It is recommended that the last 4 digits of the NETioB Module's serial number be used for this entry. Proceed to Section 2.3.7.**
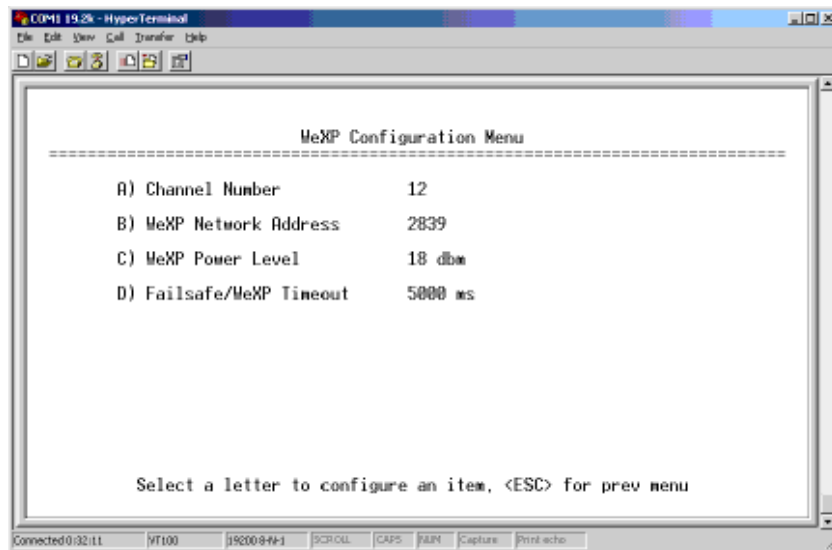
Figure 2-10. WeXP Configuration Menu

- **Channel Number**—The channel number may be set to any value from 12 to 23. When a 2.4 GHz-based NETio is used, it is recommended that the frequency of the WeXP signal be set as far away as possible from that of the 2.4 GHz radio signal, to minimize the chance of RF interference.
- **WeXP Network Address**—Unique WeXP network identifier. We recommend using last four digits of NETioB Module's serial number.
- **WeXP Power Level**—Use space bar to select the desired RF Output power for WeXP radio (in dBm). Use only the power level necessary for reliable communications.

- **NETioE WeXP Ageout Time**—Timeout period for WeXP communication.

2.3.7 Wireless NETioE Module Configuration

NOTE: Review this entire section before proceeding to Section 2.4, *ASSIGNING MODULE IDs*.

Each Wireless NETioE Module must be configured with the unique WeXP Network Address used in the NETioB Module for wireless association (see Section 2.3.6). This can be accomplished in two ways:

Method 1—Attach all Wireless NETioE Modules to the appropriate NETioB Module via the Backplane/power connector. This provides access to the NETioE Module(s) via the NETioB Module. Follow the remaining instructions in this chapter for assigning module IDs. Beginning at Section 2.4, you will assign the WeXP Network Address in Section 2.4.3.

Method 2—Connect a PC to the configuration port (RJ-11 modular) on the front of the NETioE Module and establish a HyperTerminal session as described in Section 2.3. This provides a command line interface with the unit.

Quick Start Step #9:

Using the command line interface, enter the following string and press the Return key:

wexp netaddr <WeXP Network Address used in NETioB Module>

Repeat this step for all Wireless NETioE Modules that are to associate with a particular NETioB Module. When finished, proceed to Section 2.4.

2.4 ASSIGNING MODULE IDs

When power is applied to a NETioB Module, an I/O Network is automatically established for NETioE Modules. The I/O Network is one NETioB Module (or a NETioB Module plus NETioE Modules) connected physically via the Power/Communication Bus and/or wirelessly via WeXP. Note that only Wireless NETioE Modules whose WeXP Network Address matches the address in the NETioB Module (see Section 2.3.6) will associate.

The NETioB Module automatically resolves the quantity, type and connection method for NETioE Modules upon power-up and assigns temporary Module IDs until they are formally configured.

Set Module ID

Formally "activate" the NETioE Modules in a NETio Remote Unit by assigning a permanent Module ID to each module.

NOTE: Activation is done through the **I/O Network Menu** configuration screens. Upon power-up, all NETio Module(s) will appear first in the **Unconfigured/Conflicting Module** menu. Once a Module ID is assigned by the user, the Modules will appear on the I/O Network Menu.

Figure 2-11 is an example of an operational network. If the menu displays **UNCONFIGURED/CONFLICTING MODULES**, this means there are conflicts that need to be resolved. If this menu option is not shown, then there are no conflicts and you may proceed directly to Section 2.4.3. Selecting the letter associated with a module takes you to its configuration screen.

Quick Start Step #10:   **Select κ to proceed to the Unconfigured/Conflicting Modules Menu (refer to Section 2.4.1), if shown. Otherwise, proceed to Section 2.4.3, Quick Start Step 13.**
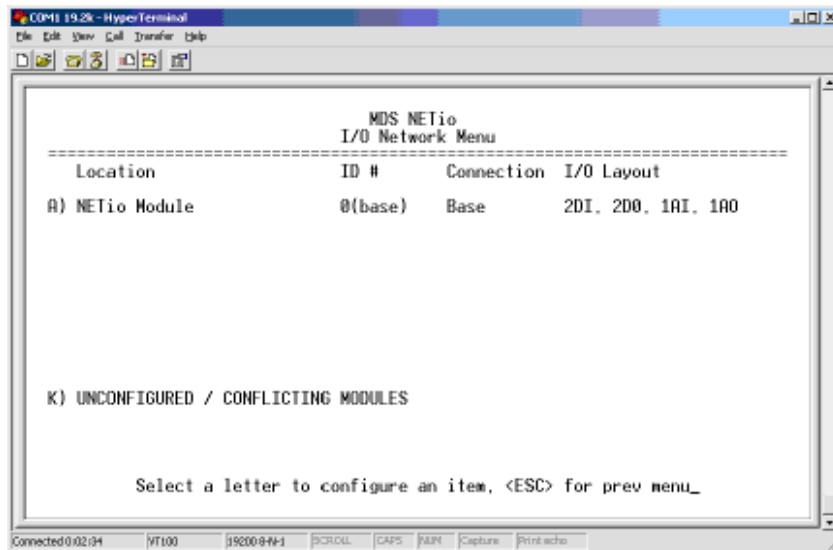

Figure 2-11. Example of I/O Network Menu

- **Location—**Module's "name" or description as defined by the user. This entry is optional.
- **ID #**—The Module ID used by this module.
- **Connection** —The type of connection each NETioE Module has to the associated NETioB Module, for example:

    Base—This module is a NETioB Module.

    Wired—Connected directly to the NETioB Module via the Backplane/power connector.

    WeXP—Connected to the NETioB Module via the WeXP wireless network.

- **I/O Layout**—The module's I/O point (number and type) capacity.

The Unconfigured and Conflicting Modules Menu is very similar to the
Network Menu, but it lists only modules which are not configured or are
improperly configured.

NOTE: In most cases, newly-installed NETioE Modules will initially
appear on the Conflicting/Unconfigured Modules list.

2.4.1 ID Conflict List Menu

The Conflict List Menu, Figure 2-12, is similar to the Network Menu,
but it lists only modules which have not been given a confirmed Module
ID. Each module must be "activated" through this menu. This menu dis-
plays all of the modules with unconfigured or conflicting Module IDs.

Quick Start Step #11: **Select the letter associated with the Module in conflict to proceed to the Conflict Menu (refer to Section 2.4.2).**

NOTE: Modules on this list are functionally out-of-service until the
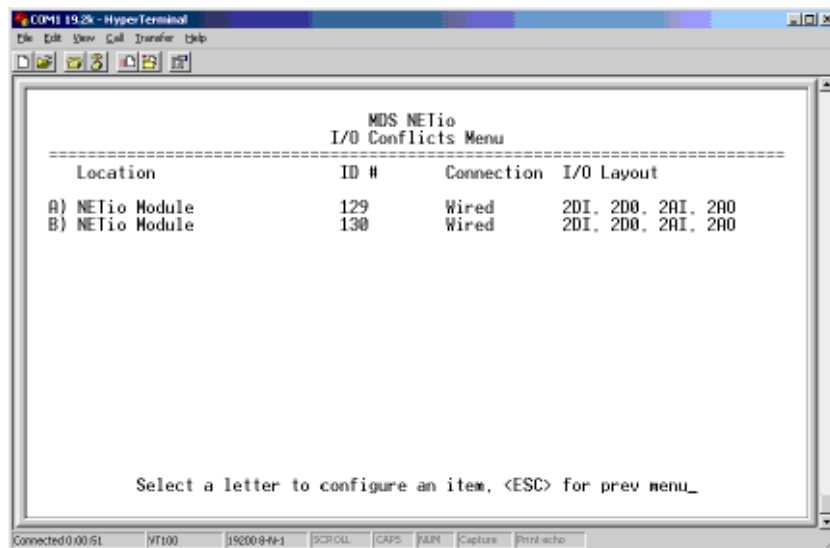conflict is resolved by assigning each module a unique Module
ID.

Figure 2-12. ID Conflict Menu

Four informational fields are shown on this screen:

- **Location**—Module's "name" or description as defined by the
  user. This entry is optional.
- **ID#**—The temporary Module ID currently set for this module.
- **Connection** —The type of connection the NETioE Module has to
  the NETioB Module. For example:

        Wired—Connected directly to the NETioB via the Back-plane/power connector.

        WeXP—Connected to the NETioB Module via the WeXP wireless network.

- **I/O Layout**—The module's I/O point (number and type) capacity.

Selecting the letter corresponding to a conflicting module brings you to the Conflict Menu, Figure 2-13, where the Module ID and Location Field can be entered.

2.4.2 Conflict (Resolution) Menu

Each Module must be assigned a unique ID. Changing the Module Name is optional. Once you have entered the ID, the module moves to the I/O Network Menu.

Quick Start Step #12:   **Select B and enter a unique Module ID. Note that Module IDs must be assigned to all modules in the Conflict List Menu. See Section 2.4.1. Once completed, refer to Section 2.4.3.**
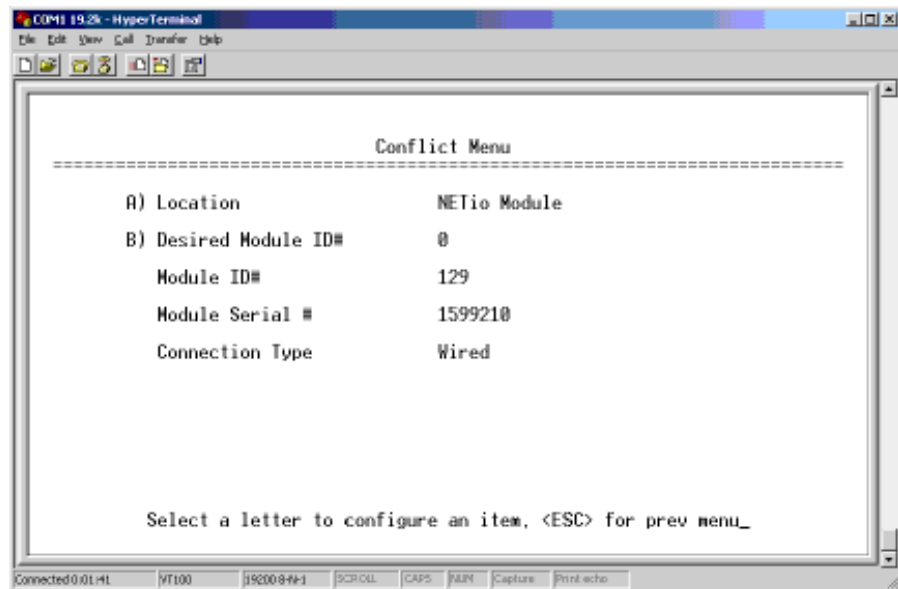

Figure 2-13. Conflict Menu

User-Alterable Parameters:
- **Location**—User-configurable name for the module.
- **Requested (Address) ID #**—Unique Module ID number.

Read-Only Parameters:
- **Serial #**—Factory's serial number of the module.
- **Connection Type**—The connection method for this NETioE to the associated NETioB Module. Options are: **WeXP** or **Wired**.

2.4.3 Configuring WeXP Wireless NETioE Modules

Once all module ID conflicts have been resolved, all modules will appear in the I/O Network Menu. You can change or modify the Module ID at any time by selecting the letter associated with a particular module. The only exception is the NETioB Module ID, which is fixed at **0** (zero).

The final step is to set the WeXP Network Address in any Wireless NETioE module that is part of this NETio Remote Unit. Note that the WeXP Network Address must match the value set in the NETioB Module earlier (see Section 2.3.6).

Quick Start Step #13:

If WeXP is used, configure the WeXP Network Address, if not already configured in Section 2.3.7 Method 2. Otherwise, proceed to Section 2.5 if Direct Mode will be used, or Section 2.6 if an entraNET AP will be used.

NOTE: **Wireless NETioE Modules show a "Connection" type of "wired" if they are temporarily attached via the Backplane/power connector. They will display "WeXP" once the WeXP Network Address is configured and the module is unattached.**

Select the letter for the Wireless NETioE Module that you wish to configure. Proceed to Section 2.4.4.
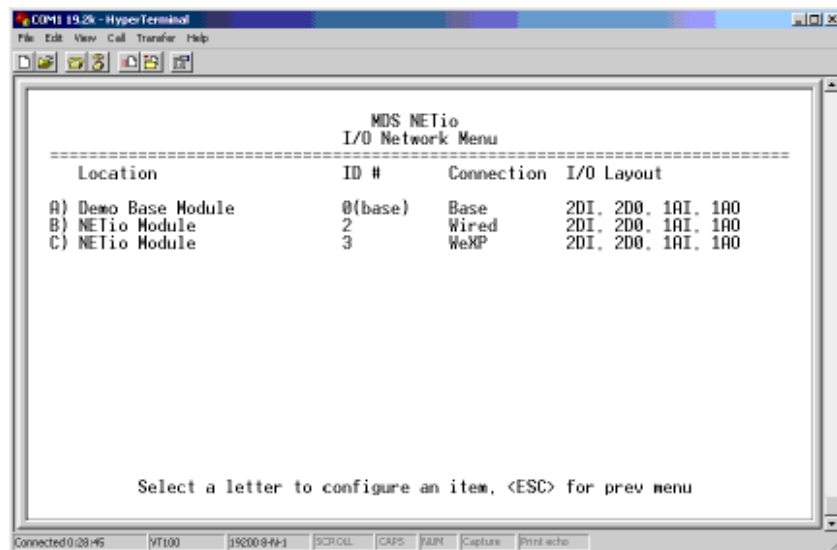

Figure 2-14. Example of I/O Network Menu

2.4.4 I/O Module Configuration Menu

The I/O Module Configuration Menu (Figure 2-15) is where all NETio Module parameters can be set or viewed, including I/O point options.

**Quick Start
Step #14:**

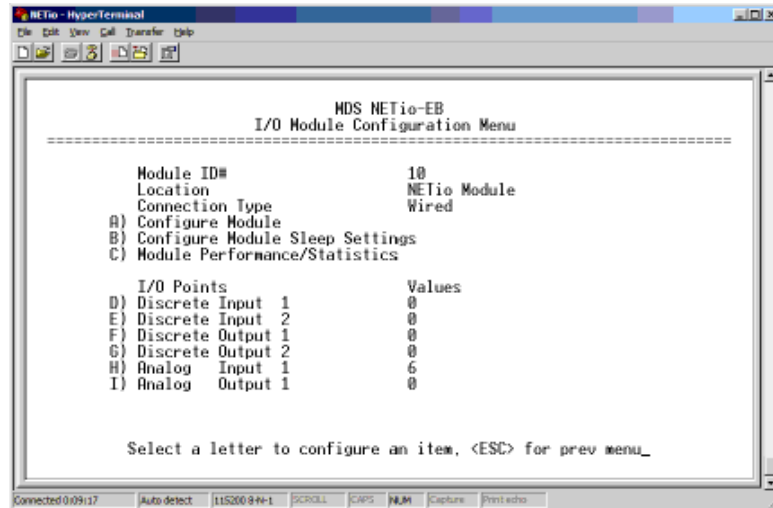**Select A and go to the Module Menu (proceed to Section 2.4.5)**

Figure 2-15. I/O Module Configuration Menu

2.4.5 Module Menu

The Module Menu (Figure 2-16) is where general NETio module parameters can be viewed or set.

**Quick Start
Step #15:**

Select B and enter the WeXP Network Address to match the address entered in the NETioB Module (refer to Section 2.3.6 above).

- Refer to Section 2.5 if NETio Remote Units will use Direct Mode.
- Proceed to Section Section 2.6 if an NETio Access Point will be used.
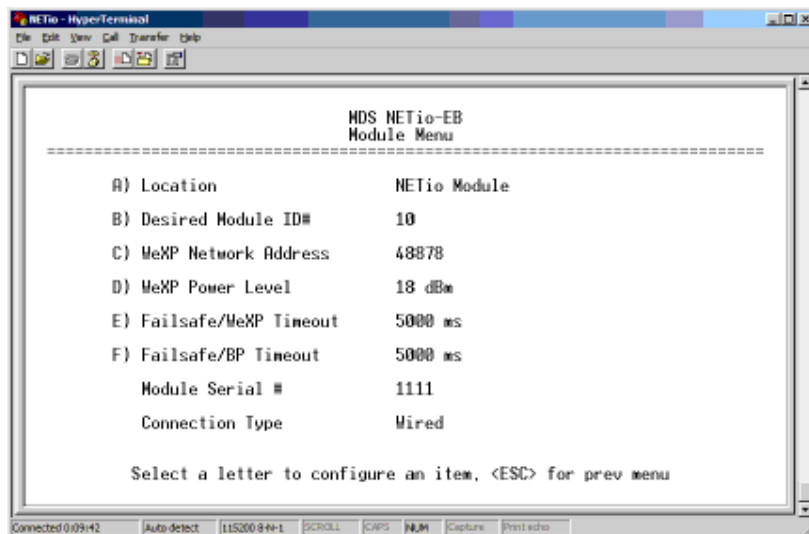- If neither mode is required proceed to Section 2.7.

Figure 2-16. Module Menu

2.5 REMOTE-TO-REMOTE COMMUNICATION—NO AP

2.5.1 Using Direct Mode

Direct Mode allows users to implement long range point-to-point and point-to-multipoint NETio systems without the use of an Access Point (AP). Direct Mode is particularly useful for smaller NETio deployments involving 2 to 5 NETio Remote Units that perform signal regeneration or protocol addressability.

In Direct Mode, the user establishes one NETioB Module as the Direct Mode Root. All other NETioB Modules that need to be associated with the Root are configured as Direct Mode Nodes. Direct Mode also requires that a unique Network Address be assigned. This address must be different from the Network Address used for association with an NETio Access Point. All NETioB modules that share the same Direct Mode Network Address will associate with the Root node when placed in Direct Mode.

Functional Limitation when in Direct Mode

The following restriction applies when operating in Direct Mode:

When in Direct Mode, you must connect directly to each NETioB Module to configure I/O points and I/O mapping. When in Infrastructure Mode, any NETio device in the Network can be configured through the NETio Access Point.

2.5.2 Configuration Instructions

Quick Start Step #16: **From the Main Menu, select item "C" to go to the Wireless Configuration Menu, then select "A" to go to the entraNET Configuration Menu shown in Figure 2-17.**
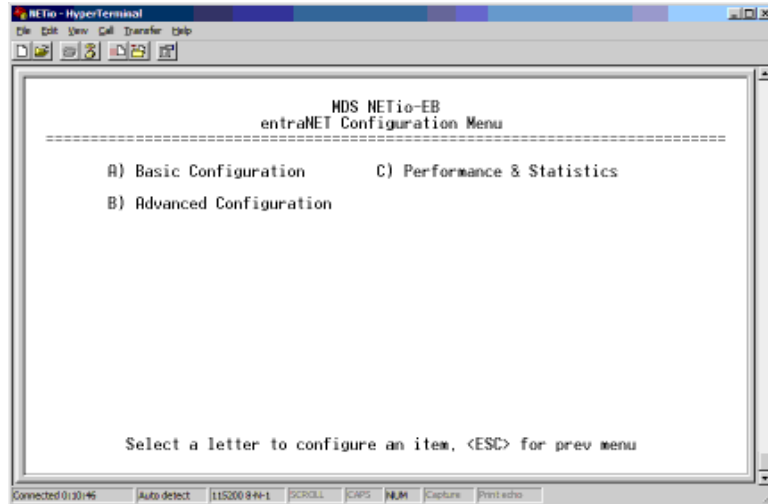
Figure 2-17. entraNET Configuration Menu

Quick Start
Step #17:
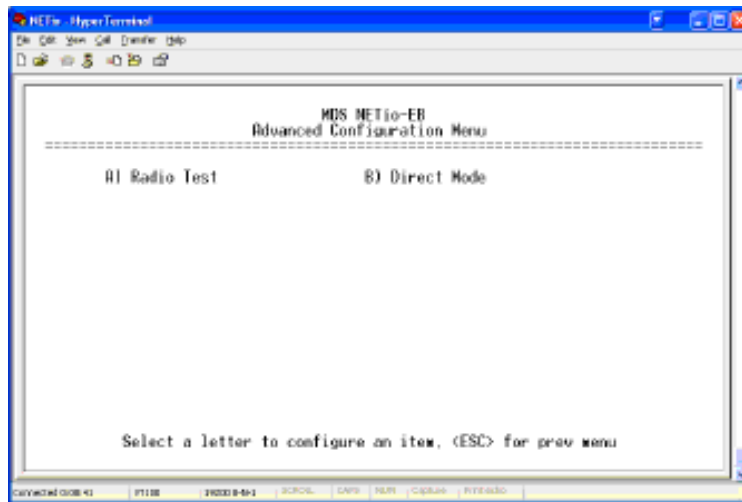Select "B" to access the Advanced Configuration Menu shown in Figure 2-18.

Figure 2-18. Advanced Configuration Menu

Quick Start
Step #18:
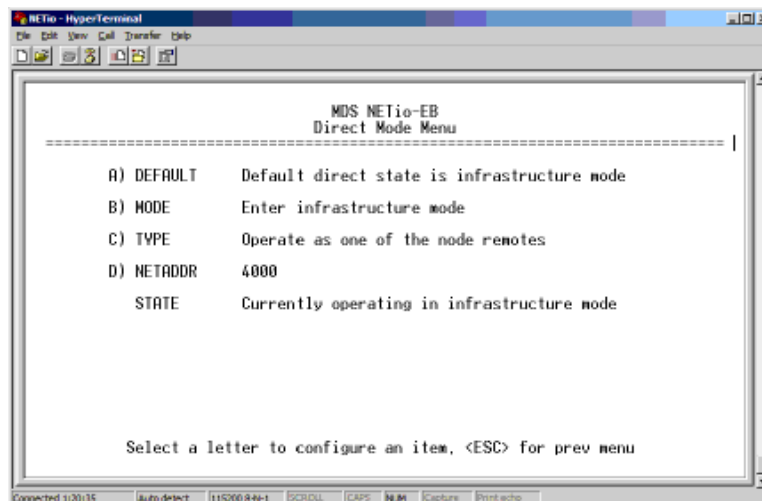Select "B" to access the Direct Mode Menu shown in Figure 2-19.

Figure 2-19. Direct Mode Menu
(When Type is set to "Node Remote")
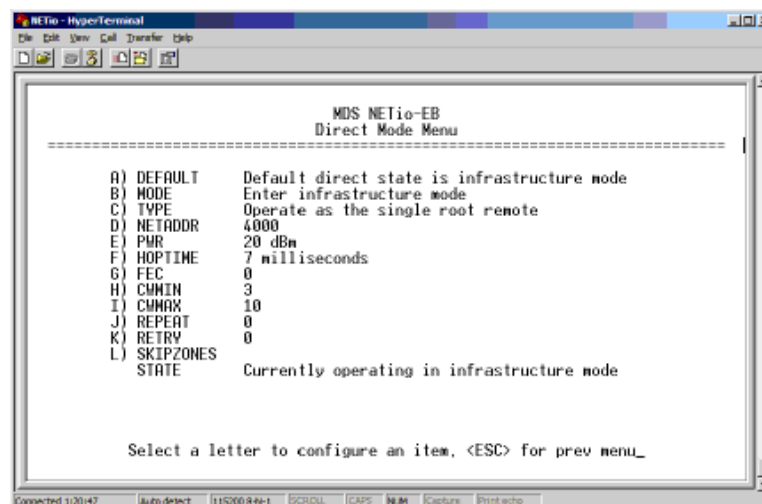
Figure 2-20. Direct Mode Menu
(When Type is set to "Single Root Remote")

The following descriptions apply to the previous two menu screens.

Default—Establishes the mode that the NETioB Module will enter upon startup/reboot. See following variables.

Mode—Value can be **Enter infrastructure mode, Enter to Direct Mode,** or **Enter direct mode by external control**

- **Infrastructure Mode** - NETioB module functions as standard remote to a NETio AP
- **Direct Mode** - NETioB module will function in Direct Mode
- **Direct Mode by external control** - NETioB Module will enter direct mode when forced by an external I/O pin (future functionality).

Type—Defines the type of Direct Mode operation this NETioB Module executes.

- Operate as the single root remote—Establishes this NETioB Module as the Direct Mode Root to which all other Direct Mode NETioB Modules whose **NETADDR** value matches will associate. Note: Only one NETioB Module can be designated as the Root.
- Operate as one of the node remotes—Establishes the NETioB Module as a Direct Mode Node. This Direct Mode NETioB Module will associate with the Direct Mode Root NETioB Module that shares the same **NETADDR** value entered in item "D."

NETADDR—Set this value to a unique Network Address. All other Direct Mode Node NETioB Modules must share the same Network Address.

PWR—Set/display RF Output power.

HOPTIME—Can be set to 7, 14 or 28 msec. (Use 7 for lowest latency.)

FEC—Forward Error Correction (Future functionality.)

CWMIN—Contention Window Minimum.

CWMAX—Contention Window Maximum.

REPEAT—Broadcast Repeat Count.

RETRY—Unicast Retry Count.

SKIPZONES—Menu to configure which frequency zones are skipped.

STATE—Current mode the NETioB Module is in (Infrastructure, Direct, etc.)

2.5.3 Variables for Direct Mode Operation

There are four variables to set for Direct Mode Operation.

Quick Start Step #19:

Select menu item A for the DEFAULT variable and use the space bar to set the operation state you wish this NETioB Module to operate in upon start-up.

Select menu item C for the TYPE variable and use the space bar to set the NETioB Module as the ROOT or a NODE.

Select menu item B for the MODE variable and use the space bar to select Enter direct mode.

Select D for the NETADDR variable and enter the unique Network Address to be used in Direct Mode, then proceed to Section 2.7.

2.6 MDS NETio ACCESS POINT USE & CONFIGURATION

NOTE: An MDS NETio Access Point is used with NETio for payload communication to RTUs, PLCs or other equipment attached to the serial or Ethernet connections on the NETioB Module. It is also used when long-range, peer-to-peer communication between NETio Remote Units is needed (for example, when I/O Extension is required between multiple NETio Remotes anywhere on the network). *All NETio parameters and menus may be accessed over the air through a NETio Access Point via remote access. See Section 2.6.3.*

For convenience, this section describes various NETio Access Point configuration steps necessary for NETio setup. For comprehensive information on the entraNET radio, please refer to publication 05-4055A01.

Figure 2-21 shows the interface connectors present on an MDS NETio Access Point. Review these items before making the connections described in this section.
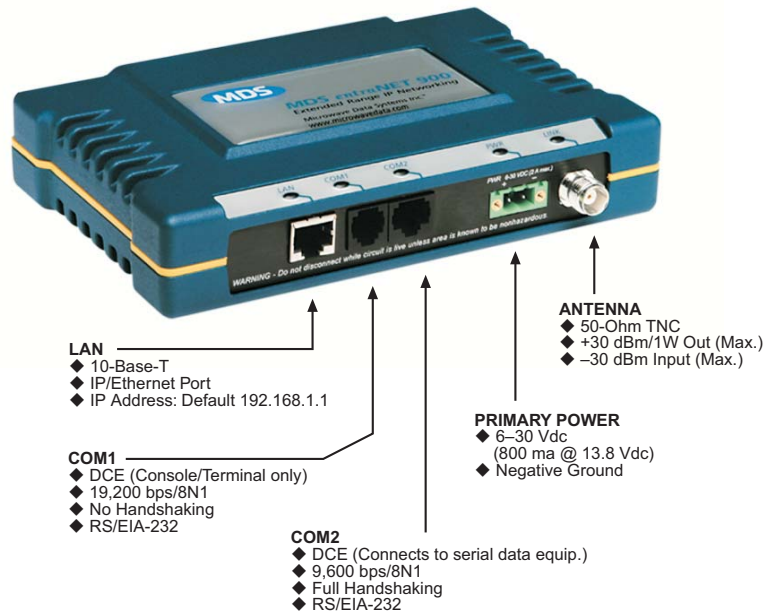

LAN
◆ 10-Base-T
◆ IP/Ethernet Port
◆ IP Address: Default 192.168.1.1

COM1
◆ DCE (Console/Terminal only)
◆ 19,200 bps/8N1
◆ No Handshaking
◆ RS/EIA-232

COM2
◆ DCE (Connects to serial data equip.)
◆ 9,600 bps/8N1
◆ Full Handshaking
◆ RS/EIA-232

ANTENNA
◆ 50-Ohm TNC
◆ +30 dBm/1W Out (Max.)
◆ –30 dBm Input (Max.)

PRIMARY POWER
◆ 6–30 Vdc
  (800 ma @ 13.8 Vdc)
◆ Negative Ground

Figure 2-21. MDS NETio Access Point Interface Connectors
(See MDS publication 05-4055A01 for detailed entraNET information)

2.6.1 INITIAL SETUP

The following steps explain how to make connections to the NETio
Access Point, power it up, and set basic configuration.

Figure 2-22 shows a typical benchtop arrangement. Connect the antenna
ports of each device as shown through attenuators and an RF power
divider. This provides for stable radio communications between each
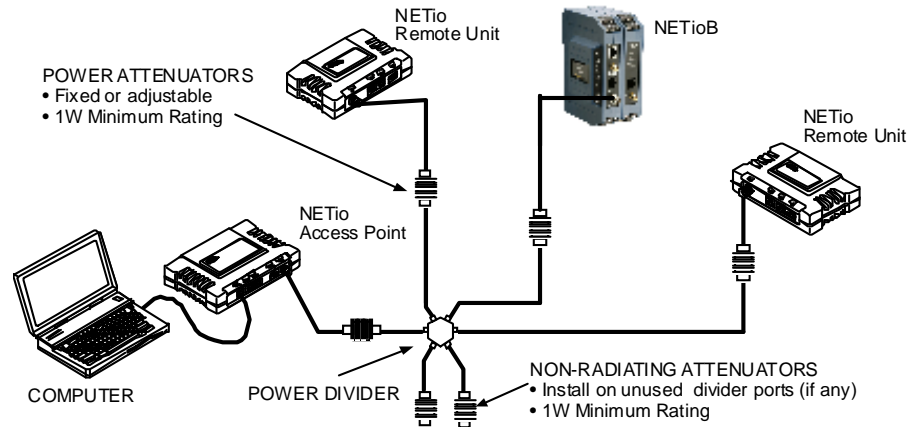module and prevents interference to nearby equipment.

Figure 2-22. Typical Setup for Benchtop Testing of Radios

NOTE: It is important to use attenuation between modules in the test
setup. The amount of attenuation required will depend on the
number of modules being tested and the desired signal strength
(RSSI) at each transceiver during the test. In no case should a
signal greater than –30 dBm be applied to any transceiver in
the test setup. A transmit RF power output level of +20 dBm
(100 mW) is recommended. This can be set via the radio's
menu (**Main Menu>Radio Configuration>RF Output Power Setpoint**).

Measure & Connect DC Power

The DC power applied to transceivers must be within 6–30 volts and be
capable of continuously providing a minimum of 11 Watts.

A power connector with screw-terminals is provided with each module.
Strip the wire leads to 6 mm (0.25"). Be sure to observe proper polarity
as shown in Figure 2-3 with the positive lead (+) on the left.

NOTE: It will take about 30 seconds for the AP transceiver to power
up and be ready for operation.

2.6.2 Set Basic Configuration of NETio Access Point

The following instructions give a summary of the basic settings for the
NETio Access Point for operation with NETio radios. For detailed AP

instructions and menu navigation, refer to MDS publication 05-4055A01.

Log-In Procedure   NETio Remotes depend on the NETio Access Point's beacon signal for association via their embedded entraNET radio. Figure 2-23 shows the basic setup for configuring an AP radio.
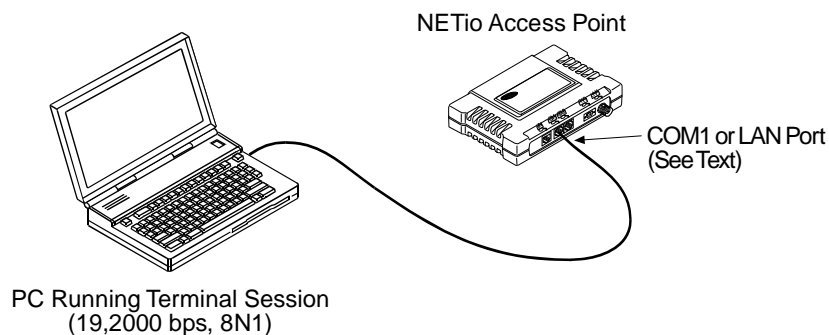
NETio Access Point

COM1 or LAN Port
(See Text)

PC Running Terminal Session
(19,2000 bps, 8N1)

Figure 2-23. AP Configuration Setup

Console Terminal Connection (Recommended for first-time log-in)   The NETio Access Point and NETioB Modules can both be configured using a PC running Hyper Terminal or a console terminal. To configure the Access Point, connect a PC to the radio's COM1 port and establish a HyperTerminal session using the following parameters: 19200 bps, 8 bits, no parity, one stop bit (8N1), flow control disabled, VT100 emulation.

NOTE: The *exact* parameters given above must be used for console terminal communication. Improper settings are a common cause of difficulty.

Telnet connection using the AP's LAN Port (A valid IP address must be set)   To configure the Access Point via its LAN port, connect a PC's Ethernet port to the AP with an Ethernet crossover cable. *Note: The radio must first have a valid IP address programmed—the default IP address is 192.168.1.1.*

With a PC connection made, launch a Telnet session and log into the AP as follows:

1. Press the ENTER key to receive the **login** prompt. The COM1/LAN LED flashes to indicate data communications.

2. At the **login** prompt, enter the username (**admin** is the default username). Press ENTER.

3. At the **Password** prompt, enter the password. (**admin** is the default password). Press ENTER. Upon successful log-in, the Starting Information Screen appears.

GE MDS

> **NOTE:** The AP Management System supports the use of "configuration scripts" to aid in uniformly configuring multiple transceivers. This time-saving technique is discussed in the MDS entraNET manual, 05-4055A01).

Set Key AP Parameters

Table 2-1 provides a listing of key AP operating parameters, their default settings, and values or range. Typically, these are the only settings that need to be set or reviewed for a basic check of the radio system. The **Net Address** is the only parameter that *must* be set in every case. **IP Address** and **Netmask** are set only if IP/Ethernet connections will be used. A complete list of AP commands appears in the MDS entraNET Manual (05-4055A01).

Table 2-1. Key AP Parameters & Defaults

Menu Item	Mgt. System Location	Default	Values/Range
Net Address*	Main Menu> Network Configuration> Wireless Mac Configuration	100	15 character alphanumeric entry (See note below table)
IP Address	Main Menu> Network Configuration>IP Configuration	192.168.1.1	Contact your Network Administrator
IP Netmask	Main Menu> Network Configuration>IP Configuration	255.255.0.0	Settable, per user requirement
RF Output Power (non-ETSI)	Main Menu> Radio Configuration	900 MHz: 30 dBm 2.4 GHz: 27 dBm	900 MHz: 20–30 dBm 2.4 GHz: 17-27 dBm
RF Output Power (ETSI)	Main Menu> Radio Configuration	2.4 GHz: 20 dBm	2.4 GHz: 10-20 dBm
Password Changes	Main Menu> Security Configuration> User Passwords	Administrator Password: **admin** (lower case) Guest Password: **guest** (lower case)	• 1–8 alphanumeric characters • Passwords are case-sensitive; can be mixed case

* It is recommended that the Net Address be set to the last four digits of the AP's serial number. This reduces the chance of conflict with other nearby MDS entraNET systems.

Starting Information Screen

Upon successful log in to the Menu System, the *Starting Information Screen* (Figure 2-5) appears. This screen provides a read-only overview of the transceiver's current operating conditions. A summary of available screens and selections is given below. For detailed explanations of these menu items, refer to the MDS entraNET manual (05-4055A01).

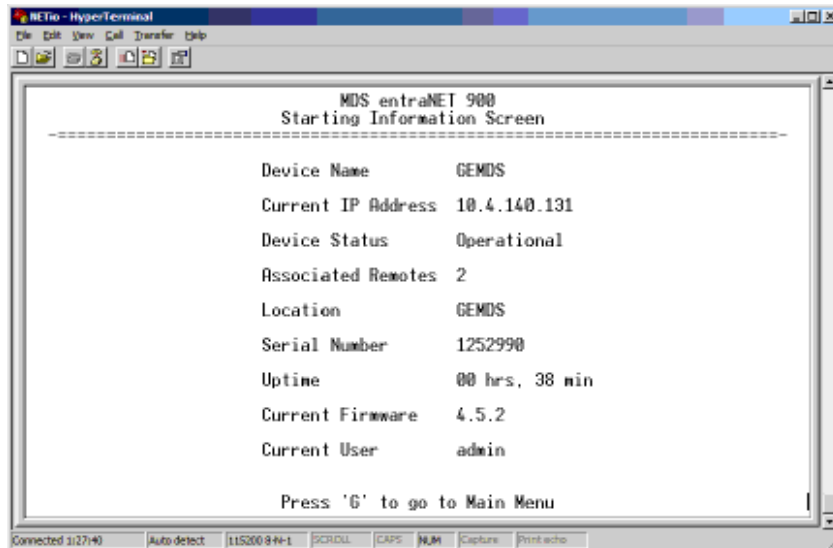***Quick Start Step #20:*** Select **G** to go to the Main Menu. Proceed to "Main Menu" description below.

Figure 2-24. Starting Information Screen

Main Menu The Main Menu (Figure 2-25) is the entryway to all user-controllable features. The radio's Device Name appears at the top of this and all other screens to identify the unit that is being interrogated. A summary of available selections is given below.

Quick Start Step #21: Select **B** to go to the Network Configuration Menu. Proceed to "Network Configuration Menu" described below.
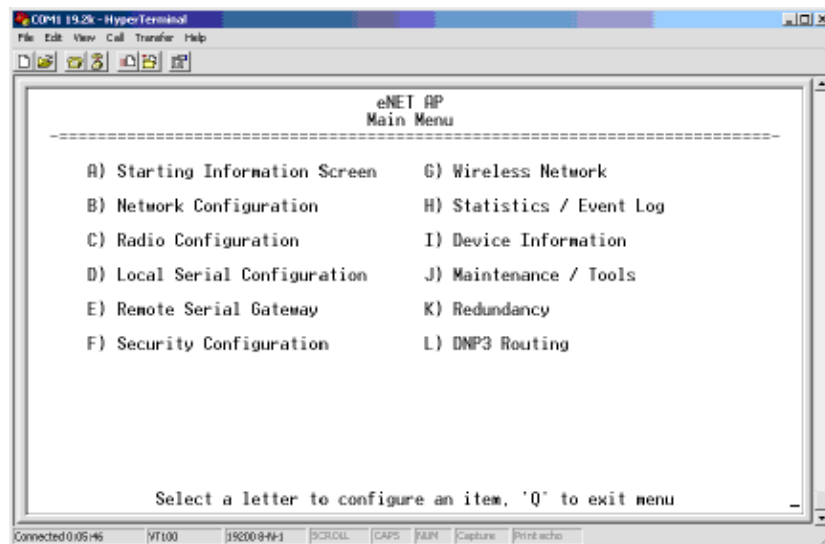
Figure 2-25. Main Menu

Network Configuration Menu

The *Network Configuration Menu* (Figure 2-26) is where you establish key system-wide communication parameters such the Net Address and all IP and Ethernet level parameters.

Quick Start Step #22:

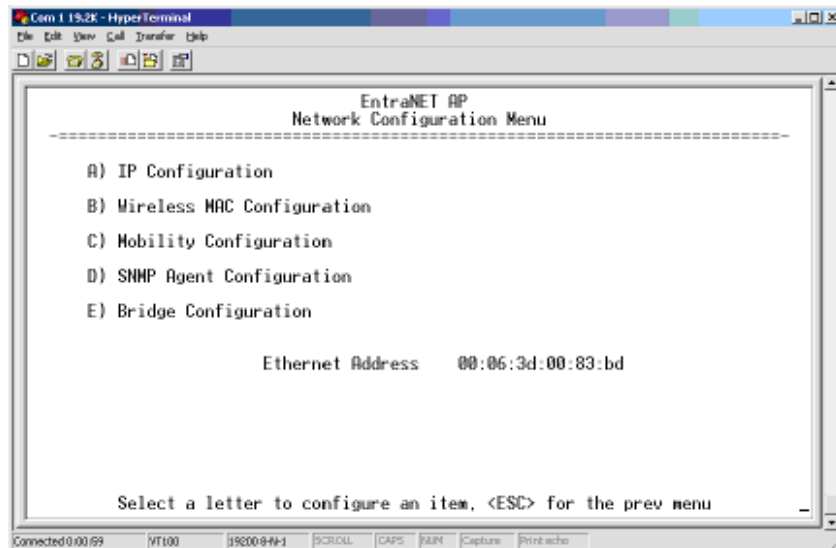**Select B to access the Wireless Mac Configuration Menu. (See *Wireless MAC Configuration Menu* below.)**

Figure 2-26. Network Configuration Menu
(From Access Point)

The Network Configuration Menu is subdivided into the sections listed below. For additional details on these settings, refer to the MDS entraNET manual (05-4055A01).

- **IP Configuration**—Allows viewing/setting the transceiver's IP address, netmask and gateway addresses.
- **Wireless MAC Configuration**—Provides access to the Net Address and parameters for the Media Access Control (MAC) wireless protocol.

Wireless MAC Configuration Menu

The Wireless MAC Configuration Menu (Figure 2-27) is where you enter the Net Address for your network. In this case, the term "Network" applies to the AP and *all* NETio Remote Units that will be communicating with each other. All devices must have the *identical* Net Address to associate and synchronize with each other. The Net Address matches the Network Address that was set in NETioB Modules in Section 2.3.5.

Quick Start Step #23:

Select A and enter the Net Address. It is recommended that the last 4 digits of the AP's serial number be used as the Net Address.

Next, proceed to the IP Configuration Menu described on the following page if IP/Ethernet will be used. Otherwise, proceed to Section 2.6.3.
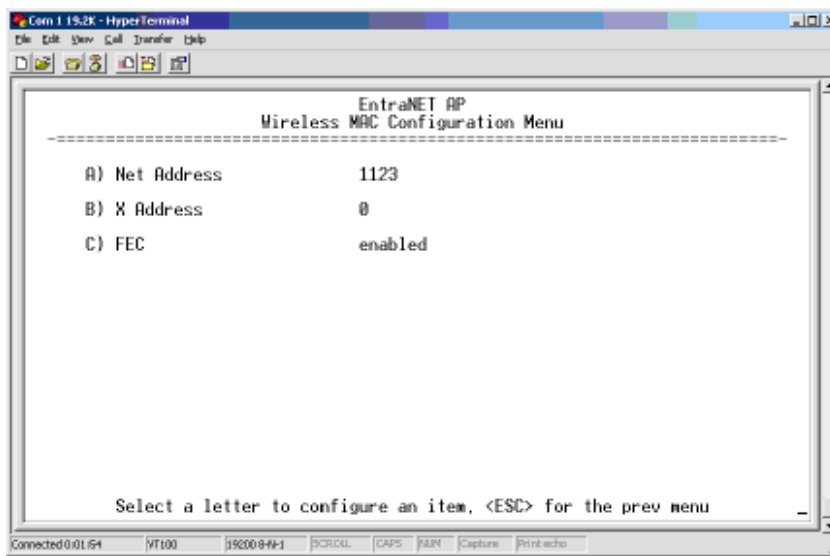
Figure 2-27. Wireless Mac Configuration Menu

- **Net(work) Address**—Address of the network to which this Unit belongs. An address is essential for connection of Remotes to the NETio Access Point.
- **X Address**—"Extended Address" used for installations with multiple APs supporting mobility. This address must be a unique value, different from the Net Address. For single AP networks, this parameter is not used.
- **FEC**—Forward Error Correction status (enabled/disabled). The FEC setting has a significant effect on the throughput/speed of the radio network. For a discussion on this, and other issues affecting throughput speed, refer to the MDS entraNET manual, 05-4055A01.

IP Configuration Menu

The IP Configuration Menu (Figure 2-29) is reached from the Network Configuration Menu shown earlier in Figure 2-26.

Quick Start Step #24:

Configure the IP settings, then proceed to Section 2.6.3.
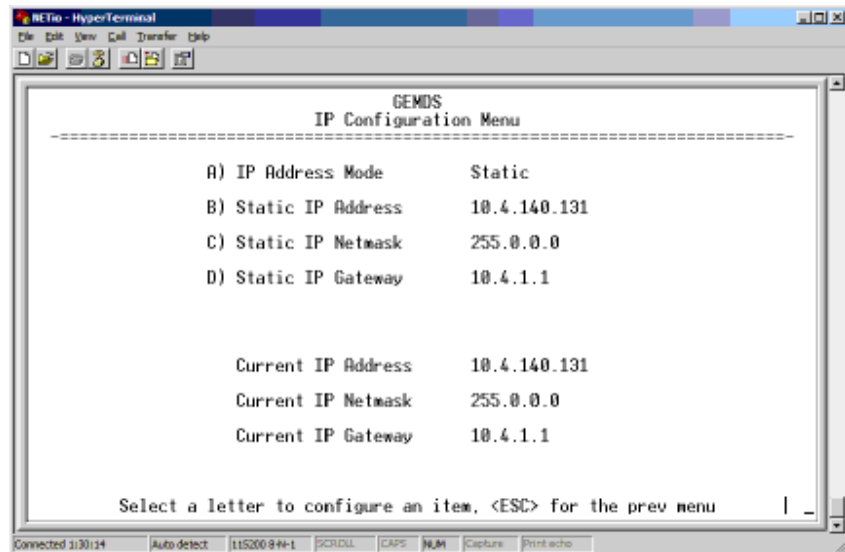
Figure 2-28. IP Configuration Menu

- **IP Address Mode**—Selects either Static or Dynamic IP Address assignment.
- **IP Address** *(User Review Recommended)*—Essential for connectivity to the NETio AP menu system via the LAN port or over the air. Enter any valid IP address that will be unique within the network. [**192.168.1.1**]

  CAUTION: Changing this value in the transceiver while you are communicating with it over the network, will cause a loss of communication with the transceiver. Communication will need to be re-established using the new IP address.

- **IP Netmask**—The IPv4 local subnet mask. This field is unnecessary if DHCP is enabled. [**255.255.0.0**]
- **IP Gateway**—The IPv4 address of the default gateway device, typically a router. This field is unnecessary if all devices are on the same subnet [**0.0.0.0**]

NOTE: The NETio Access Point is not a router, and thus all IP parameters are used to gain access to local management only, and have no affect on the routing of system data.

2.6.3 Accessing NETio Remote Units Via the NETio Access Point

All NETio configuration can be performed over-the-air through an NETio Access Point. This is especially convenient after units have been installed. To communicate with NETio Remote Units, a common Network Address must be programmed into the AP and each NETioB Module in the network. Once this is done, the POWER and LINK LEDs

should be lit on the AP, and each NETioB Module. This indicates that the NETioB Modules are associated with the AP.

The remainder of this section describes the menu steps that must be followed to connect over-the-air with NETioB Modules. Once a connection has been made, continue with the configuration steps in this manual, beginning with Section 2.3.5.

Quick Start
Step #25:

From the NETioA Access Point Main Menu (Figure 2-29), select item G and proceed to Wireless Network Menu description below.
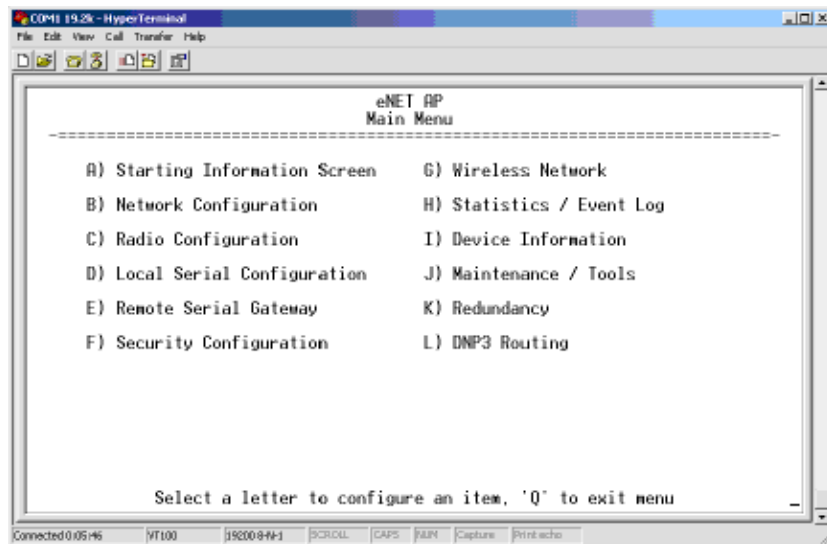
Figure 2-29. Main Menu

Wireless Network Menu

The Wireless Network Menu (Figure 2-30) provides visibility and access to all remote radios associated with the AP. Select D to review a summary of all radios associated with the AP including their Unit IDs and radio type. A typical sample summary screen is shown in Figure 2-31.
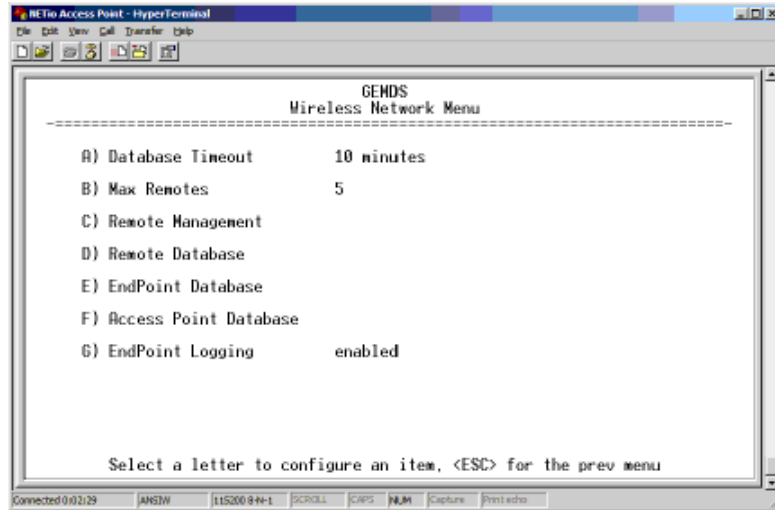
Figure 2-30. Wireless Network Menu

***Quick Start
Step #26:***

Select item C to configure a specific NETio Remote Unit, then proceed to Remote Management Menu below.
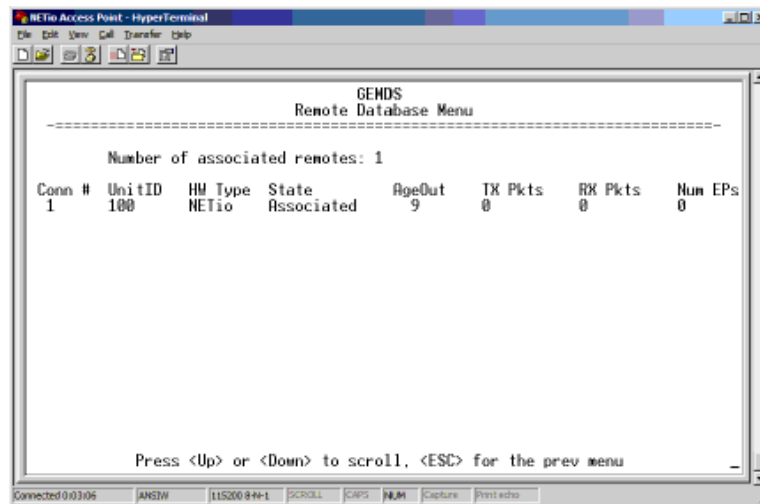

Figure 2-31. Remote Database Menu

***Remote
Management Menu***

The Remote Management Menu (Figure 2-32) provides a portal to each Remote radio as well as menus and tools used for updating remote radio firmware and programming.
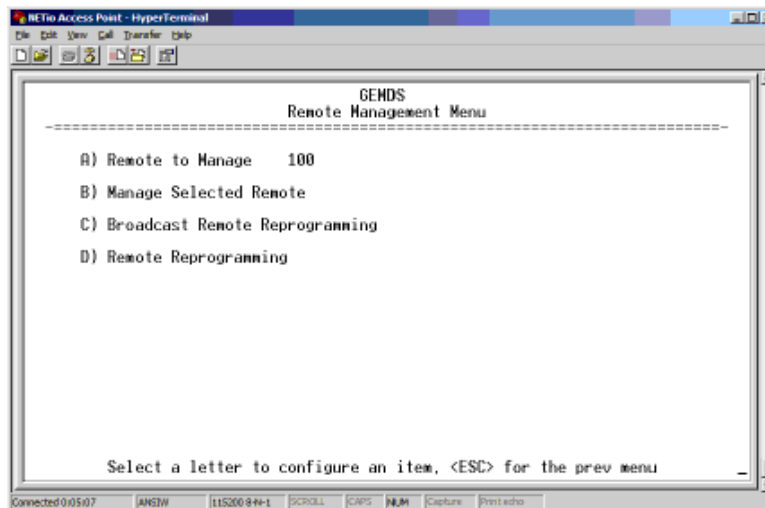
Figure 2-32. Remote Management Menu

To configure a remote NETio Remote Unit, enter the Unit ID for the remote then select **Manage Selected Remote**.

Quick Start Step #27:

Select item A and enter the NETio Remote Unit ID, then select B to configure.

Over-the-Air Configuration of Remotes

Once **Manage Selected Remote** has been selected, an over-the-air connection is made to the NETio Remote Unit. All configuration steps can now be performed as if the terminal were directly connected to the NETio Remote Unit. When configuration is complete, remember to type * three times to return to the AP configurator (see Figure 2-33).
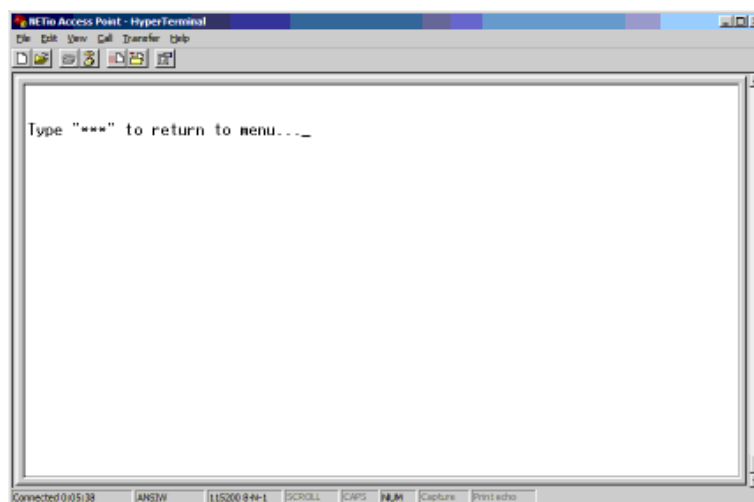

Figure 2-33. HyperTerminal Command Screen

2.7 CHECK for NORMAL OPERATION

When all modules have been configured, you should be able to use all modules in the I/O Network Menu. Note that you will only see Wireless NETioE Modules displayed with a connection type of WeXP if they are not attached via the Backplane/power connector.
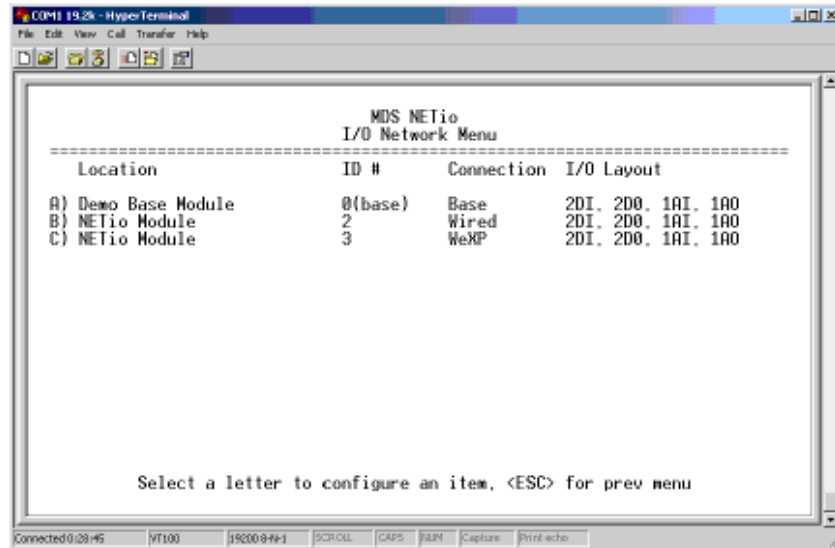

Figure 2-34. Example of I/O Network Menu

Observe the NETioB Module LEDs on the faceplate for the proper indications. In a normally operating system, the following LED indications should be seen:

- PWR—Lit continuously
- LINK—Lit continuously (if associated with an entraNET AP)
- COM1—Blinks to indicate data exchange with terminal

In a normally operating system, the following LED indications should be seen within 30 seconds of start-up on the Wireless NETioE Module:

- PWR—Lit continuously
- WeXP—Lit continuously

If the previous steps have been successfully completed, the I/O point configuration can be set. These steps are described in *CHAPTER-3 I/O POINT CONFIGURATION* beginning on Page 49.

If a NETio Access Point is used for over-the-air configuration, refer to Section 2.6.

3 I/O POINT CONFIGURATION

3.1 I/O POINT CONFIGURATION

This section describes how to configure I/O points in a NETio Remote Unit. This process is required for each I/O signal connected to a NETio Remote Unit. These instructions assume that you have established a PC connection with the unit as described earlier in this manual.

This section also gives instructions for "mapping" an input to a particular output. This is required in cases where an input signal connected to one NETio Module must be regenerated as an *output* from a different NETio Module.

Each I/O point has a unique address that corresponds to where it is located in a NETio Remote Unit. You use this address when mapping one point to another in a Signal Extender function, or when selecting the point in a Protocol node.

A point address consists of three fields:

- **Unit ID** —The unique Unit ID of the NETioB Module (see Section 2.3.4).
- **Module ID**—The number assigned to the NETio module.

  For NETioE Modules: The Module ID is set by the user, for the Base it is 0 (see Section 2.3.5).
- **Point Number**—This number references the physical termination number of a particular I/O point on a NETio Module. It is automatically assigned.

Each I/O point connected to a NETio Remote Unit has an address with the format shown below. Each field is separated by a comma:

<div align="center">

<Unit ID>,<Module ID>,<Point Number>

</div>

3.2 I/O NETWORK MENU

The I/O Network menu shows the NETioB Module and any NETioE Modules (if present) connected via the Backplane/power connector or WeXP. If there are a large number of modules in the network, it may be necessary to scroll down the screen to view all entries.

I/O points are configured by selecting the module that a signal is wired to and then selecting a particular I/O point. When a Wireless NETioE Module is selected, the WeXP LED blinks to indicate that it is being accessed for configuration.

Quick Start Step #28: | **Select the letter associated with the module containing the I/O point to be configured. Proceed to Section 3.2.1.**
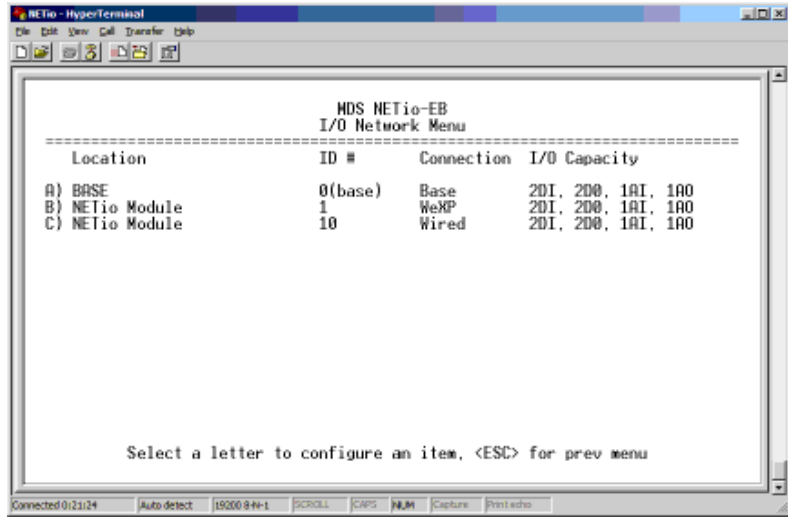
Figure 3-1. Example of I/O Network Menu

3.2.1 I/O Module Configuration Menu

The I/O Module Configuration Menu is where all NETio Module-spe-
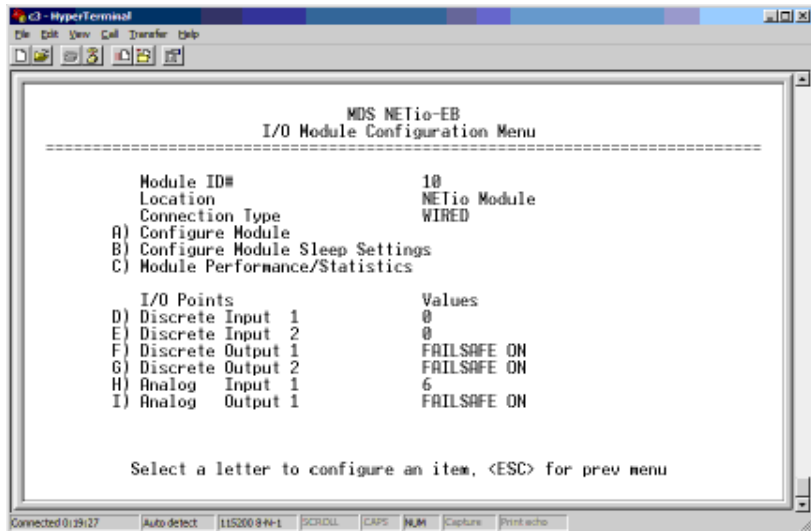cific information can be viewed or changed.

Figure 3-2. I/O Module Configuration Menu

Quick Start
Step #29:

Select the letter associated with a specific I/O point to be configured and proceed as follows:

If a <u>Discrete Input</u> is selected, proceed to Section 3.2.2.

If a <u>Discrete Output</u> is selected, proceed to Section 3.2.4

If an <u>Analog Input</u> is selected, proceed to Section 3.2.3

If an <u>Analog Output</u> is selected, proceed to Section 3.2.5

3.2.2 Discrete Input Menu

This menu allows you to view and change the Point ID Tag for a discrete input by selecting the letter A.
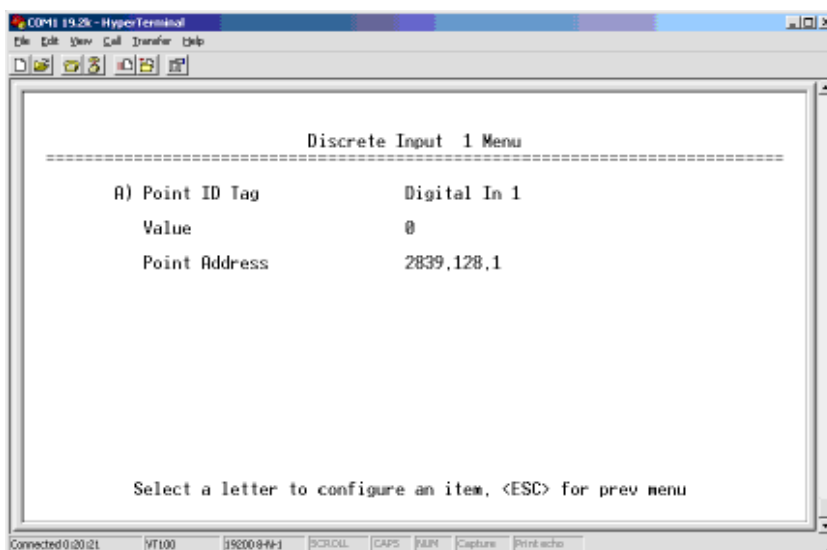

Figure 3-3. Discrete Input Menu

- **Point ID Tag—**Free-form text field to describe the use of this I/O point.

Read-Only Parameters:
- **Value**—The current state (logic high or logic low) for this point.
- **Point Address**—Address used to identify this input point. Format is: Unit ID, Module ID, Point Number.

3.2.3 Analog Input Menu

This menu allows you to view and change the Input Range and/or the Point ID Tag for an analog input.
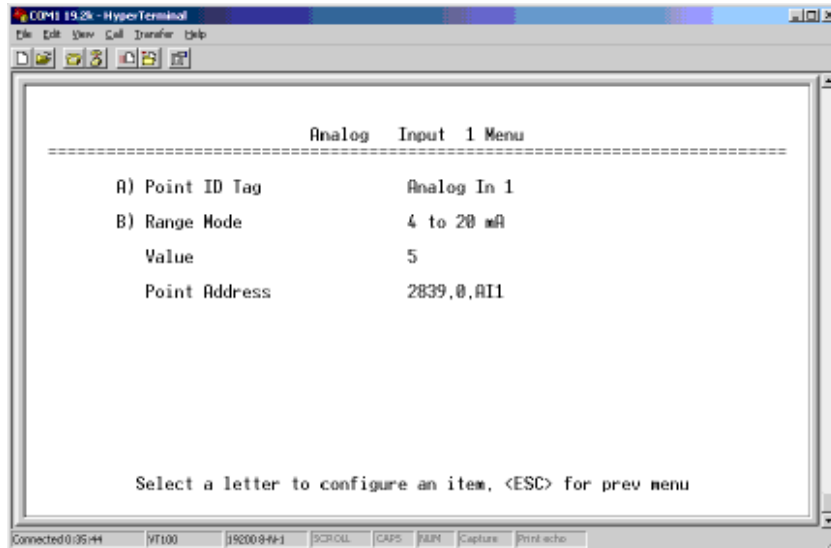

Figure 3-4. Analog Input Menu

User-Alterable Parameters:
- **Point ID Tag**—Text to describe the use of this I/O point.
- **Range Mode**—User-configured field that sets the type of input. Options are determined by module type but can be 4-20 mA, 0-5 volts, 0-10 volts, or 0.1-5 volts.

Read-Only Parameters:
- **Value**—The present value in A/D counts for this point address.
- **Point Address**—Address used to identify this input point. Format is: Unit ID, Module ID, Point Number.

3.2.4 Discrete Output Menu

This menu allows you to view and change various parameters for a discrete output point.
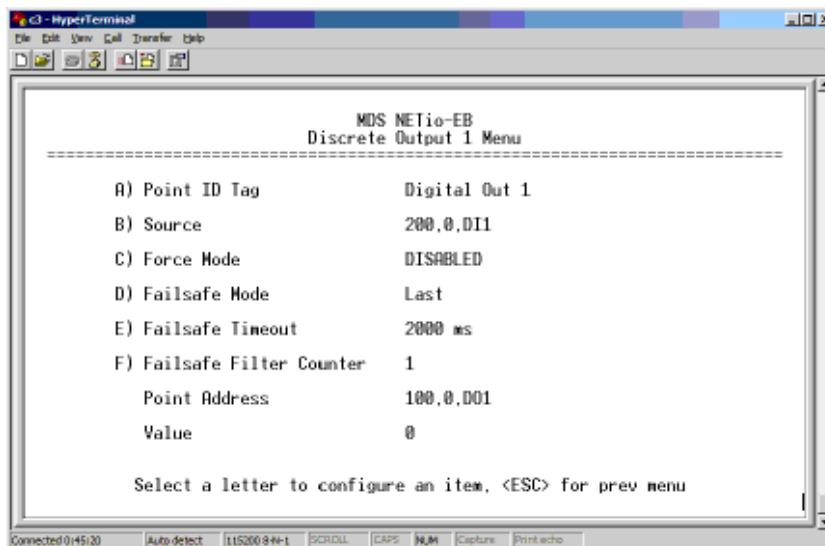

Figure 3-5. Discrete Output Menu

User-Alterable Parameters:

- **Point ID Tag**—Text to describe the use of this I/O point.
- **Source**—The input point address to get this output's value from. The format is: Unit ID, Module ID, Point Number.
- **Force Mode**—A convenience field that allows the user to force an output value. Press the spacebar to cycle through the available settings as follows:
  Off—Force Mode disabled.
  High (1)—Force Mode enabled and output is turned on.
  Low (0)—Force Mode enabled and output is turned off.
- **Failsafe Mode**—The value for this Output if communications is lost. Press the spacebar to cycle through the options as follows:
  On—On or logic 1.
  Off—Off or logic 0.
  Last—Hold last value
- **Failsafe Timeout**—Amount of time (in ms) that the wireless communication link with a Source Point in a different NETio Remote Unit must be lost before entering Failsafe Mode. It is read-only if the Source Point is in the same NETio Remote Unit.
- **Failsafe Filter Counter** (Only available when source and output are of different Remote units)—This is a failsafe timeout multiplier. The failsafe function will not be activated until the failsafe timeout has been reached this number of times. Use this value to extend the Failsafe period while maintaining an adequate I/O value update rate.

NOTE: This value is used to extend the Failsafe period while maintaining an adequate I/O update rate. This variable also establishes how often an output point is updated in I/O Extension. For more information, see *"I/O UPDATE REFRESH RATES" on Page 65.*

Read-Only Parameters:

- **Point Address**—Address used to identify this Output point. The format is: Unit ID, Module ID, Point Number.
- **Value**—The current state (logic high or logic low) of this point.

3.2.5 Analog Output Menu

This menu allows you to review and revise many parameters for a analog output point.
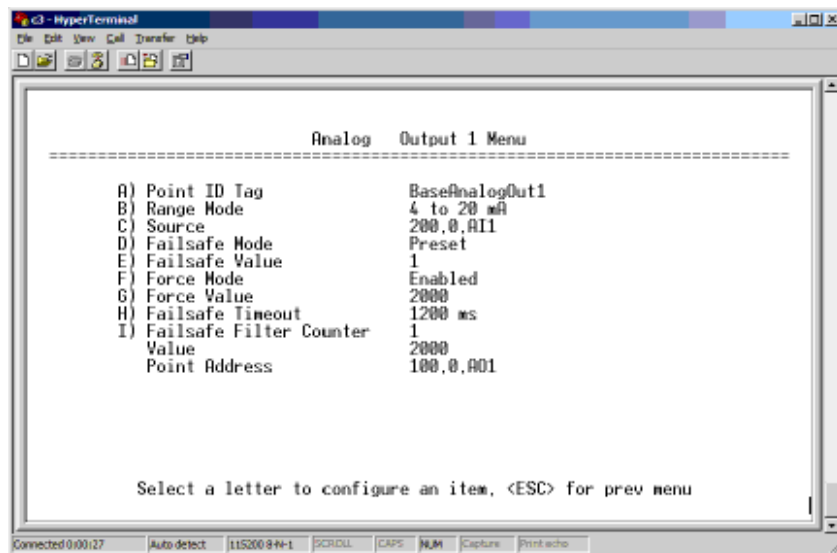

Figure 3-6. Analog Output Menu

User-Alterable Parameters:

- **Point ID Tag**—Text to describe the use of this I/O point.
- **Range Mode**—Sets the type of output. Options are determined by module type but can be 4-20 mA, 0-5 volts, 0-10 volts, or 0.1-5 volts.
- **Source**—The input point address to get this output's value from. Format: Unit ID, Module ID, Point Number.
- **Failsafe Mode**—The way this output should be set if communications is lost. Press the spacebar to cycle through the options as follows:
  High—Highest possible output for range.
  Low—Lowest possible output for range.

Last—Last value
Preset—User specified value.

- **Failsafe Value**—Preset value for Failsafe operation.
- **Force Mode**—A convenience field that allows forcing an output value.
- **Force Value**—The value (in counts) to output when Force Mode is enabled.
- **Failsafe Timeout**—Amount of time (in ms) that the wireless communication link with a Source Point in a different NETio Remote Unit must be lost before entering Failsafe Mode. It is read-only if the Source Point is in the same NETio Remote Unit.
- **Failsafe Filter Counter** (Only available when source and output are of different Remote units)—This is a failsafe timeout multiplier. The failsafe function will not be activated until the failsafe timeout has occurred this number of times. Use this value to extend the Failsafe period while maintaining an adequate I/O update rate.

NOTE: This value is used to extend the Failsafe period while maintaining an adequate I/O update rate. This variable also establishes how often an output point is updated in I/O Extension. For more information, see *"I/O UPDATE REFRESH RATES" on Page 65*.

Read-Only Parameters:

- **Value**—The present value in A/D counts for this point address.
- **Point Address**—Address used to identify this output point. Format is: Unit ID, Module ID, Point Number

3.3 CONFIGURING NETio OUTPUTS FOR PROTOCOL CONTROL

In order for a protocol to set control outputs for either analog or discrete outputs connected to NETio Modules, the **Source** variable for the particular output must be set to **Protocol**. To do this, Select the letter for the "Source" variable (shown in Figure 3-5 or Figure 3-6) to view the menu shown in Figure 3-7. Enter **p** to enable protocol control as the source for the output.
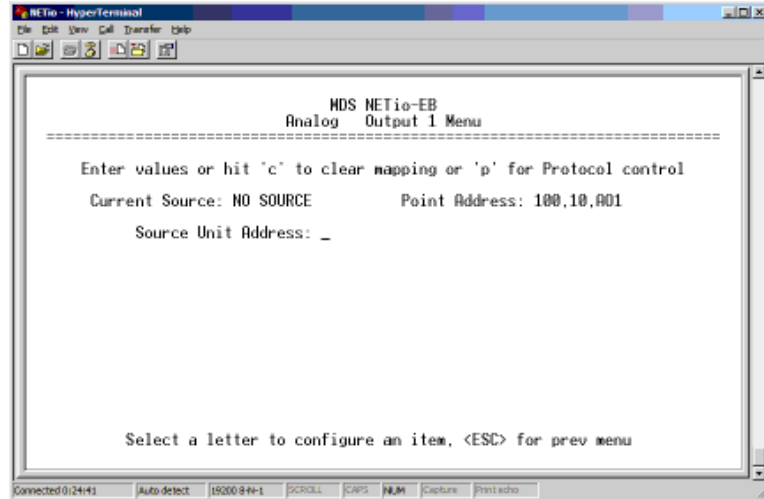
Figure 3-7. I/O Mapping Wizard

3.4 MAPPING INPUTS TO OUTPUTS FOR I/O EXTENSION AND SIGNAL REGENERATION

One of the primary uses of NETio is to regenerate Input signals connected to NETio modules at one location as outputs from NETio modules at a *different* location. This is accomplished by mapping.

Figure 3-8 shows a simplified representation of mapping. A 4-20 mA analog input is connected to the NETioB Module (on the left) with a Unit ID of 7769. This input is mapped to a 4-20 mA analog output connected to the NETioB Module with a Unit ID of 7770 (on the right).

To configure the mapping, enter the address of the Analog Input (in this example, **7769**, **0**, **AI 1**) in the **Source** field for the Analog Output (in this example, **7770**, **0**, **AO 1**).
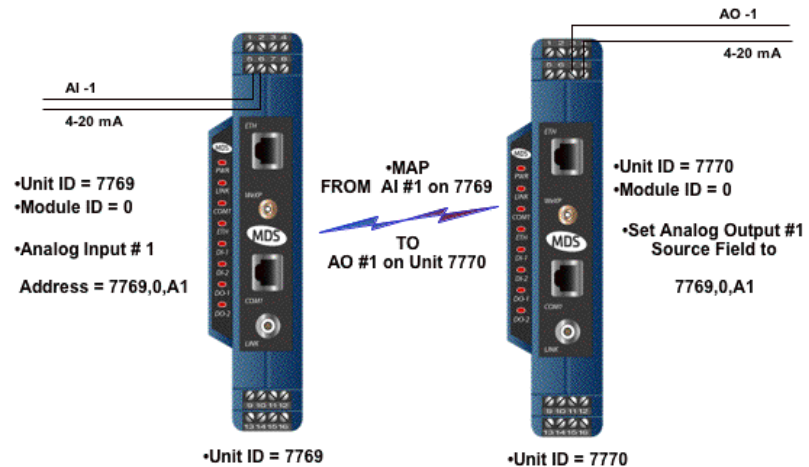
Figure 3-8. I/O Mapping Overview (Direct Mode)

I/O signals can be mapped between NETio Modules anywhere on the wireless network. The only limitations are that a single input point can be mapped to a maximum of four output locations and an input can only map to an output of the same general type (analog-to-analog and discrete-to-discrete).

3.4.1 Mapping Within NETio Remote Units

Setting the Source Field for Mapping

Mapping is accomplished by simply setting the address of the input signal into the source field in an output point.

Figure 3-9 shows the Analog Output Menu with the source field set to **2939,3,AI 1**. This means that this Analog Output will regenerate the signal connected to AI 1 on Unit ID 2939 and Module ID 3.
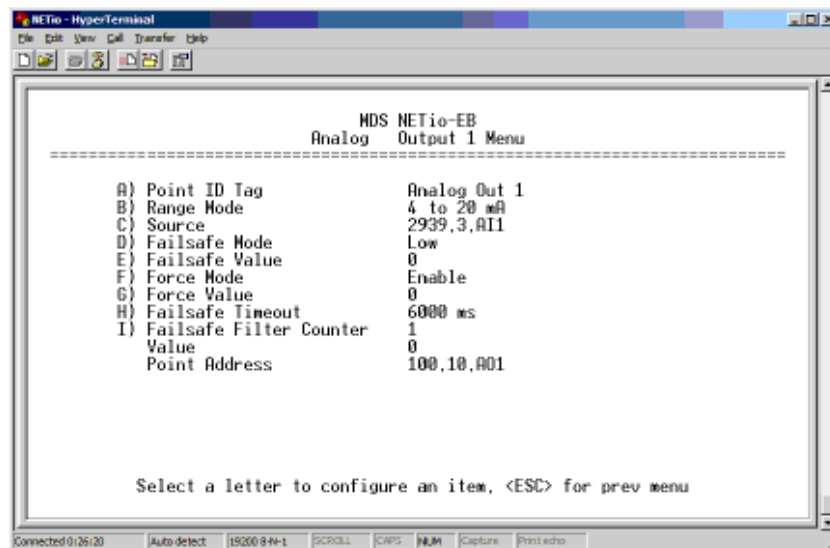

Figure 3-9. Analog Output Menu

Figure 3-10 shows a simple representation of a NETio Remote Unit that uses WeXP.
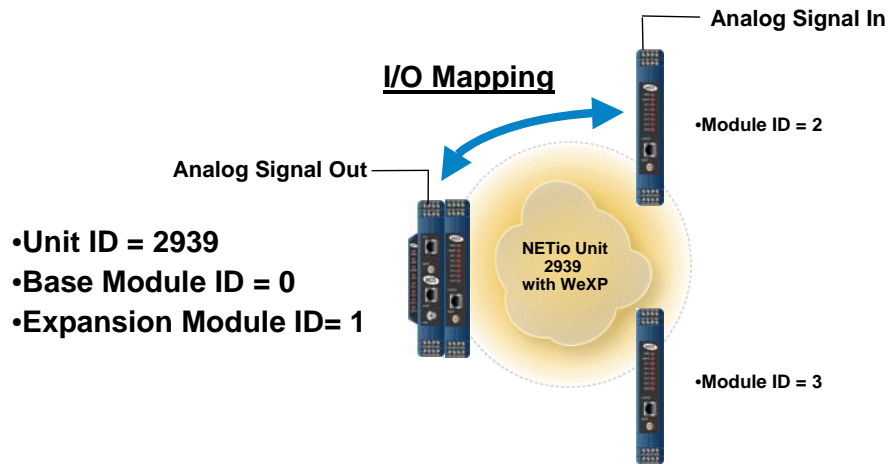

Figure 3-10. I/O Mapping Concept with WeXP

To map an Analog Input connected to Module ID 2 to the Analog Output on the NETioB Module, proceed as follows:

1. Go to the Analog Output Menu for Analog Output # 1 on the NETioB Module (see Figure 3-9), and select item **C** to enter the source address.

2. NETio prompts you for three entries as follows:

   a. The Unit ID of the Source Signal. (In this example, the Unit ID is 2939.)

   b. The Module ID of the Source Signal. (In this example, the Module ID is 2.)

   c. The Point number of the Source Signal. In this example, it is AI 1 for Analog Input #1.

      Note that pressing the spacebar will cycle through two AI choices for Analog and six DI choices for Discretes. This is due to the maximum capacity for Analog inputs and Discrete inputs on any NETio Module.

3.4.2 Mapping Between NETio Remote Units

Figure 3-11 illustrates how I/O signals can be mapped between NETio Remote Units anywhere on the wireless network.
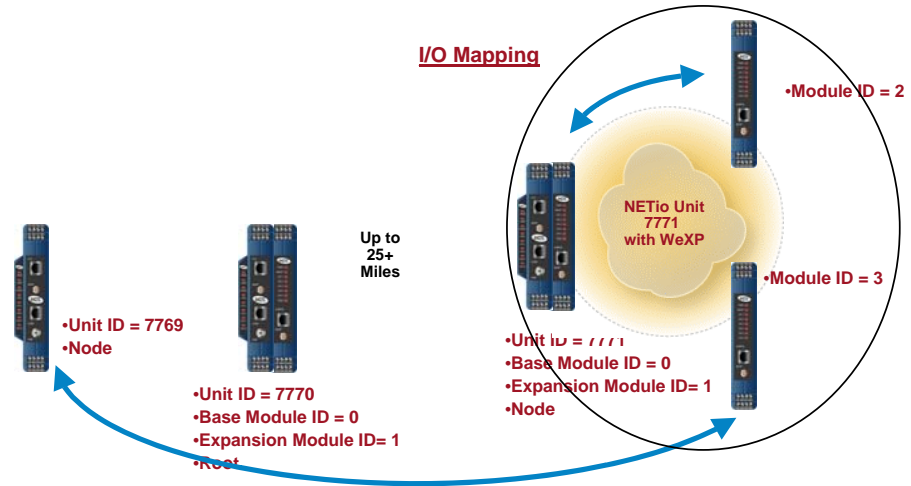
Figure 3-11. I/O Mapping Between Units (Direct Mode)

When mapping between NETio Remote Units, the same steps given in Section 3.4.1 should be followed, with the exception that the Unit ID must match the NETio Remote Unit where the I/O signal originates.

3.5 FAILSAFE SETTINGS

NETio Failsafe settings allow configuration of the output signal's behavior in the event of loss of communication in I/O Extension applications. Failsafe is not active if an output point is under protocol control. By definition, in I/O Extension, any output signal a NETio module generates relies on one or more of these communication modes:

1. WeXP—Wireless communication between Wireless NETioE Modules and a NETioB Module within a NETio Remote Unit.

2. NETio Long-Range entraNET Radio—Wireless communication over longer ranges between NETio Remote Units.

3. NETio Backplane—Wired communication between a NETioB Module and NETioE Modules using the NETio Backplane/power Connectors.

When any one or more of these communication modes fails for a configurable period of time, an output will enter Failsafe mode and generate the Failsafe value selected by the user. The user can accept the factory settings or modify them, but Failsafe behavior is always activated for an output signal.

3.5.1 Configuring Failsafe Settings

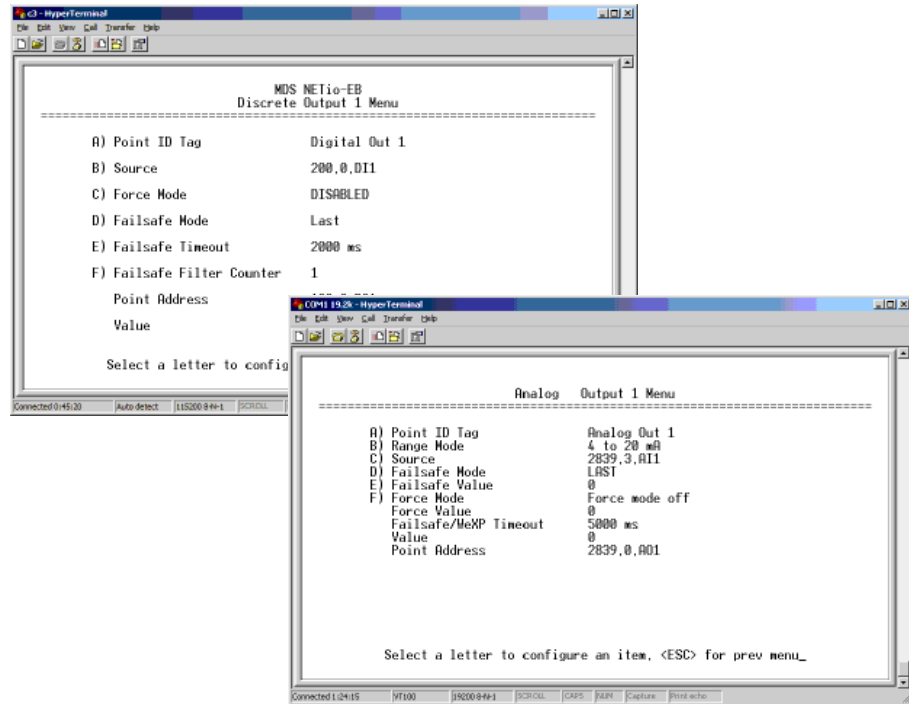Figure 3-12 shows the Analog Output and Discrete Output menus. Each menu contains a field for failsafe mode.

MDS NETio-EB
Discrete Output 1 Menu
==

A) Point ID Tag   Digital Out 1

B) Source   200,0,DI1

C) Force Mode   DISABLED

D) Failsafe Mode   Last

E) Failsafe Timeout   2000 ms

F) Failsafe Filter Counter   1

   Point Address

   Value

   Select a letter to config

Analog Output 1 Menu
==
A) Point ID Tag   Analog Out 1
B) Range Mode   4 to 20 mA
C) Source   2839,3,AI1
D) Failsafe Mode   LAST
E) Failsafe Value   0
F) Force Mode   Force mode off
   Force Value   0
   Failsafe/WeXP Timeout 5000 ms
   Value   0
   Point Address   2839,0,AO1

   Select a letter to configure an item, <ESC> for prev menu_

Figure 3-12. Discrete Output and Analog Output Menu

For a Discrete Output the Failsafe Mode options are:

HIGH—Output is set to logic 1.

LOW—Output is set to logic 0.

LAST—Output last state prior to communication failure.

For an Analog Output the Failsafe Mode options are:

HIGH—Set output to the highest value in the range.

LOW—Set output to the lowest value in the range.

LAST—Holds last value output prior to communication failure.

PRESET—Generate a preset value. When this option is selected, a variable field is presented where you can enter the preset value.

3.5.2 Configuring Failsafe Timeout—NETioB Modules

Figure 3-12 also shows a field for **Failsafe Timeout**. This field defines the timeout period in milliseconds (ms) *if the source input for this output is in a different NETio Remote Unit*. That is, if the Unit ID of the source is different than the Unit ID shown in this output's Point Address field.

The default value is 5000 ms. This may be changed to any value, but it is recommended that it not be set any lower than 1000 ms (1 second). If there is a loss of communication for more than the timeout value, then the output enters the specified Failsafe Mode.

NOTE: If the source input for the output point has the same Unit ID then the Failsafe/WeXP Timeout field is read-only. The Failsafe Timeout is dictated by the WeXP timeout described in *Configuring Failsafe Timeouts over WeXP* below.

3.5.3 Configuring Failsafe Timeouts over WeXP

The WeXP Failsafe Timeout values are set in a NETioB Module and in the appropriate Wireless NETioE Module. They may be changed in the NETioB Module by selecting item **C** for the WeXP Configuration Menu shown in Figure 3-13 (**Main Menu>Wireless Configuration>WeXP Configuration**).
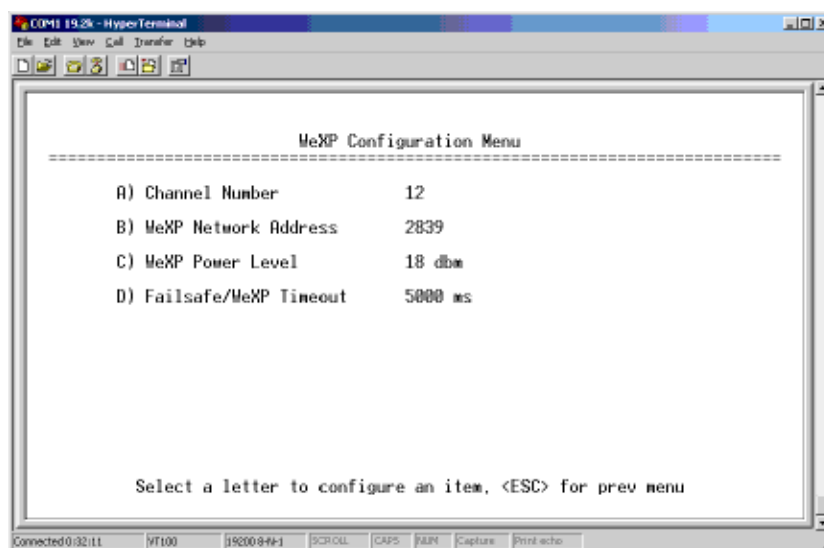
Figure 3-13. WeXP Configuration Menu

The default value is 5000 ms (5 seconds) The value should not be set below 1000 ms (1 second).

The WeXP Timeout value is set in Wireless NETioE Modules by selecting the NETioE Module from the I/O Network Menu then selecting **A** for Configure Module. The Module Menu shown in Figure 3-15 is displayed.
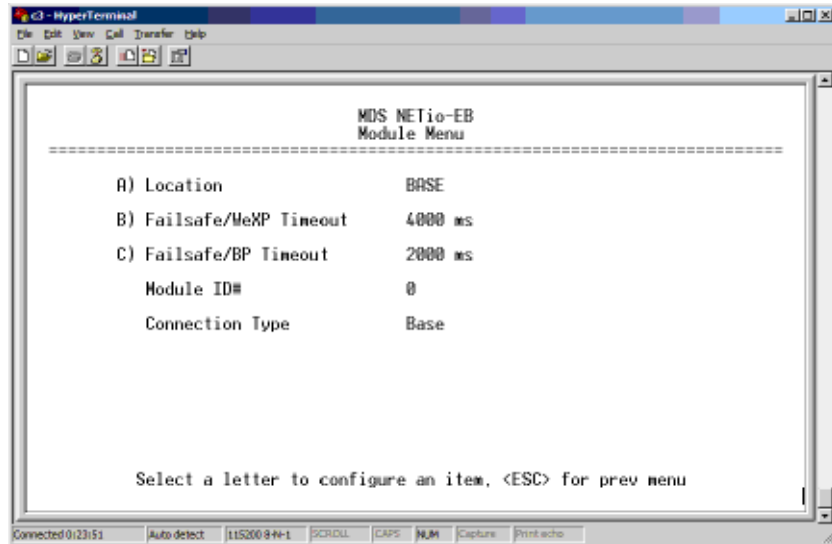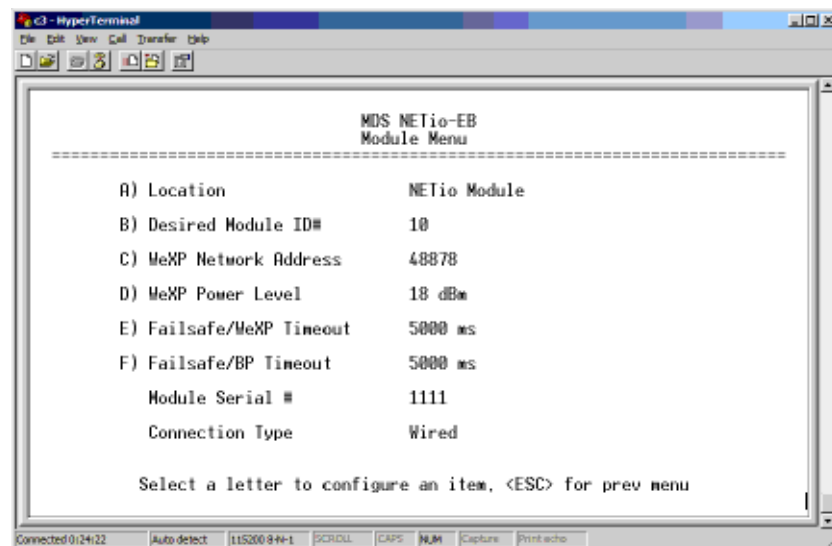
Figure 3-14. Module Menu for a NETioB Module

Figure 3-15. Module Menu for Wireless Expansion Module

The default WeXP timeout setting may be changed by selecting item **F** from the menu. The default setting is 5000 ms (5 seconds). This value should not be set lower than 1000 ms (1 second).

3.6 I/O UPDATE REFRESH RATES

When NETio Modules are configured for I/O Extension, it is important to know how fast the output signal is being updated.

I/O Extension Over WeXP: I/O that is mapped between Wireless NETioE Modules and a NETioB Module via WeXP is updated at approximately 100 ms per module. Consequently, if there is one Wireless NETioE Module associated with a NETioB Module, then all I/O will update at the following rates:

- (# of Wireless NETioE Modules x 100 ms)
- (1 Wireless NETioE Module x 100 = 100 ms)

If there are four Wireless NETioE Modules associated with a NETioB Module, the refresh rate for any one I/O point would be as follows:

- 4 Wireless NETioE Modules x 100 = 400 ms

I/O Extension Between NETio Remote Units: Signals that are mapped between NETio Remote Units or NETioB Modules, the refresh rate is calculated from the **Failsafe Timeout** variable shown in Figure 3-12. This provides flexibility in tuning over-the-air performance of the system. NETio calculates the refresh rate using the following formula: **(Failsafe Timeout / 2) –100 ms**

Therefore, if the **Failsafe Timeout** variable is set to 5000, the refresh rate is (5000 / 2) –100 = 2400 ms, or approximately 2.4 seconds.

3.7 Failsafe Filter Counter

The Failsafe Filter Counter variable is used to extend the Failsafe Timeout period. This is useful when the user wants to maintain an I/O update rate but has greater tolerance for communication loss.

For example, if the user wants to establish the update rate for an output point to once every second, the **Failsafe Timeout** variable would be set to 2000 ms. However, at this setting, the output point will enter Failsafe if communication is lost for over 2 seconds (2000 ms). If the user does not want to enter Failsafe this quickly, configure the **Failsafe Filter Counter** variable to extend that period.

If the user wants to set the Failsafe time to 1 minute, then set the **Failsafe Filter Counter** variable to 30:
(Failsafe Timeout = 2000 ms) x (Failsafe Filter Counter = 30)
= 60,000 ms, or 1 minute

The *Discrete Output 1 Menu* shown in Figure 3-12 on Page 62 shows an example screen with the Failsafe Filter Counter variable. This variable is also found on Analog Output menus.

3.8 SLEEP SETTINGS

NETioE Modules have a sleep option which can be utilized to reduce power consumption. Figure 3-16 shows the I/O Expansion Module Sleep Menu.
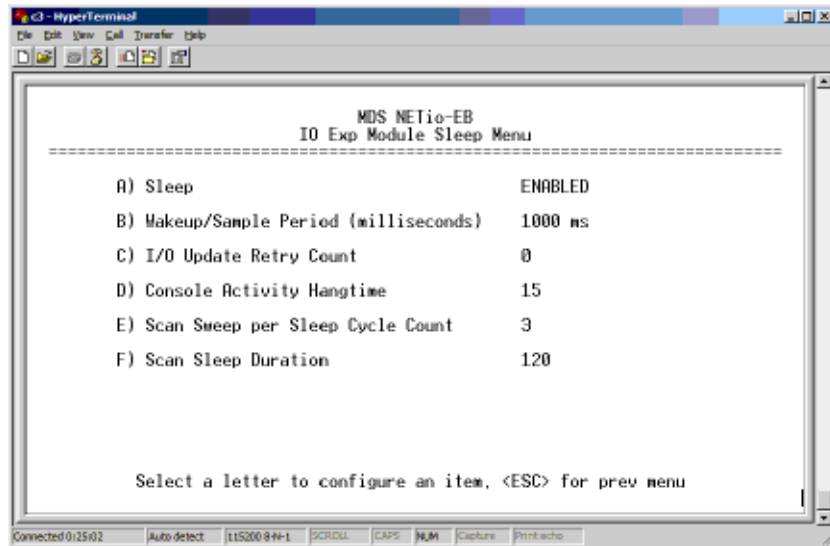

Figure 3-16. I/O Expansion Module Sleep Menu

- **Sleep**—Enable or disable sleep mode for this NETioE Module. [**Enabled, Disabled; Disabled**]
- **Wakeup/Sample Period (milliseconds)**—Amount of time the NETioE Module sleeps between I/O updates with the NETioB Module. [**500-4294967295;1000**]
- **I/O Update Retry Count**—Number of retries made by the NETioE Module when attempting I/O updates with the NETioB Module. This variable is used if the Expansion Module is unable to communicate with its NETioB module when it awakens. You should not set this variable higher than 2 or 3 in applications where power is limited. [**0-255:0**]
- **Console Activity Hangtime**—Number of seconds to stay awake after local console input was detected. [**5-65530;5**]
- **Scan Sweep per Sleep Cycle Count**—Number of complete scans of the channel list made by the NETioE Module to find the NETioB Module before going to back to sleep. Expansion Modules and NETioB modules communicate on a dedicated channel. If communication is not established when the Expansion module awakens, it will automatically attempt to find the NETioB module on an alternative channel. You should not set this variable higher than 3 in applications where power is limited. [**1-65535;3**]
- **Scan Sleep Duration**—Number of seconds the NETioE Module sleeps between association attempts when the NETioE Module is unassociated to a NETioB Module. [**0-4294967295;120**]

4 WIRING & TERMINATIONS

4.1   I/O & POWER CONNECTIONS

This section explains how to connect the NETio modules to external interface equipment and make DC power connections. All connections to external devices are made at the screw terminals at the front corners of each module.

A label on the side of each enclosure shows the terminal descriptions for the module, I/O capacity and module type.

NOTE: The maximum number of NETioE Modules that can be attached to a NETioB Module is 50. However, when over 8 Modules are used, power should be connected directly to the NETioE power terminals (#1 and #2) for every 8 additional modules. Powering more than 8 modules from a single NETioB module will likely cause the fuse in the NETioB Module to fail.
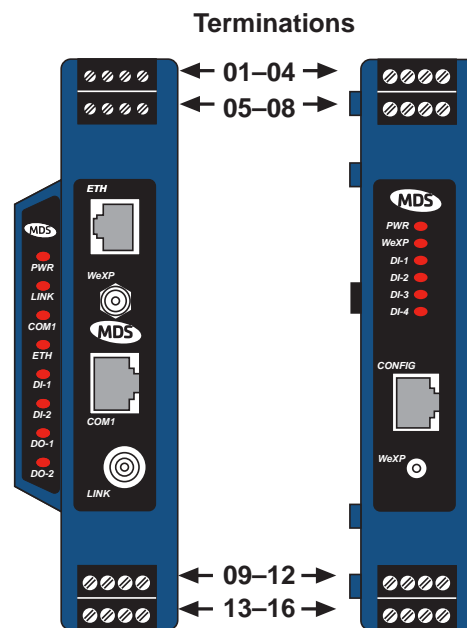
Figure 4-1. I/O Point Terminations
(Terminal assignments are dependent on module type)

4.1.1 Module Dimensions

Dimensions for the NETioB and NETioE Modules are provided below:

NETioB Module Dimensions
14.6 H x 4.14 W x 11.4 D cm (5.75 H x 1.63 W x 4.5 D in.)

NETioE Module Dimensions (all types)
14.6 H x 3.00 W* x 11.4 D cm (5.75 H x 1.18 W* x 4.5 D in.)

* Width does not include 3 mm (0.12 in.) projection for connector and mating pegs.

4.1.2 I/O Configurations

NETio modules are available in a variety of configurations depending on the requirements of the particular application. Table 4-1 lists the available module types and shows the functions supported by each type. In addition, references are also given to show where detailed wiring information may be found in this manual.

Table 4-1. I/O Configurations

Module	Model	I/O Type	Functions Supported	I/O Wiring Examples & Terminations
Base	NETioB	N/A	2DI, 2DO, 1AI, 1AO	Figure 4-8 on Page 73
				Table 4-4 on Page 75
Expansion	NETioE-1	1	2DI, 2DO, 1AI, 1AO	Figure 4-10 on Page 75
				Table 4-4 on Page 75
	NETioE-2	2	6DI	Figure 4-11 on Page 76
				Table 4-5 on Page 76
	NETioE-3	3	6DO	Figure 4-12 on Page 77
				Table 4-6 on Page 77
	NETioE-4	4	4DI, 2AI	Figure 4-13 on Page 78
				Table 4-7 on Page 78
	NETioE-6	6	2AI, 2AO, 2DI, 2DO	Figure 4-10 on Page 75
				Table 4-4 on Page 75
	NETioE-7	7	2AI, 1DI, 3DO	Table 4-9 on Page 80

4.2 I/O POINTS WIRING & TERMINATION

This section provides two views of wiring schemes for the NETio modules. The first is a simplified view with block diagrams organized by type of I/O application. The second view is specific, with connections shown based on actual module types. These drawings do not reflect all possible wiring schemes or applications. Please contact GE MDS Technical Services if additional guidance is required.

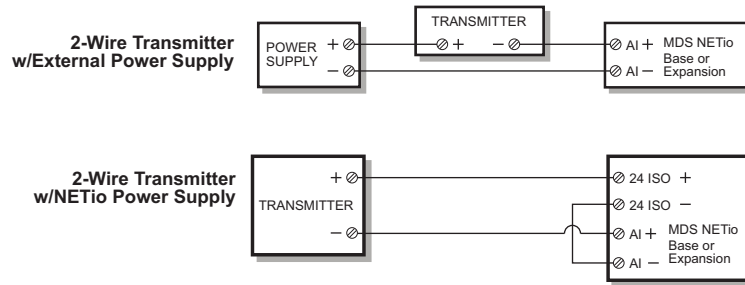## 4.2.1 Analog Input Wiring (Current Signals)
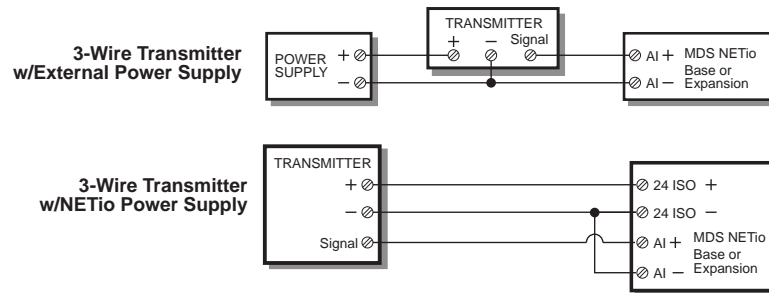

Figure 4-2. 2-Wire Transmitter Wiring
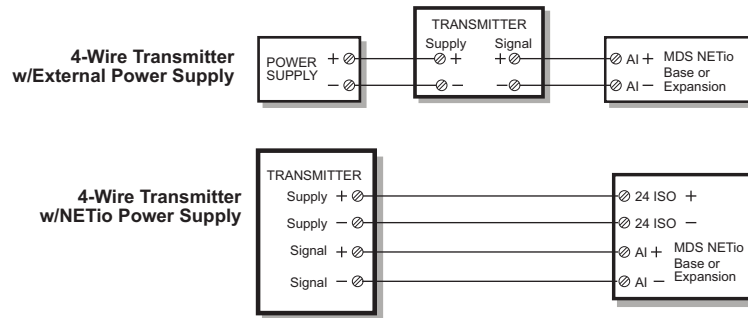

Figure 4-3. 3-Wire Transmitter Wiring

Figure 4-4. 4-Wire Transmitter Wiring
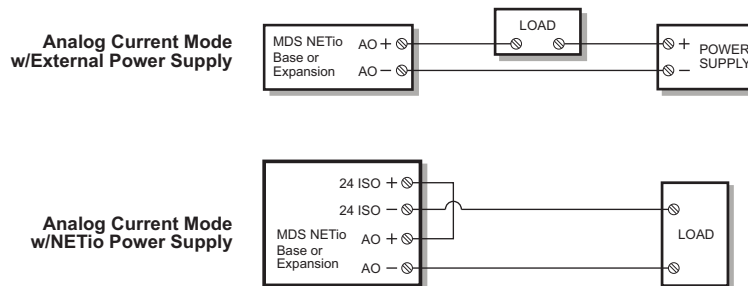
4.2.2 Analog Output Wiring (Current Signals)

Figure 4-5. 2-Wire Analog Current Mode Wiring
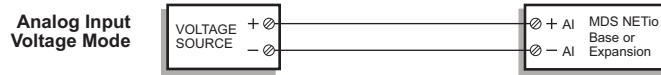
4.2.3 Analog Input Wiring (Voltage Signals)

Analog Input Voltage Mode

Figure 4-6. 2-Wire Analog Voltage Mode Wiring

4.2.4 Discrete Points Wiring

Discrete Input w/External Power Supply

Discrete Output w/External Power Supply
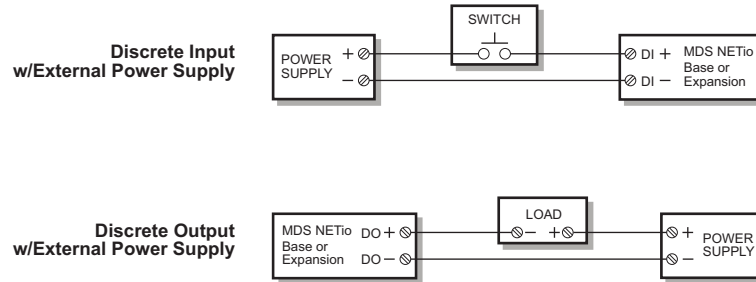
Figure 4-7. 2-Wire Discrete Wiring

4.2.5 Module Wiring Diagrams

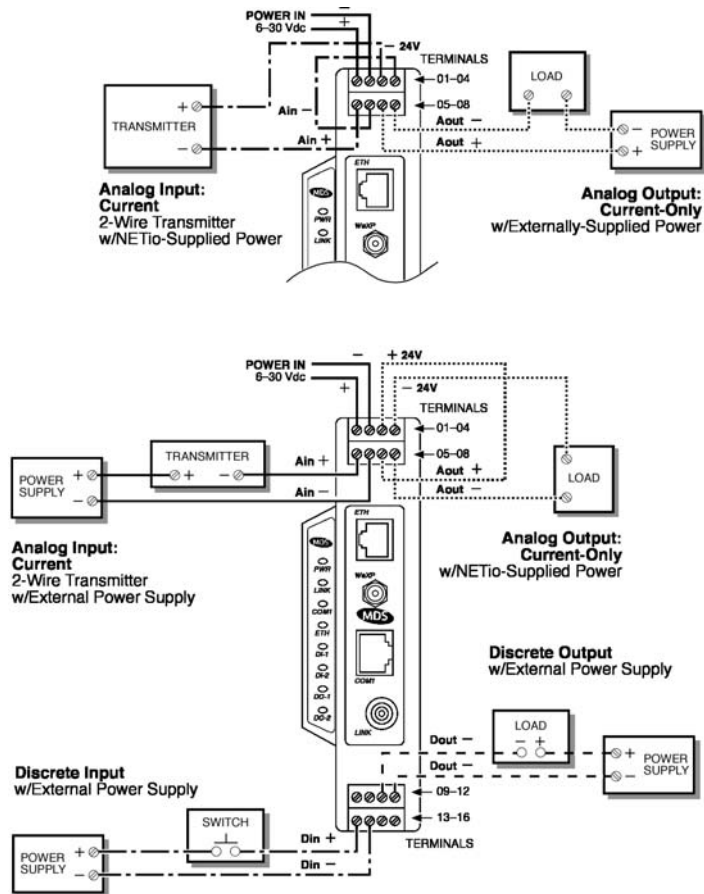The following diagrams are based on specific applications of NETio Modules.

Figure 4-8. NETioB Module I/O Wiring

Table 4-2. NETioB Module I/O Terminal Functions
2DI, 2DO, 1AI, 1AO

TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION
01	POWER +	05	Ain +	09	Dout 1 +	13	Din 1 +
02	POWER –	06	Ain –	10	Dout 1 –	14	Din 1 –
03	24 ISO +	07	Aout +	11	Dout 2 +	15	Din 2 +
04	24 ISO –	08	Aout –	12	Dout 2 –	16	Din 2 –

4.2.6 NETioB Module COM1 Port

A terminal device may be connected to the COM1 port (RJ-45) of the NETioB Module for payload data connection. Pinout information for this port is provided in Figure 4-9 and Table 4-3 below.
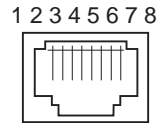
1 2 3 4 5 6 7 8

Figure 4-9. COM1 Port (DCE)
(as viewed from the outside of the unit)

Table 4-3. COM2 Port, EIA-232 Interface

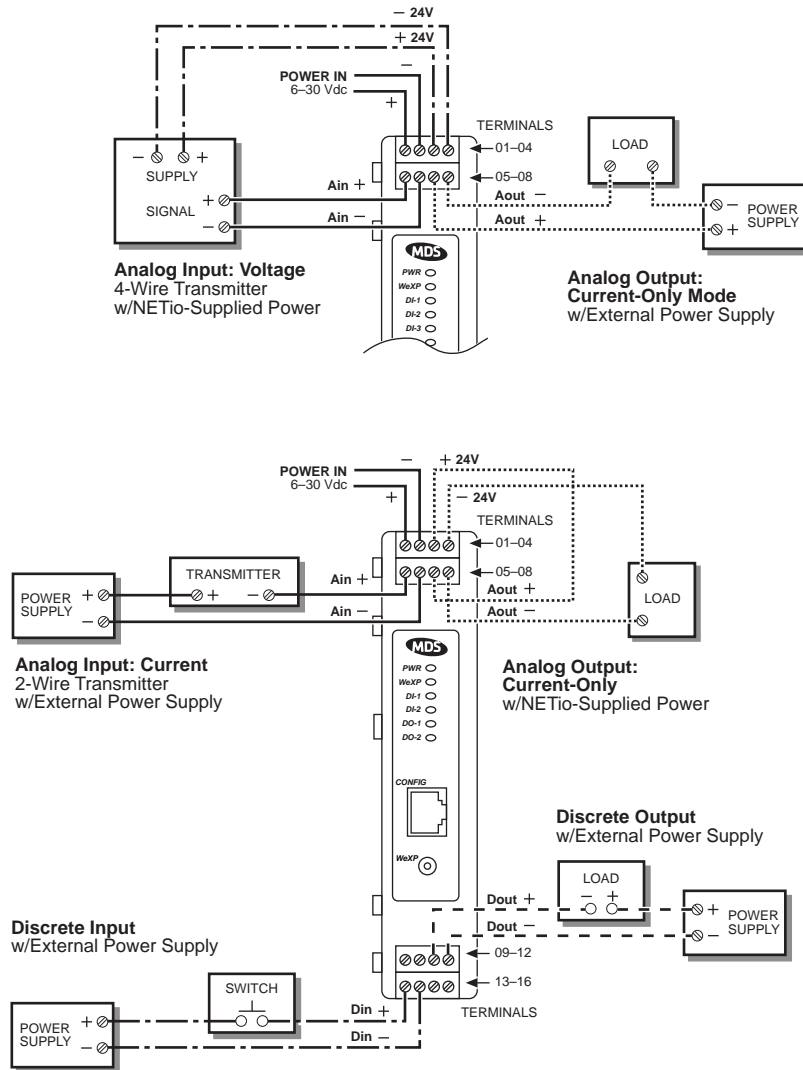| Pin	Functions	COM1 Port (DCE)
1	Unused	
2	Data Carrier Detect (DCD)	Out
3	Data Terminal Ready (DTR)	In
4	Signal Ground (GND)	—
5	Receive Data (RXD)	Out
6	Transmit Data (TXD)	In
7	Clear-to-Send (CTS)	Out
8	Request-to-Send (RTS)	In

Figure 4-10. NETioE-1 Module I/O Wiring

**Table 4-4. NETioE-1 Module I/O Terminal Functions
2DI, 2DO, 1AI, 1AO**

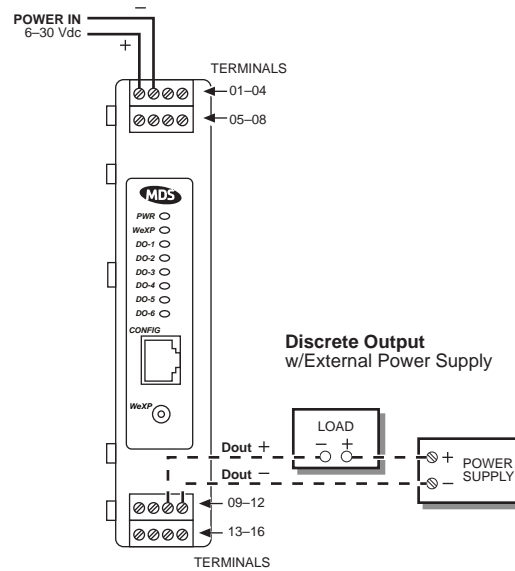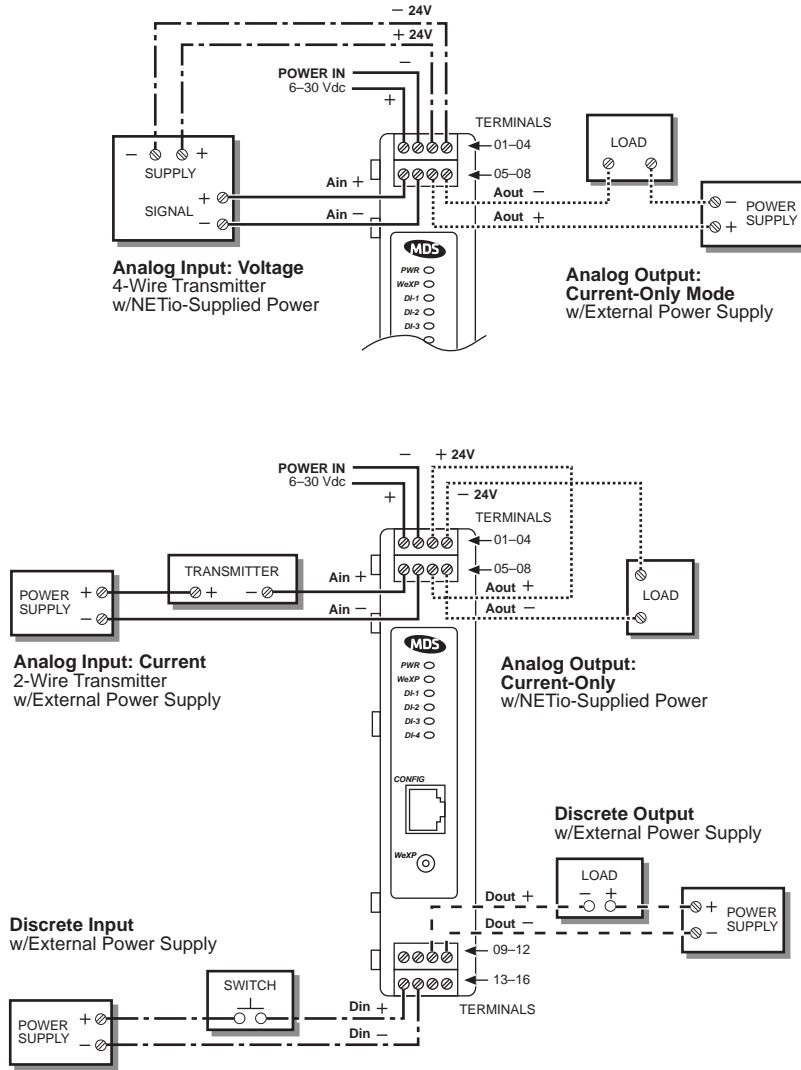| TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION
01	POWER +	**05**	Ain +	**09**	Dout 1 +	**13**	Din 1 +
02	POWER −	**06**	Ain −	**10**	Dout 1 −	**14**	Din 1 −
03	24 ISO +	**07**	Aout +	**11**	Dout 2 +	**15**	Din 2 +
04	24 ISO −	**08**	Aout −	**12**	Dout 2 −	**16**	Din 2 −
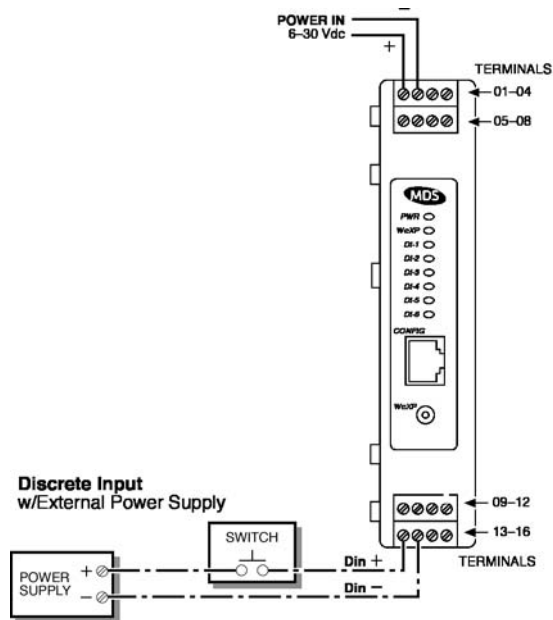
Figure 4-11. NETioE-2 Module I/O Wiring

**Table 4-5. NETioE-2 I/O Configuration 2 Terminal Functions
6DI**

TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION
01	POWER +	**05**	Din 1 +	**09**	Din 3 +	**13**	Din 5 +
02	POWER −	**06**	Din 1 −	**10**	Din 3 −	**14**	Din 5 −
03	NC	**07**	Din 2 +	**11**	Din 4 +	**15**	Din 6 +
04	AGND	**08**	Din 2 −	**12**	Din 4 −	**16**	Din 6 −

Figure 4-12. NETioE-3 Module I/O Wiring

**Table 4-6. NETioE-3 I/O Configuration 3 Terminal Functions
6DO**

TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION
01	POWER +	05	Dout 1 +	09	Dout 3 +	13	Dout 5 +
02	POWER –	06	Dout 1 –	10	Dout 3 –	14	Dout 5 –
03	NC	07	Dout 2 +	11	Dout 4 +	15	Dout 6 +
04	AGND	08	Dout 2 –	12	Dout 4 –	16	Dout 6 –

Figure 4-13. NETioE-4 Module I/O Wiring

**Table 4-7. NETioE-4 I/O Configuration 4 Terminal Functions
4DI, 2AI**

TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION
01	POWER +	05	Ain 1 +	08	Din 1 +	13	Din 3 +
02	POWER –	06	Ain 1 –	10	Din 1 –	14	Din 3 –
03	24 ISO +	07	Ain 2 +	11	Din 2 +	15	Din 4 +
04	24 ISO –	08	Ain 2 –	12	Din 2 –	16	Din 4 –

NOTE: There is no Type 5 Module offered for the NETio product line.
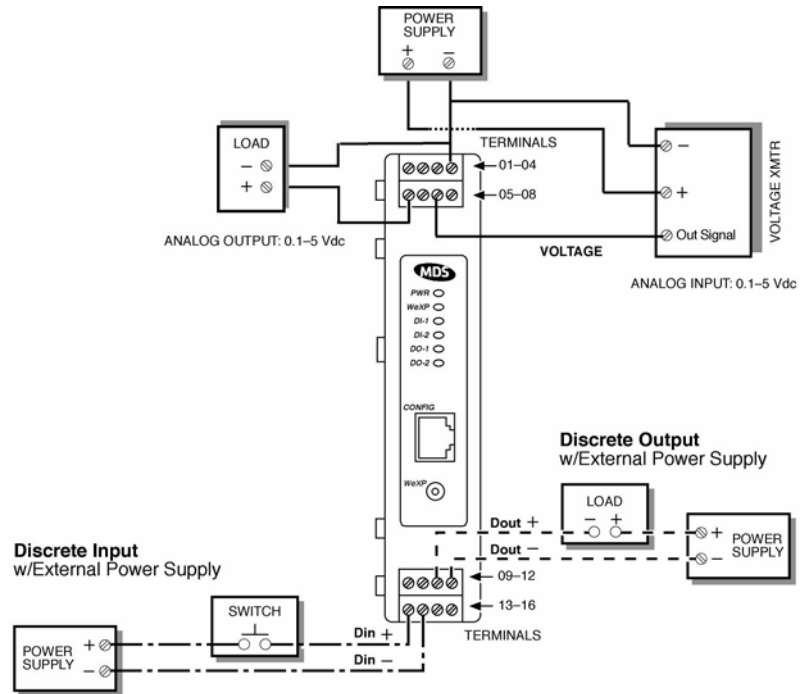
Figure 4-14. NETioE-6 Module I/O Wiring

Table 4-8. NETioE-6 Module I/O Terminal Functions
2DI, 2DO, 2AI (V), 2A0 (V)
Note: Analog inputs and outputs are not isolated

TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION
01	POWER +	05	Aout 1	09	Dout 1 +	13	Din 1 +
02	POWER –	06	Aout 2	10	Dout 1 –	14	Din 1 –
03	GROUND	07	Ain 1	11	Dout 2 +	15	Din 2 +
04	GROUND	08	Ain 2	12	Dout 2 –	16	Din 2 –

For wiring information on Type 7 Modules, refer to the illustration below and Table 4-9. The following sections in this manual contain additional information that should be reviewed:

- Section 4.2.1, *Analog Input Wiring (Current Signals)* for connecting analog inputs.
- Section 4.2.4, *Discrete Points Wiring* for connecting discrete input or output points
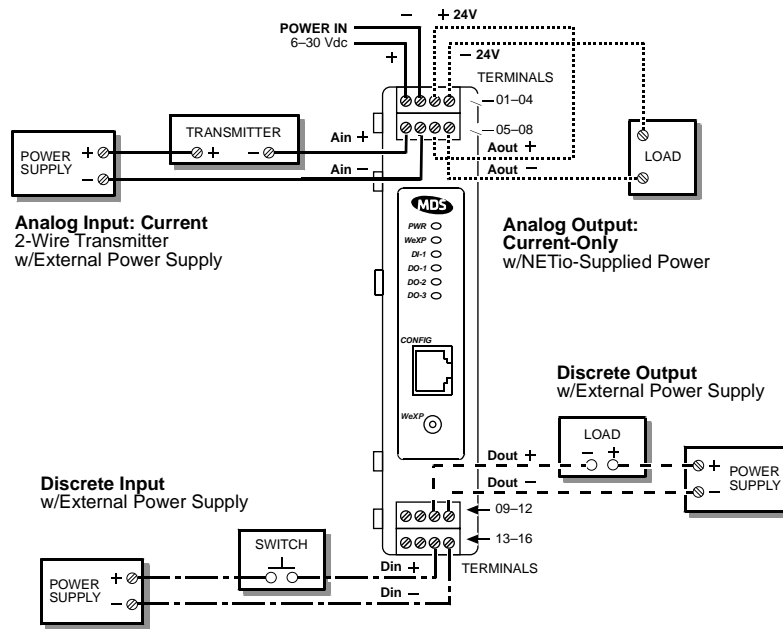
Figure 4-15. NETioE-7 Module I/O Wiring

Table 4-9. NETioE-7 Module I/O Terminal Functions
1DI, 3DO, 2AI (I)

TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION	TERM	FUNCTION
01	POWER +	05	Ain 1 +	09	Dout 1 +	13	Dout 3 +
02	POWER −	06	Ain 1 −	10	Dout 1 −	14	Dout 3 −
03	24 ISO+	07	Ain 2 +	11	Dout 2 +	15	Din 1 +
04	24 ISO-	08	Ain 2 −	12	Dout 2 −	16	Din 1 −

5 *SERIAL, IP/ETHERNET CONFIGURATION*

5.1 CONFIGURING SERIAL AND IP/ETHERNET COMMUNICATIONS

NETio supports payload Serial and IP/Ethernet communications for intelligent devices such as RTUs or PLCs when they are connected to either COM1 or the LAN port on the front of a NETioB Module.

Most of the wireless network configuration for Serial and IP/Ethernet communication is performed at the NETio Access Point. Refer to the MDS entraNET manual (05-4055A01) for a comprehensive summary of Access Point Configuration steps. In general, the applicable information is contained in Chapter 3 of that manual.

The menus described below relate to configuring serial and IP/Ethernet Communication in NETio as a remote Ethernet bridge or Serial Gateway for an Access Point.

NOTE: If COM1 is inadvertently changed to "data" it will not be possible to log-in using a console terminal connected to the COM1 connector. This problem can be remedied by typing the Hayes modem-compatible escape sequence of **Shift +++**. This restores COM1 to console terminal mode, and requires you to log in again.

COM1 pinout information is provided in the section titled *NETioB Module COM1 Port* on Page 74.

5.1.1 Configuring the NETioB Serial Port

To configure the NETio Serial Port (COM1), select **D** from the NETio Main Menu shown in Figure 5-1.
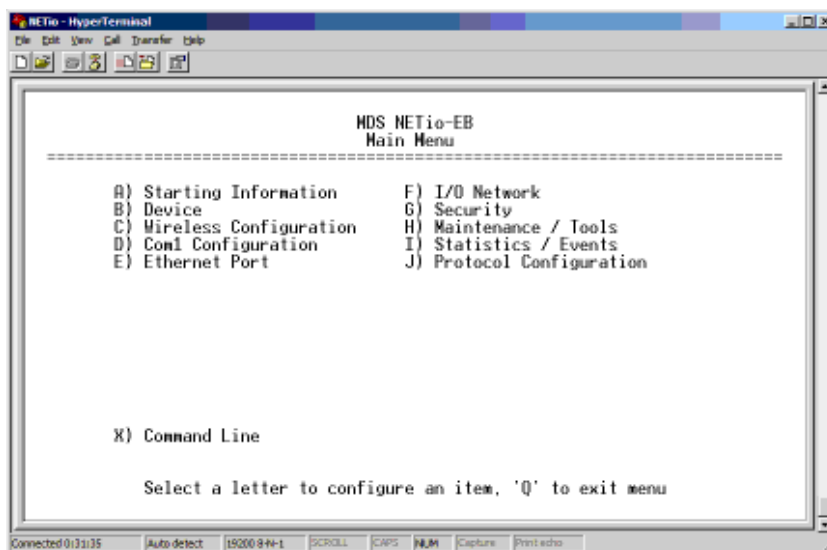
Figure 5-1. Main Menu

![GE MDS logo]

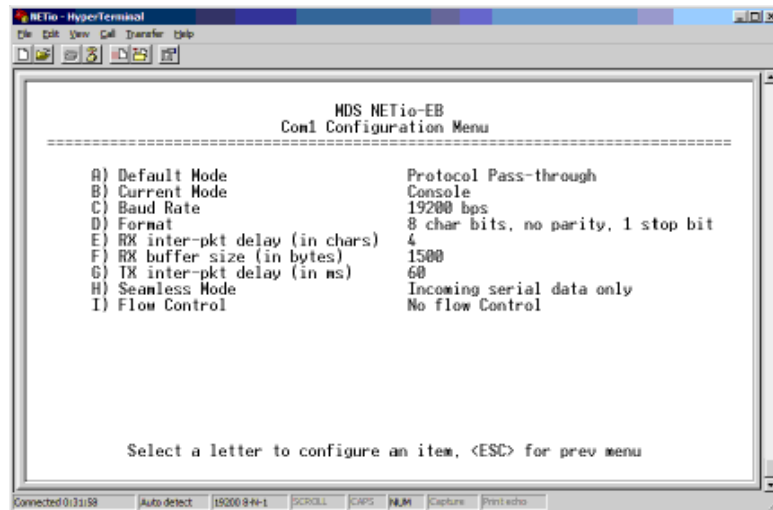This selection brings up the COM1 Configuration Menu as shown in Figure 5-2 below.

Figure 5-2. COM1 Configuration Menu

- **Default Mode**—Specifies how this port should behave upon powerup. Use the spacebar to cycle through the two available options: **Default to Console** (used for configuring NETio) or **Default to Data** (used for payload communication to an RTU or PLC).

- **Current Mode—**Shows the mode the COM1 port is currently in. Press the spacebar to change.

- **Baud Rate**—This menu item is used to set the data rate for the COM1 port in bits-per-second. [**1,200–115,200; 19200**]

- **Format**—This item allows the user to set the interface signaling parameters that will be used. Data bits, parity and stop bits may be set using this command. [**7N1, 7E2, 7N2, 7O2, 7E1, 7O1, 8N1, 8N2, 8E1, 8E2, 8O1, 8O2; 8N1**]

- **RX inter-pkt delay (in chars)**—Specifies the number of milliseconds (ms) that signify the end of a message. [**0–65535; 60**]

- **RX buffer size (in bytes)**—This item allows selection of the appropriate buffer size for each serial message packet. [**1–1500Bytes; 1500**]

- **TX inter-pkt delay (in ms)**— Specifies the number of milliseconds (ms) between transmitted messages. [**0–65535; 60**]

- **Seamless Mode**—**Incoming serial data only**: Seamless mode applies to incoming serial data only. During seamless receive operation, the receive parser collects data bytes into a single message buffer until the buffer size (character bytes) is reached, or a period of **RXDELAYCHARS** (character bytes time) duration is passed.

- **Seamless Mode**—**Incoming/Outgoing serial data**: Seamless mode applies to both Incoming and Outgoing serial data. In addition to the "Incoming serial data only" seamless operation

described above, when transmitting serial data packets, the transmitter ensures that the next ready packet does not go out until an inter-packet period of **TXDELAY** milliseconds has passed.

- **Flow Control—**This command sets/displays the transceiver's flow control status. The options are:

  NONE—No flow control
  CTS CTRL—CTS (Clear-to-Send) flow control
  CTS RTS—CTS follows RTS (Ready-to-Send) flow control
  RTS CTS—DCE RTS/CTS flow control

5.1.2 Configuring the NETioB IP Ethernet Port

To enable or disable the IP Ethernet port as shown in Figure 5-3, select **Ethernet Port** from the Main Menu (Figure 5-1).
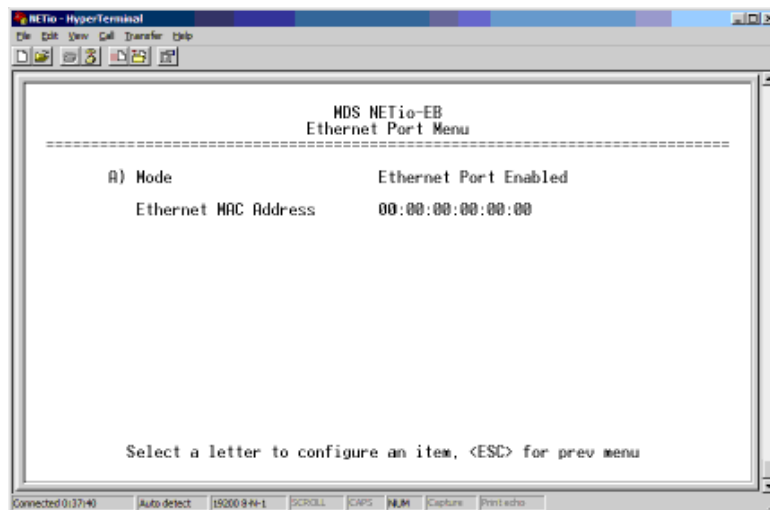
Figure 5-3. Ethernet Port Menu

Select **A) Mode** to enable or disable the Ethernet port.

6 *PROTOCOLS*

6.1 CONFIGURING MODBUS RTU OPERATION

A NETioB Module processes Modbus® messages that come from one of three sources depending on how it has been configured. The sources are:

1. Over-the-air (wireless) from a NETio Access Point: This method allows a NETioB Module to wirelessly communicate with a Modbus® Master device or system via a NETio Access Point. The Access Point is where the physical connection to the Modbus® device is made (COM2 or the Access Point's IP ports).

2. Over-the-air (wireless) from a NETio DirectMode Root or NETio DirectMode node: This method allows a NETioB Module to wirelessly communicate with a Modbus® Master device or system via another NETioB Module. One of the NETioB Modules is where the physical connection to the Modbus® host is made (COM1).

3. Local: This method allows a NETioB Module to communicate with a Modbus® Master device or system physically connected to the serial communication port (COM1) on the NETioB Module. This is useful when the Modbus Master is accessing I/O connected only to the NETioB Module and its NETioE Expansion Modules.

NOTE: Modbus® TCP cannot be set up at the same time as Modbus® RTU in the same system, or conflicts will result.

6.1.1 Configuring Modbus RTU in a NETio Access Point

There are parameters that must be configured in the NETio Access Point when the Modbus® Master is connected to its COM2 serial port.

NOTE: For detailed instructions about addressing NETio including the Modbus® Memory Map and the functions supported, please download the *Modbus® Protocol Supplement* (05-4672A01) from the GE MDS website (**www.GEmds.com**).

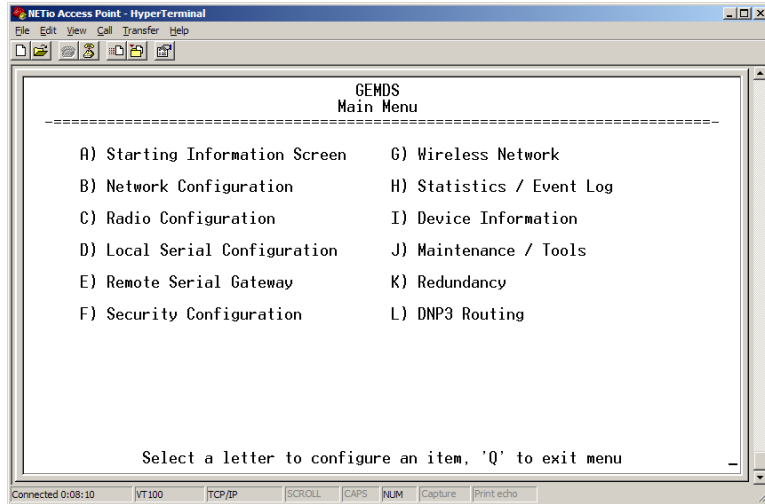1. From the NETio Access Point Main Menu, select item **D** to choose Local Serial Configuration.

Figure 6-1. NETio Access Point Main Menu

2. From the Local Serial Configuration Menu, select **D** to choose Serial Config. Wizard.
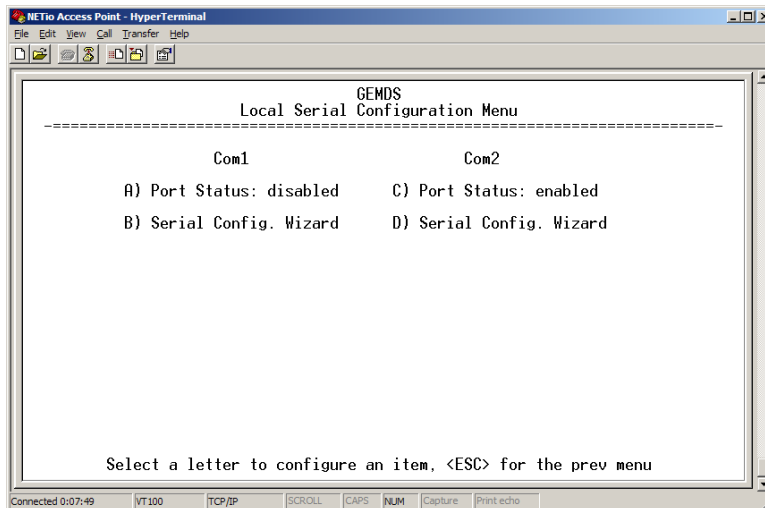

Figure 6-2. Local Serial Configuration Menu

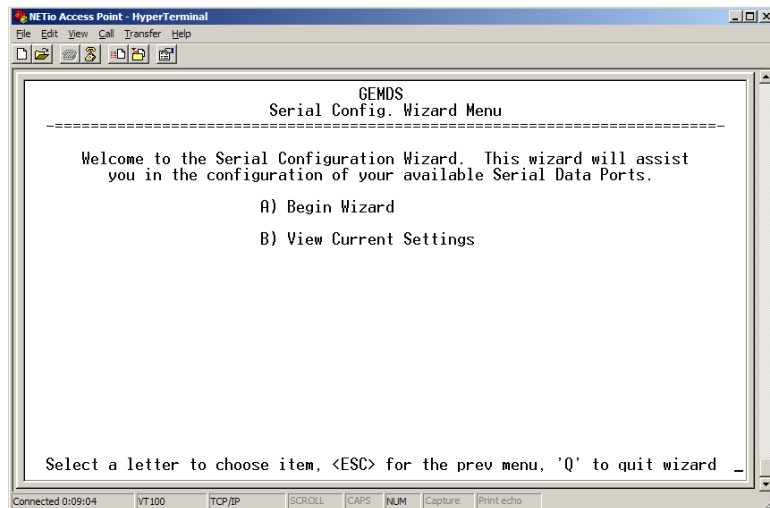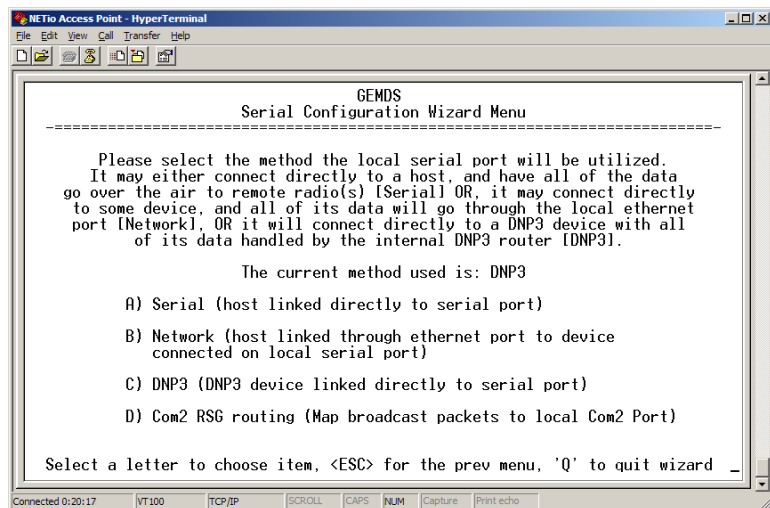3. Select **A** to begin the Serial Configuration Wizard.

Figure 6-3. Begin the Serial Configuration Wizard

4. Select **A** to choose Serial.

Figure 6-4. Serial Configuration Wizard Menu
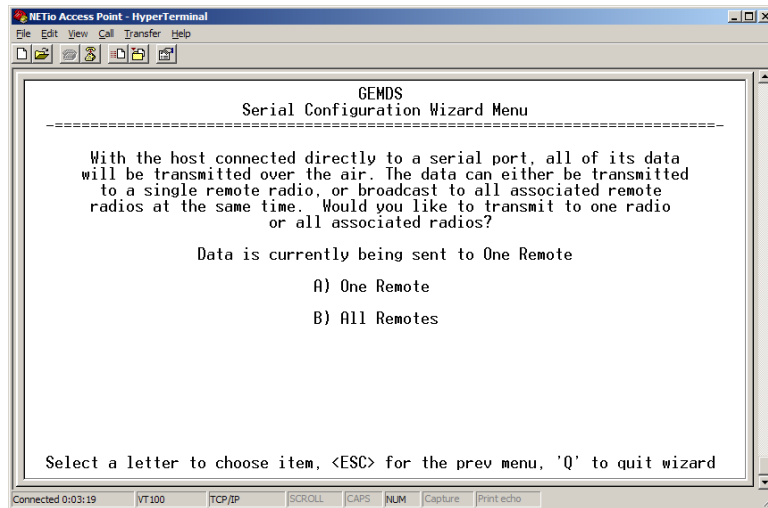*(choose Serial)*

5. Select **B** to choose All Remotes.

Figure 6-5. Serial Configuration Wizard Menu
(choose All Remotes)

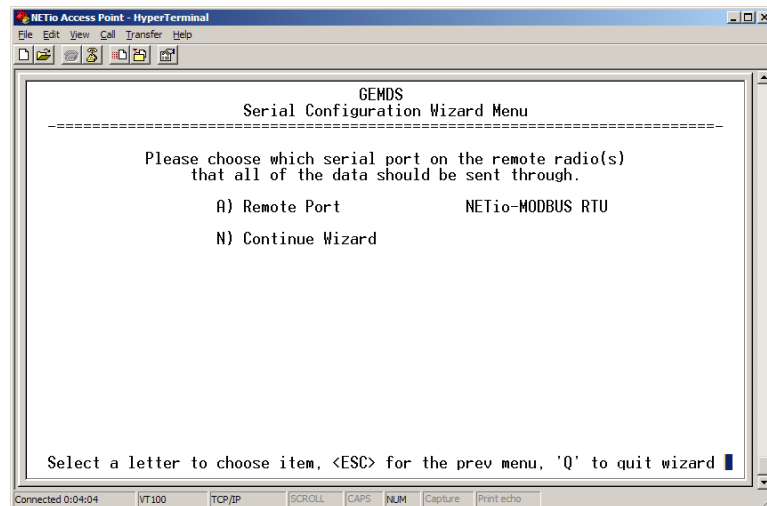6. Select **A** to choose the remote port (MODBUS, COM1, or COM2), then select **N** to continue the wizard.

Figure 6-6. Serial Configuration Wizard Menu
(choose the Remote Port)

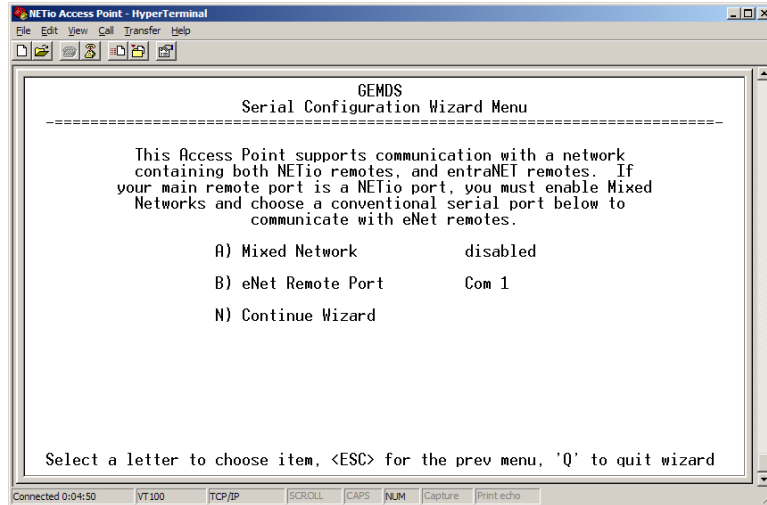7. Select **N** to continue the wizard.

Figure 6-7. Serial Configuration Wizard Menu
(continue the wizard)

8. Select **N** to continue the wizard again.
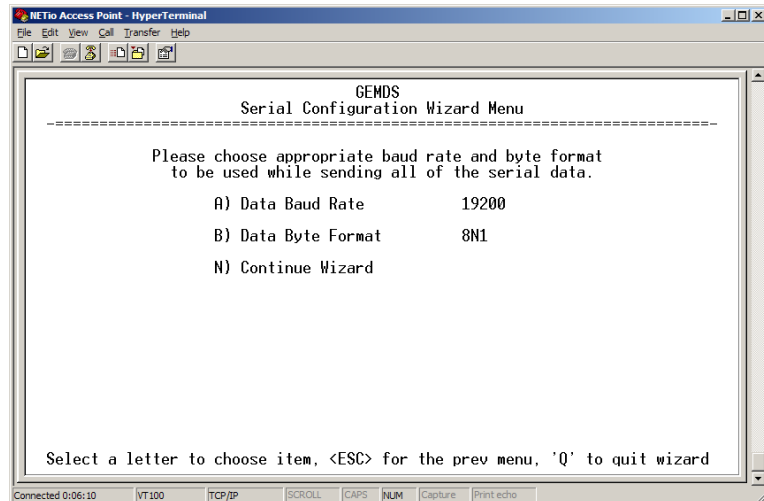

Figure 6-8. Serial Configuration Wizard Menu
(continue the wizard again)

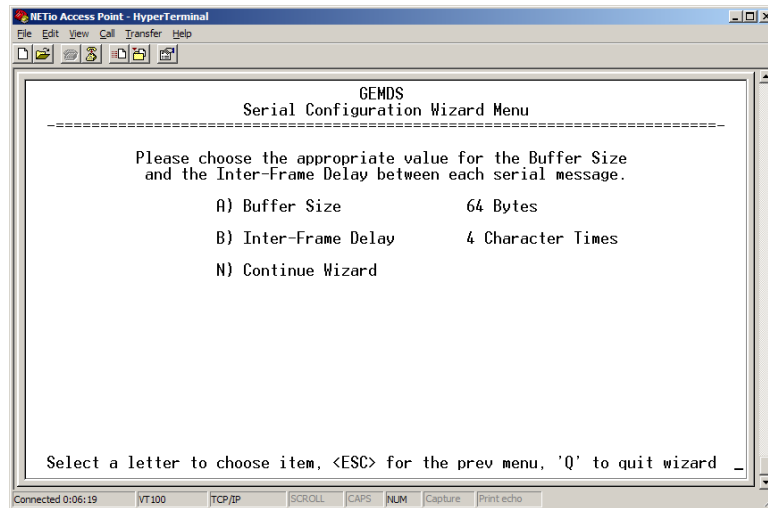9. Select **N** to continue the wizard again.

Figure 6-9. Serial Configuration Wizard Menu
(continue the wizard again)

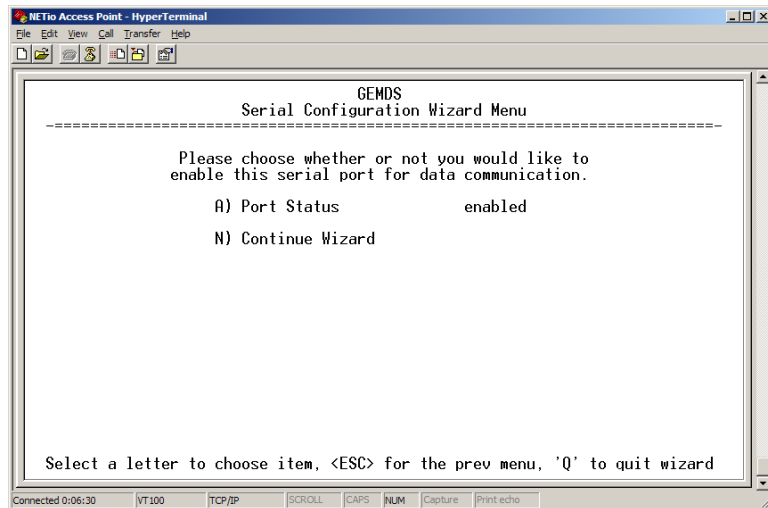10.Select **N** to continue the wizard again.

Figure 6-10. Serial Configuration Wizard Menu
(continue the wizard again)

11.The wizard shows the final menu, which lists the selections that will be configured for the NETio Access Point's serial port. Select **X** to commit the changes and exit the wizard.
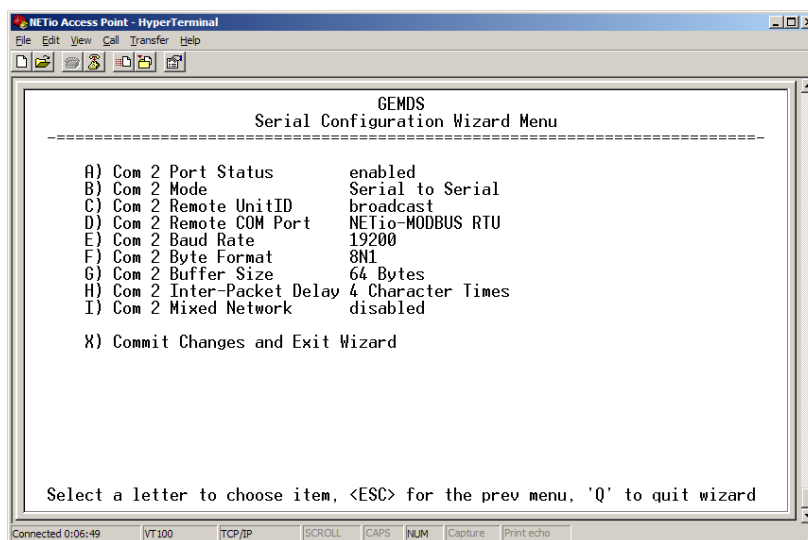

Figure 6-11. Serial Configuration Wizard Menu
(commit changes and exit wizard)

6.1.2 Configuring Modbus TCP in a NETio AP

Modbus® TCP protocol support is available for a NETio radio network exclusively from the Access Point. The Access Point handles multiple TCP Modbus® connections at a time and coordinates the over-the-air Modbus® requests and responses with the NETio Remote Units. During a typical Modbus® TCP transaction, a single request is sent over the air to the NETio Remote Unit(s) and then the Access Point waits for a response. The Access Point will process the next pending request when a response is received or if the **No Response Time Out** period has expired. Modbus® TCP packets are converted by the Access Point to Modbus® RTU before being sent to the NETio remotes. All responses are converted back into Modbus® TCP when received.

NOTE: For detailed instructions about addressing NETio including the Modbus® Memory Map and the Modbus® functions supported, please download the Modbus® Protocol addendum (05-4672A01) from the GE MDS website (**www.GEmds.com**).

The parameters that must be set in the entraNET Access Point for Modbus® TCP are as follows:

1. From the NETio Access Point Main Menu

   • Select item **E** For Remote Serial Gateway
   • Select item **D** for Remote Serial Wizard
   • Select item **A** to begin the Wizard or Q to quit

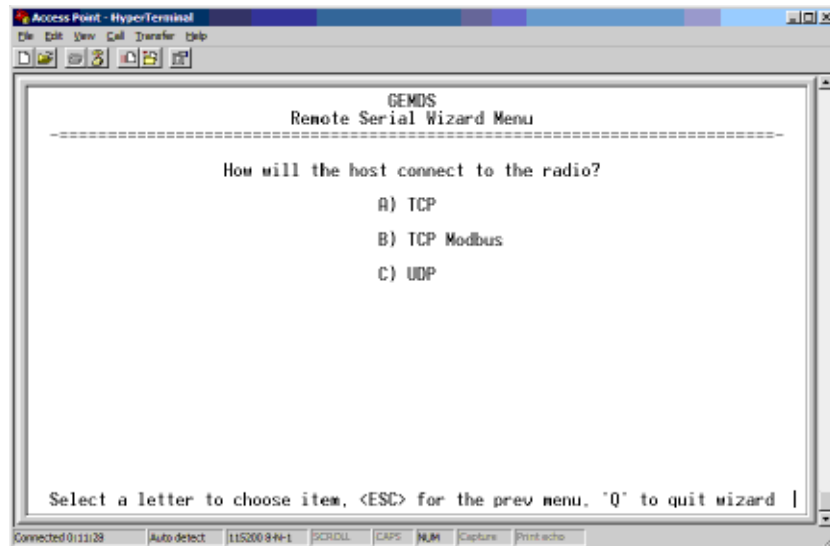2. Select **TCP Modbus** from the Wizard menu (Figure 6-12).

Figure 6-12. Remote Serial Wizard Menu

3. The next menu shown allows the user to set **No Response Time Out**. This is the amount of time that the Access Point waits for a response to a Modbus® message. If no response is received in the specified amount of time, the Access Point moves on to the next request. "No response" is generated by the Access Point for timed-out requests. The default is 1000 ms (1 second).

4. The next menu shown allows the user to set the Modbus® IP Port. Multiple TCP connections may be made over a single IP port. **The default is Port 502**.

NOTE: Some MODBUS drivers do not support connections to multiple MODBUS devices over a single IP port. Check your driver's capabilities to ensure this is supported. If not, then a dedicated IP port is needed for each NETioB/Modbus ID in the network.
For more information, review the MDS Modbus Protocol Addendum (05-4672A01) from the GE MDS website.

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5. The next menu shown allows the user to select the NETio Remote Unit ID where the MODBUS message is sent. Select **Transmit to One Remote** if the Modbus® TCP connection needs to communicate with only one NETio Remote Unit Radio. Select **Broadcast to All Remotes** if the Modbus® TCP connection needs to communicate with all NETio Remote Units.

6. The next menu shown allows the user to set the MODBUS serial protocol to MODBUS RTU. NETio Remote Units can process and respond to Modbus® RTU messages. Select **MODBUS RTU**.

7. The last screen of the wizard, shown in Figure 6-13, displays all of the parameters that were configured and allows the configuration to be committed.
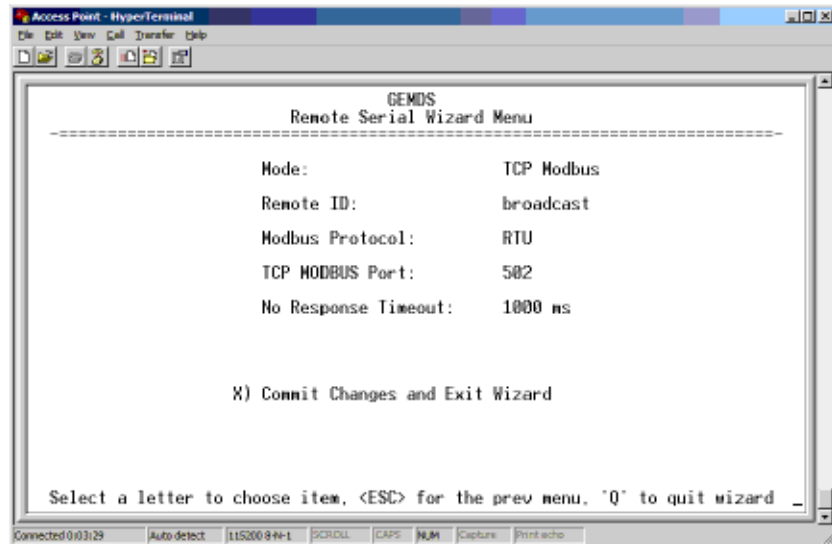

Figure 6-13. Last Screen of Remote Serial Wizard
(Provides a review of wizard settings before committing)

6.1.3 Configuring MODBUS in a NETioB Module

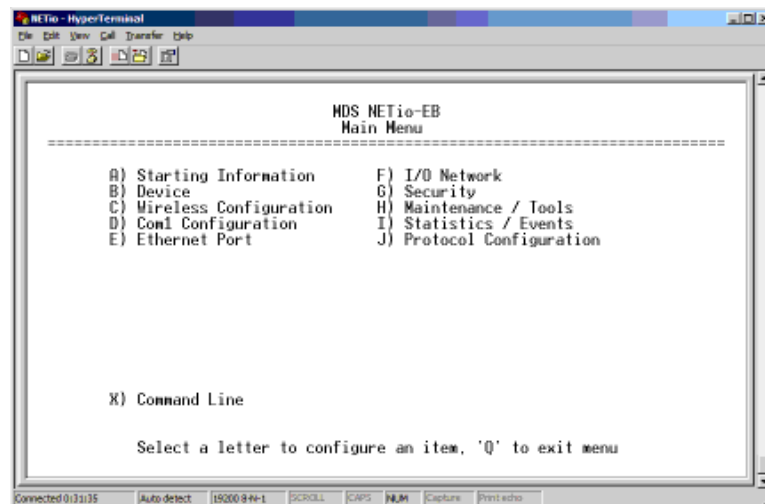1. From the NETio Main Menu (Figure 6-14) select **Protocol Configuration**.

Figure 6-14. Main Menu

2. In the Protocol Configuration Menu (see Figure 6-15), select **Modbus Protocol**.
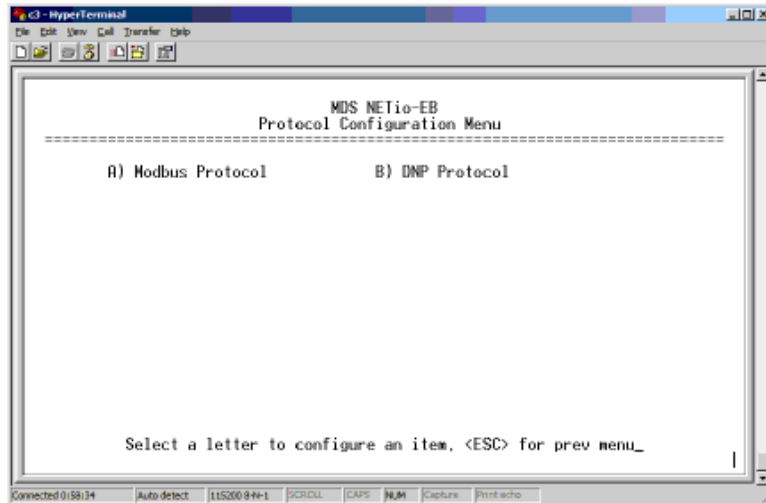
Figure 6-15. Protocol Configuration Menu
(User selection pending)

3. In the Modbus Protocol Menu (Figure 6-16), select **A)** to enter the Modbus® Slave Address. Next, select **B)** to enable the Modbus® protocol.
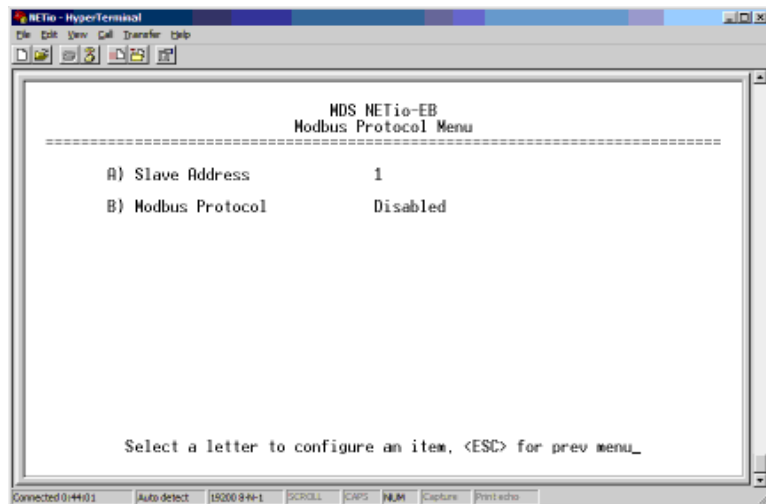

Figure 6-16. Modbus Protocol Menu

6.1.4 Optional Protocol Configuration for COM1 Serial Port on NETioB Remote

There are two additional configuration options for the Com1 Serial Port when the Modbus® feature is active:

Protocol Pass Through Mode - In this mode, the NETioB Module processes all Modbus® messaging in/out of Com1. This is useful when a Modbus® RTU or PLC is connected to Com1. In this case, the NETioB Module responds to MODBUS messages received over the air, and also transparently relays communication to a device connected to Com1. This

configuration is also used when the MODBUS Master is connected to the NETio Direct Mode Root.

Protocol Local Master Mode - In this mode, the user establishes that the Modbus® Master device is connected directly to the Com1 port on the NETioB Module rather than the entraNET AP. This mode is useful when the user wants to address I/O connected to the NETioB Module and wired or wireless NETioE Modules.

Note that Modbus® messages received by the NETioB Module in this mode are *not* wirelessly transmitted to the Access Point or any other NETioB Module. The Modbus® messaging is a local process only.

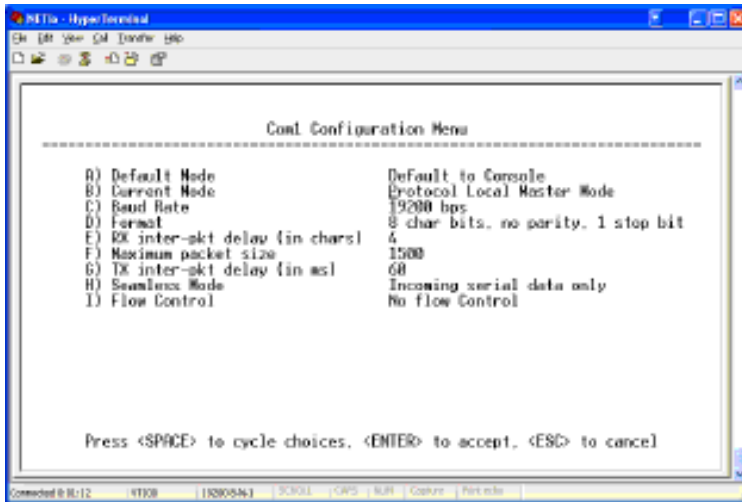1. From the NETio Main Menu select **D** to reach the Com1 Configuration Menu shown in Figure 6-17.

Figure 6-17. Com1 Configuration Menu

2. Select **Current Mode** from the menu and press the Space bar to cycle through the available options.

   • Selecting Protocol Local Master Mode specifies that the Modbus® Master device will be connected to the Com1 port on the NETioB Module.
   • Selecting Protocol Pass Through specifies that the Modbus® Master device is connected to an entraNET Access Point or a Direct Mode Root. In this case Modbus® traffic is monitored by the NETioB Module and also forwarded out of Com1 to an external RTU or PLC.

     Note that the Com1 Configuration Menu is also where various Com1 port settings such as Baud Rate and Word Format may be set.

6.2 CONFIGURING DNP OPERATION

A NETioB Module will process DNP messages that come from one of three sources depending upon how the user has configured it:

1. Over-the-air (wireless) from an EntraNET AP: This method allows a NETioB Module to wirelessly communicate with a DNP Master device or system via a NETio Access Point. The Access Point is where the physical connection to the DNP host is made.

2. Over-the-air (wireless) from a NETio DirectMode root or NETio DirectMode node: This method allows a NETioB Module to wirelessly communicate with a DNP Master device or system via another NETioB Module. One of the NETioB Modules is where the physical connection to the DNP host is made (typically the DNP host would connect to the Direct Mode Root).

3. Local: This method allows a NETioB Module to communicate with a DNP Master device or system physically connected to the serial communication port on the NETioB Module.

NOTE: For detailed instructions about addressing NETio including the DNP functions and objects supported, please download the *DNP3 Protocol Supplement* 05-4874A01, from the GEMDS website.

6.2.1 Configuring DNP on a NETio Access Point

The GE MDS implementation of Distributed Network Protocol 3 (DNP3) on the Access Point allows the transfer and routing of DNP3 messages between serial devices, while also supporting the conversion to an IP Ethernet network. As DNP3 messages are routed through the system, the APs "learn" the locations of all end devices, regardless of whether they are configured for serial or Ethernet communication, eliminating the need to configure their individual locations.

A DNP device can connect to the Access Points serial ports or Ethernet port. To set up serial DNP on Com1 or Com2, see *Section 6.2.2, Configuring Serial DNP on a NETio Access Point*. To set up an Ethernet DNP port, see *Section 6.2.3, Configuring Ethernet DNP3 on a NETio Access Point*.

6.2.2 Configuring Serial DNP on a NETio Access Point

Configure the following parameters in the NETio Access Point when the DNP Device is connected to either COM1 or COM2 port.

1. From the entraNET Access Point Main Menu, select item **D** for Local Serial Configuration.
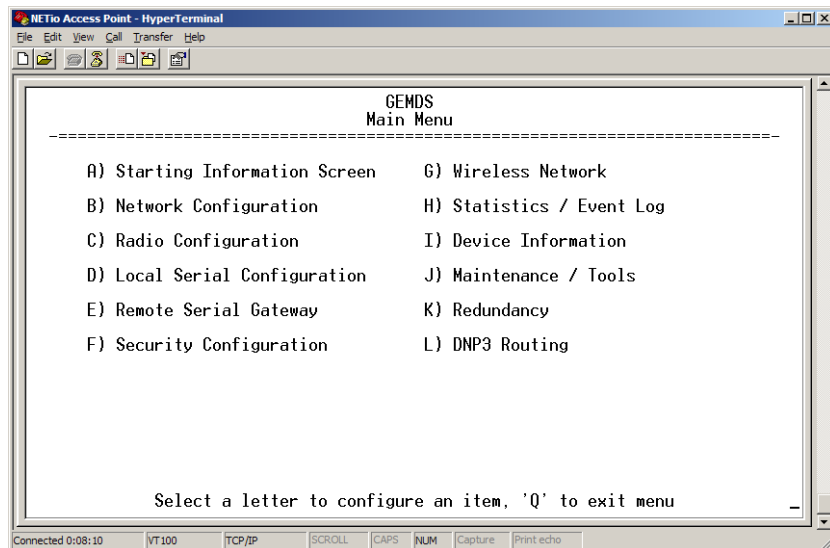

Figure 6-18. entraNET Access Point Main Menu

2. From the Local Serial Configuration Menu, select **D** to choose Serial Config. Wizard.
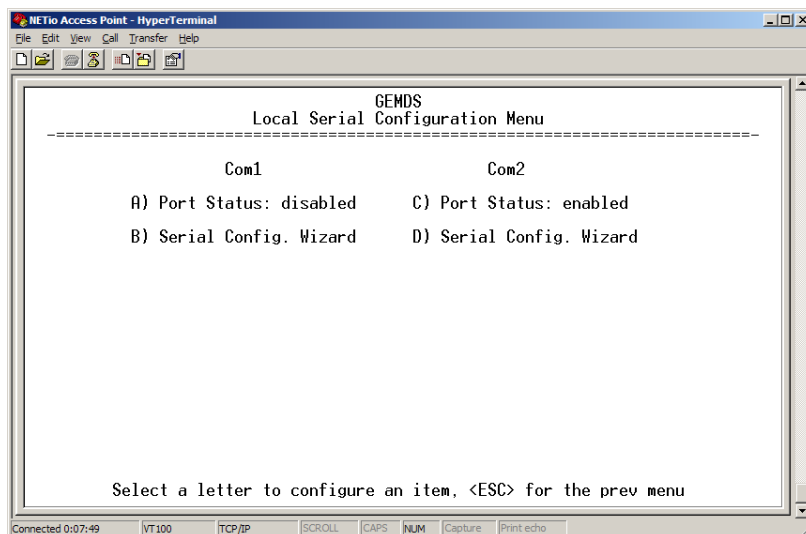

Figure 6-19. Local Serial Configuration Menu

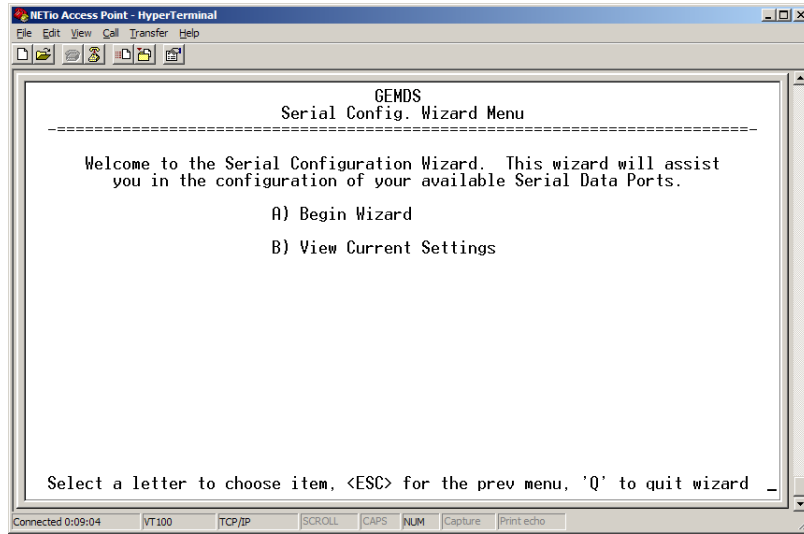3. From the Serial Configuration Wizard Menu, select **A** to begin the wizard.

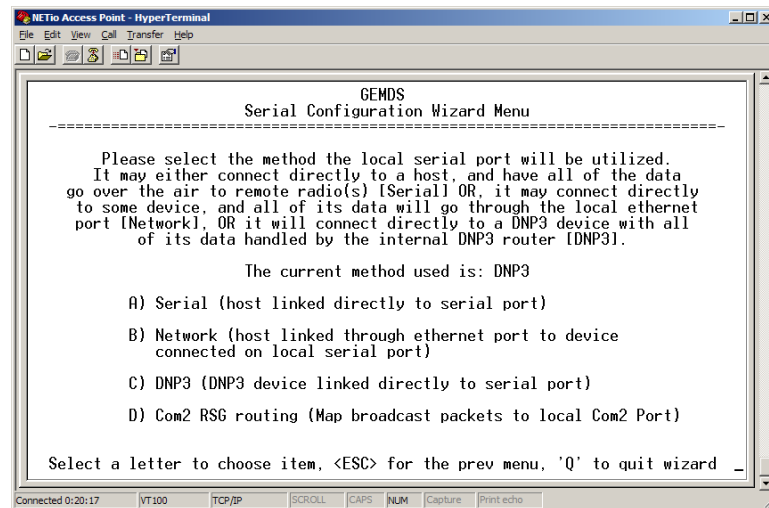**Figure 6-20. Serial Configuration Wizard Menu**

4. Select **C** to choose DNP3.

Figure 6-21. Serial Configuration Wizard Menu
(choose DNP3)

5. Select **N** to continue the wizard.
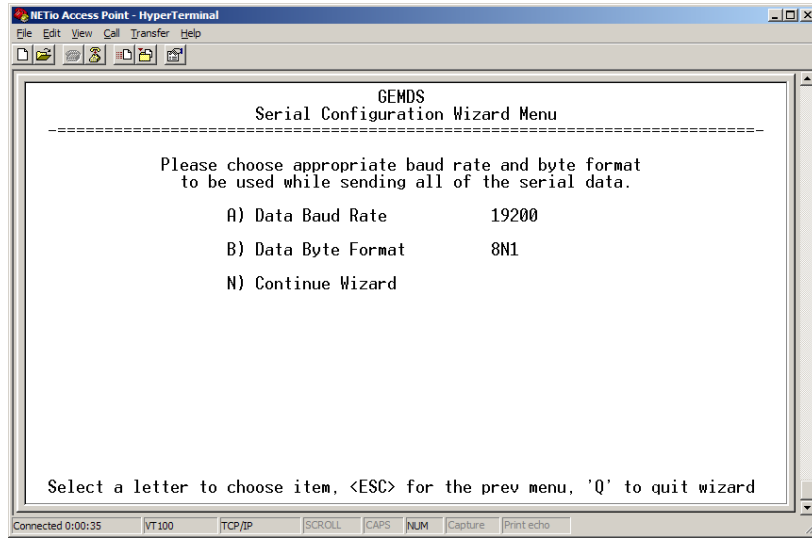
Figure 6-22. Serial Configuration Wizard Menu
(continue the wizard)

6. Select **N** again to continue the wizard.
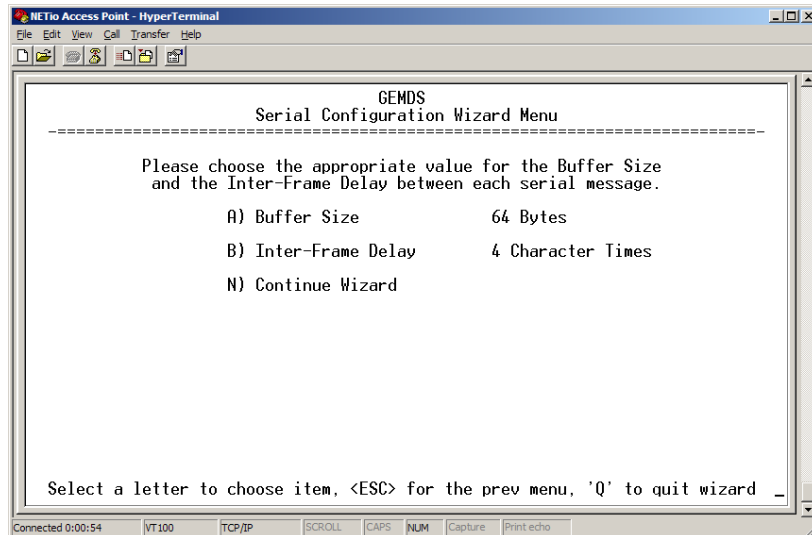
Figure 6-23. Serial Configuration Wizard Menu
(continue the wizard again)

7. Select **N** again to continue the wizard.

Figure 6-24. Serial Configuration Wizard Menu
(continue the wizard again)

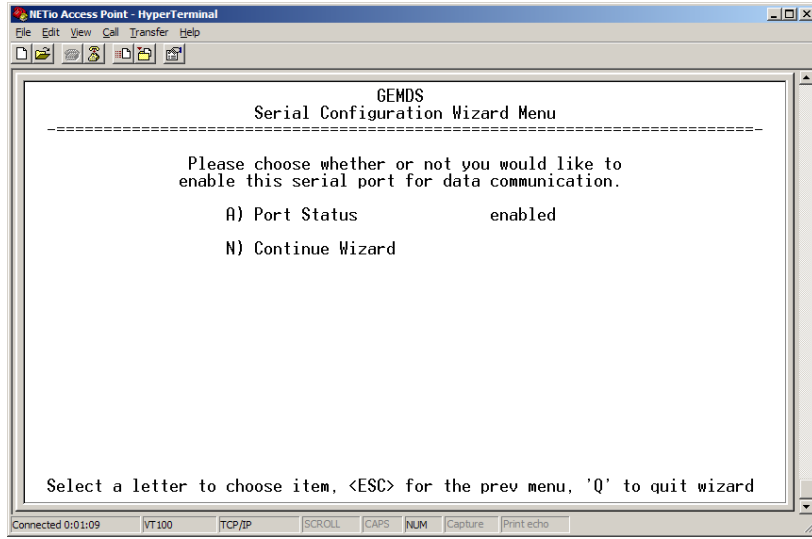8. The wizard shows the final menu, which lists the selections that will be configured into the NETio Access Point. Select **X** to commit the changes and exit the wizard.
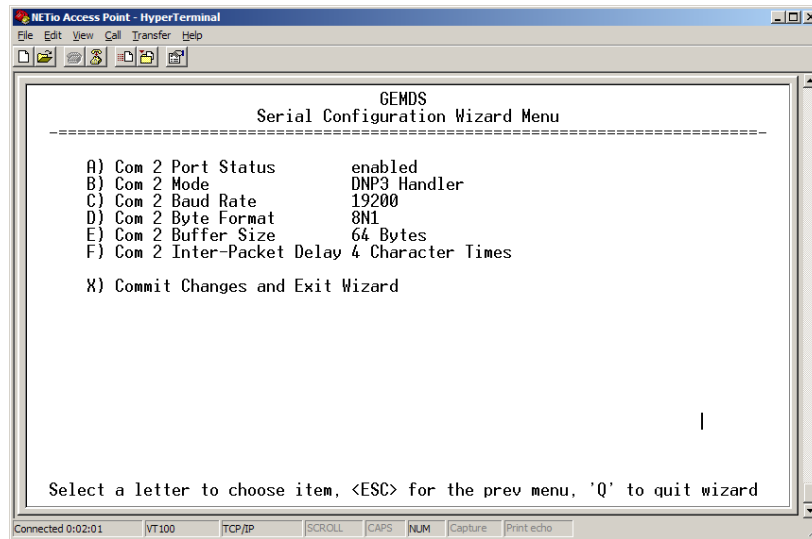

Figure 6-25. Serial Configuration Wizard Menu
(commit changes and exit wizard)

6.2.3 Configuring Ethernet DNP3 on a NETio Access Point

- Select item L from the Main Menu to access the DNP3 Routing Menu shown in Figure 6-26.
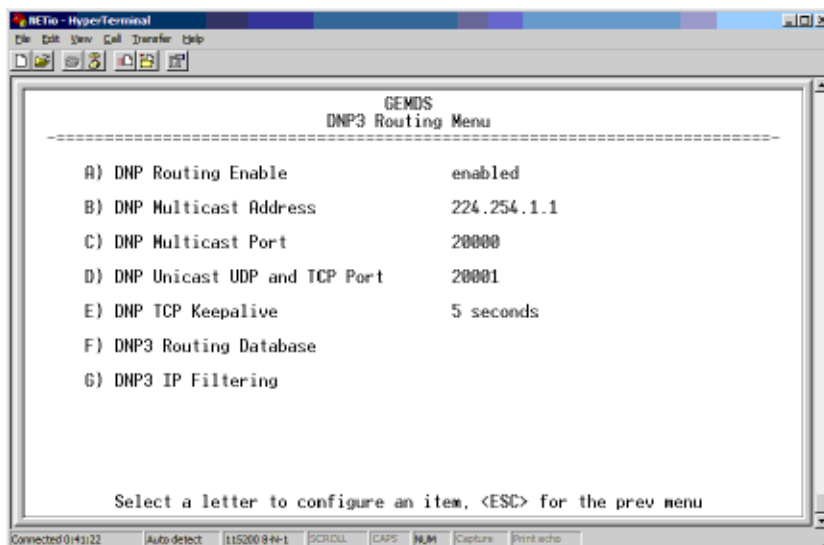

Figure 6-26. DNP3 Routing Menu

- DNP Routing Enable-Enables or disables the DNP3 routing function. **[Enabled, Disabled; Disabled]**
- DNP Multicast Address-Specifies the group address with which to exchange UDP-encapsulated messages with other IP devices that are DNP3 aware. This includes PCs, endpoint devices, and other APs. When a DNP3 packet is received and no routing information exists for the target device (see DNP3 routing database below), the AP sends the packet to all other IP devices in an attempt to find a radio that recognizes the address. **[Valid IP address; 224.254.1.1]**
- DNP Multicast Port-Specifies the IP port number used for all DNP3 Multicast messaging. **[0-65535; 20000]**
- DNP UDP/TCP Port-This field specifies the IP port number used to establish a socket to other IP devices. This TCP/UDP port (along with the AP local IP address) is used to encapsulate DNP3 messages over IP. **[0-65535; 20001]**
- DNP TCP Keepalive - The amount of time a TCP session will be held open when no data is being transmitted. **[0-600;5]**
- DNP3 Routing Database-This selection brings up a screen where the current DNP3 routing information known by the AP can be viewed.
- DNP3 IP Filtering - This selection brings up a screen where IP addresses can be entered to allow only those IP addresses to make connections to the DNP sockets.

![GE MDS logo]

NOTE: For installations that include multiple APs, it is important to properly configure IAPP, which is located within the Mobility Menu. IAPP allows APs to share their DNP3 routing information.

6.2.4 Configuring DNP IP Filtering on a NETio Access Point

The Access Point can filter which DNP devices are allowed to make connections with the DNP ethernet ports by specifying up to five allowable IP addresses. When enabled, IP filtering permits only those devices that have one of the listed IP addresses to connect to and to send data to the Access Point's DNP ethernet ports. This applies to both the unicast and the multicast port.
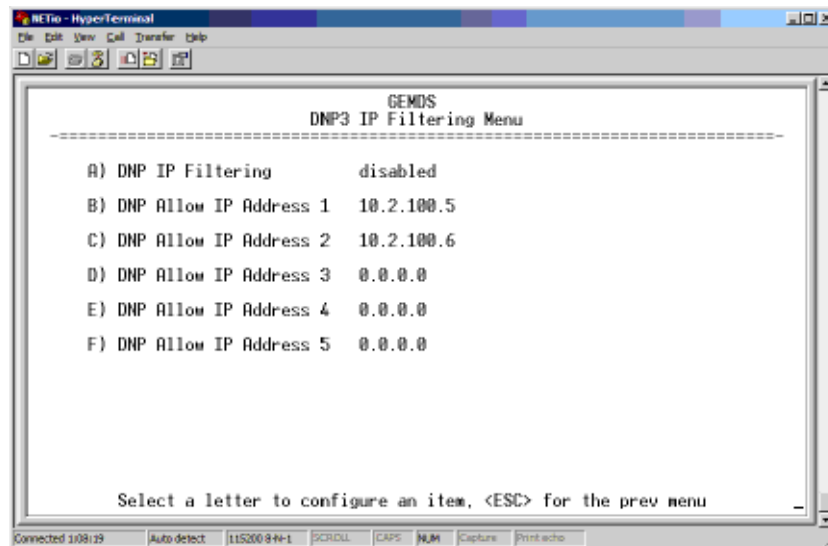
Figure 6-27. DNP IP Filtering Menu

- DNP IP Filtering - Enables or disables IP Filtering
  [enabled, disabled; disabled]
- DNP Allow IP Address 1 through 5 - Specifies an IP address from which DNP messages can be received from.
  [0.0.0.0-255.255.255.255;0.0.0.0]

When an "Allow IP Address" item is configured as "0.0.0.0", the item is ignored. For example, to allow only one DNP device to connect to the Access Point's ethernet ports, configure one "Allow IP Address" item with the device's IP address and set the remaining "Allow IP Address" items to "0.0.0.0".

6.2.5 DNP Routing Database

Figure 6-28 on Page 107 shows an example DNP3 Routing Database with two entries. In this example, a DNP Master connected to the Access Point's Ethernet port and sent a message to a DNP device with an

address of 256 (0x0100). The destination device in this case was a NETio Remote Unit with UnitId 200.

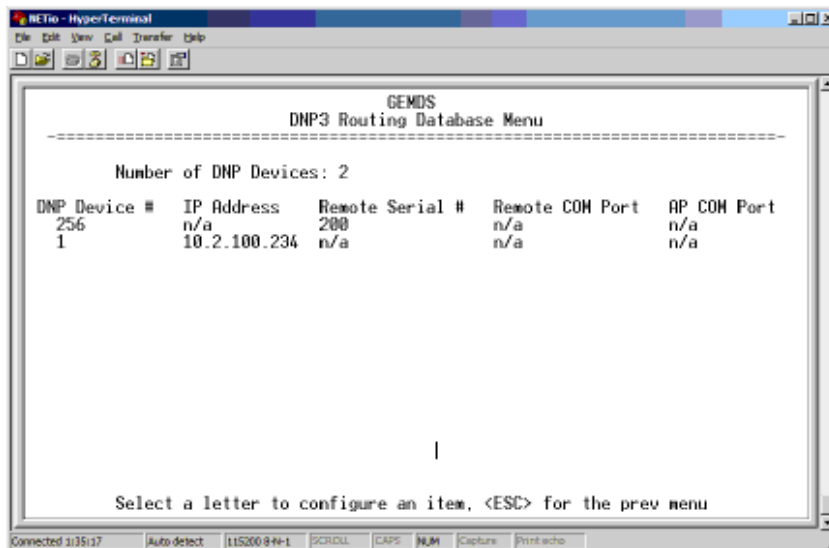**Figure 6-28. DNP3 Routing Database Example**

6.2.6 Configuring DNP in a NETioB Module

1. From the NETio Main Menu select Protocol Configuration.

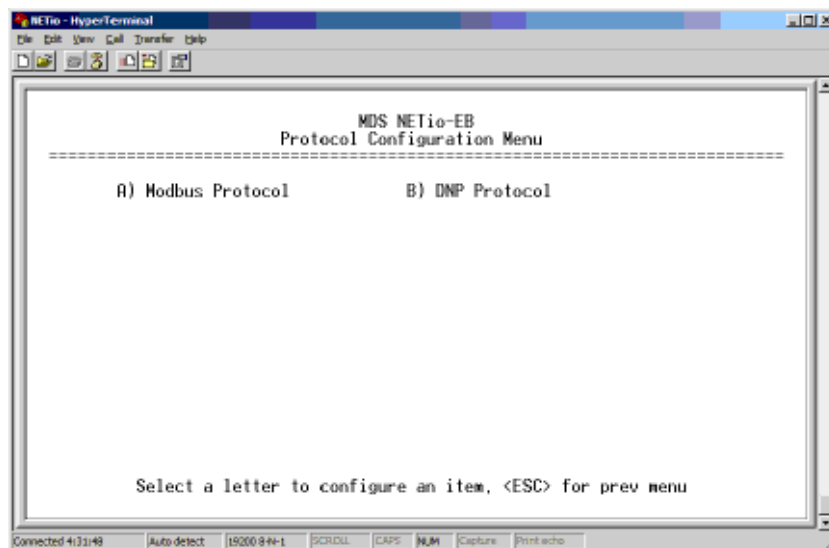2. In the Protocol Configuration Menu shown in Figure 6-29, select item **B) DNP Protocol**.

Figure 6-29. Protocol Configuration Menu

3. In the DNP Protocol Menu shown in Figure 6-30, select **ID** to enter the DNP Id. Next, select **MODE** to enable the DNP protocol.

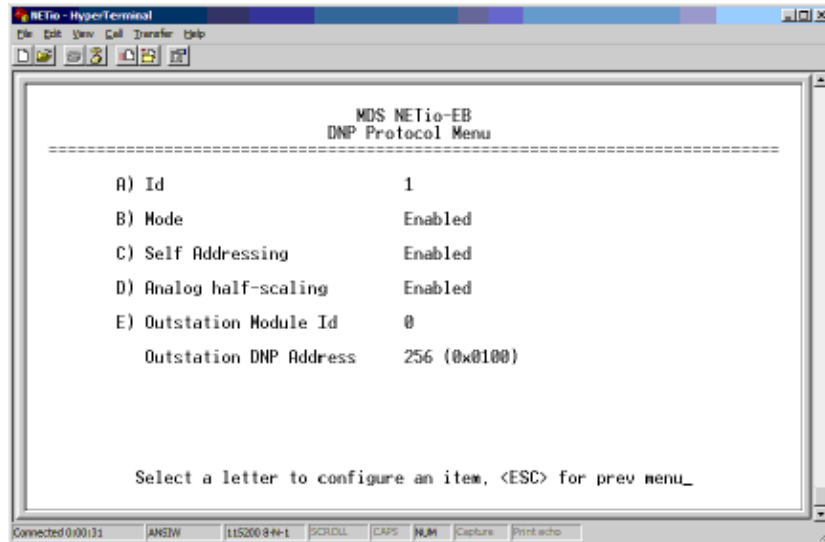**Figure 6-30. DNP Protocol Menu**

- **Id**—The value used to set the range of DNP addresses for the NETioB Module and its NETioE Modules. [**0-255**; **0**]
- **Mode**—Enables or disables DNP operation.
  [**Enabled, Disabled; Disabled**]
- **Self Addressing**—Enables or disables the use of the DNP self address feature [**Enabled, Disabled; Enabled**]
- **Analog half-scaling** - Enables or Disables scaling of DNP analog values. **[Enabled, Disabled; Enabled]**
- **Outstation Module Id**—Used for calculating the DNP address of the NETioB Module or NETioE Modules. Use module Id **0** to find the DNP address of the NETioB. [**0-255**; **0**]
- **Outstation DNP Address**—A read-only parameter displaying the DNP address (in decimal and hexidecimal format) of the module whose Id is entered in the Outstation Module Id parameter. [**0-65535**; **0**]

NOTE: Only one protocol may be enabled at a time. If DNP cannot be enabled, disable all other protocols.

6.2.7 Scaling Analog Values for DNP

The menu option **Analog half-scaling** is used to scale the values in read and write requests for analog I/O points. This allows DNP messages to utilize the 16-bit variation of analog read and write requests while still being able to use the full range of analog values. See the *Protocol Supplement* document (05-4672A01) for additional details.

6.2.8 Optional Protocol Configuration for COM1 Serial Port on NETioB remote

There are two additional configuration options for the COM1 Serial Port when the DNP feature is active.

Protocol Pass Through Mode—In this mode, the NETioB Module processes all DNP messaging in/out of COM1. This is useful when a DNP device or PLC is connected to COM1. In this case, the NETioB Module supports its own DNP addressable I/O as well as other DNP devices attached to its COM port.

Protocol Local Master Mode—In this mode, it is established that a DNP device is connected directly to the COM1 port on the NETioB Module, rather than the entraNET AP. This mode is useful when you wish to address I/O connected to the NETioB Module and wired or wireless NETioE Modules.

Note that DNP messages received by the NETioB Module in this mode are not wirelessly transmitted to the Access Point (or any other NETioB Module). DNP messaging is a local process only.

1. From the NETio Main Menu select **Com1 Configuration** to reach the Com1 Configuration Menu shown in Figure 6-31.
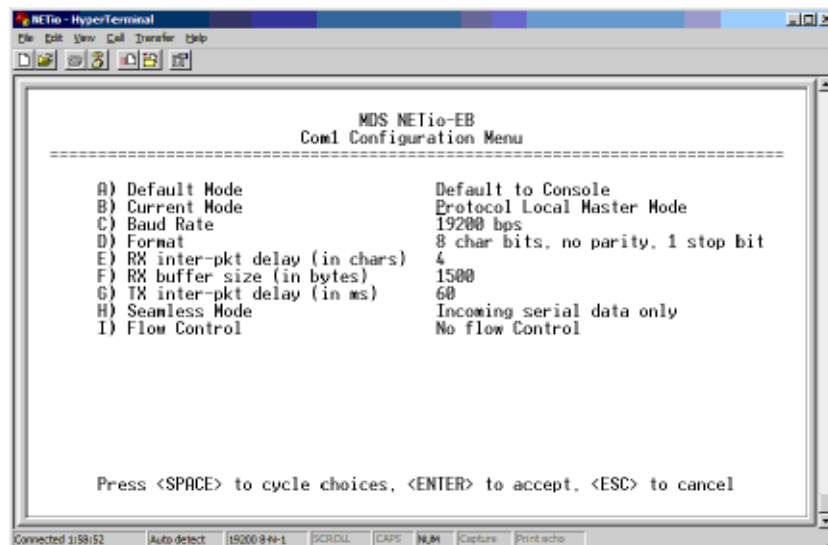
Figure 6-31. Com1 Configuration Menu

2. Select item B) Current Mode from the menu and press the Space bar to cycle through the available options.

   • Selecting **Protocol Local Master Mode** specifies that the DNP device will be connected to the Com1 port on the NETioB Module.

- Selecting **Protocol Pass Through** specifies that the DNP host device is connected to an entraNET Access Point. In this case DNP traffic is monitored by the NETioB Module and also forwarded out of COM1 to an external RTU or PLC.

7 MAINTENANCE & SUPPORT FUNCTIONS

7.1 INTRODUCTION

This chapter describes the maintenance, support and customization steps for NETio. The chapter is divided into the following major sections:

- NETio entraNET Radio Information
- WeXP Radio Information (useful if NETio is equipped with WeXP functionality)
- NETio Device and I/O Module customization
- Upgrading NETio Firmware

7.2 NETio entraNET RADIO MAINTENANCE & SUPPORT

All NETio entraNET related configuration, maintenance and support information is accessed through the NETio Main Menu shown in Figure 7-1.
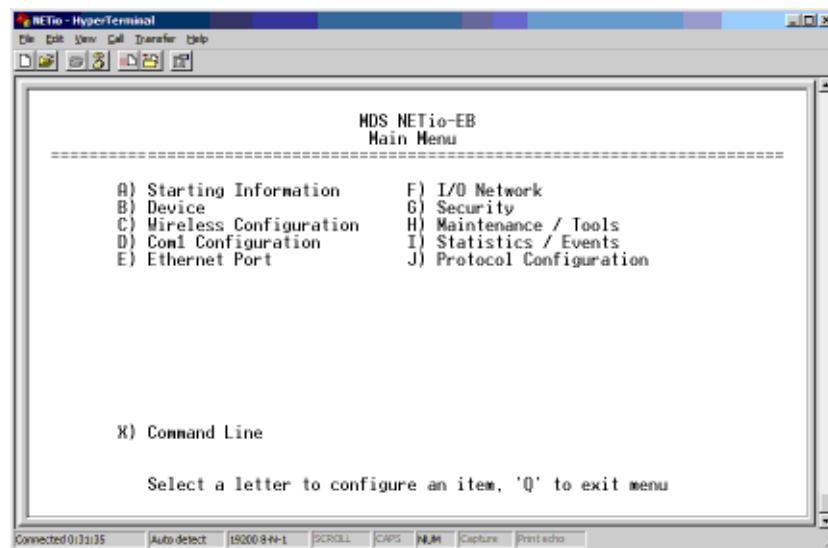
Figure 7-1. NETio Main Menu

7.2.1 Modifying NETio entraNET RF Output Power

The default value for NETio's entraNET radio is 30 dBm (1 watt). To change this value, make the following selections from the Main Menu: **Wireless Configuration > entraNET Configuration > Basic Configuration**. The menu shown in Figure 7-2 appears.
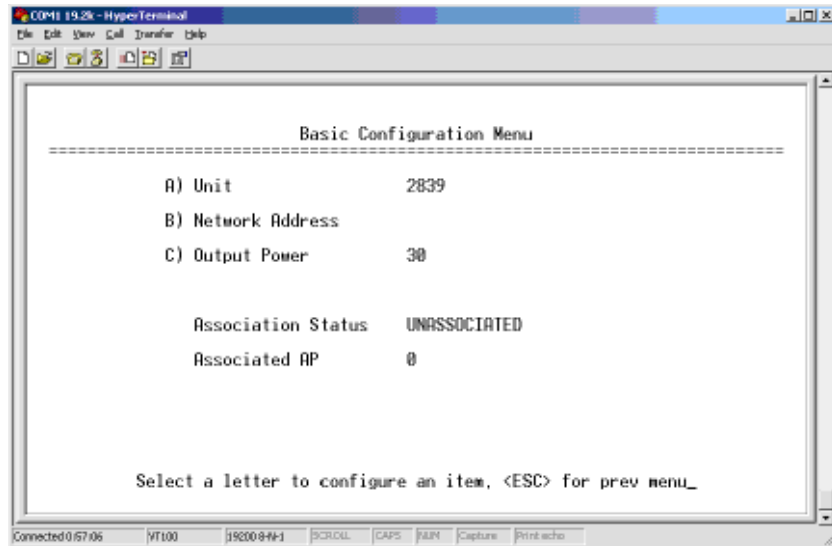
Figure 7-2. Basic Configuration Menu

7.2.2 Performance, Statistics, RSSI Information

NETio Performance information, statistics, and information on entraNET-related parameters is available from the Performance Statistics Menu (Figure 7-3). All communication statistics can be reached from this menu. To reach this menu, select **Statistics/Events>Performance Statistics**.
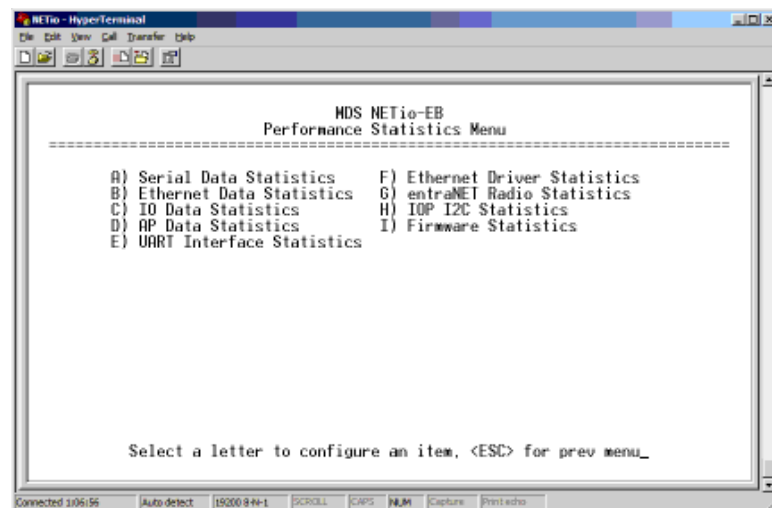
Figure 7-3. Performance Statistics Menu

To review entraNET radio information, select entraNET Radio Statistics. The menu shown in Figure 7-4 is presented.
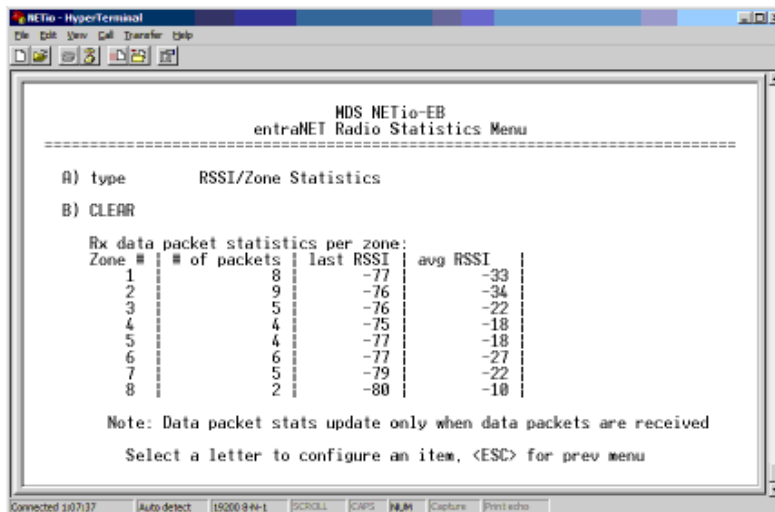
Figure 7-4. NETio entraNET Radio Statistics Menu

Various RF-related parameters of the entraNET radio can be viewed by selecting **A** and pressing the spacebar to cycle through the available selections.

7.2.3 Setting Encryption Approved Access Points and Passwords

Using the Security Menu, a list of approved Access Points can be built to ensure the NETio Remote Unit only associates with authorized systems. You can also change the default password of the NETio. If data encryption is available, it can also be modified. These parameters are located in the Security menu (**Main Menu > Security**) shown in Figure 7-5.
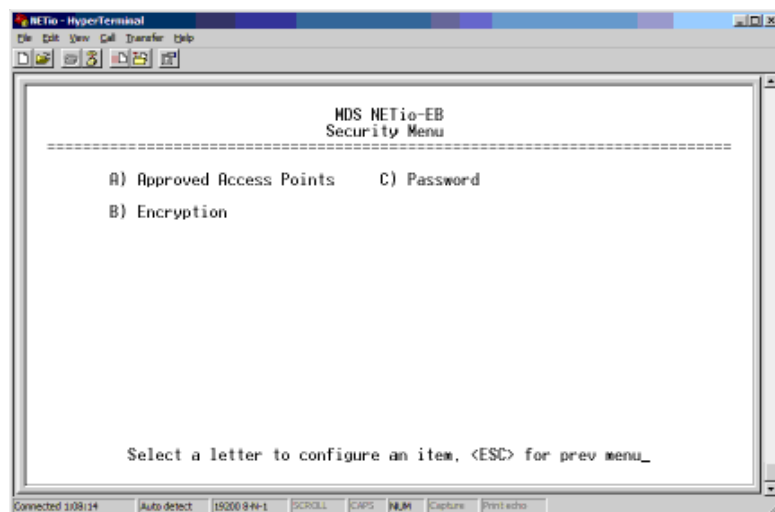
Figure 7-5. Security Menu

7.2.4 Maintenance/Tools/Date and Time

The Maintenance/Tools Menu (**Main Menu>Maintenance/Tools**) shown in Figure 7-6. It contains various selections for:

- **Version**—Shows the firmware versions and which image is running.
- **Verify**—Verifies the integrity of the firmware in the radio.
- **Reboot**—Restarts NETio firmware.
- **Current Time**—Shows the NETio's date and time. (Parameters obtained from entraNET AP, when used.)
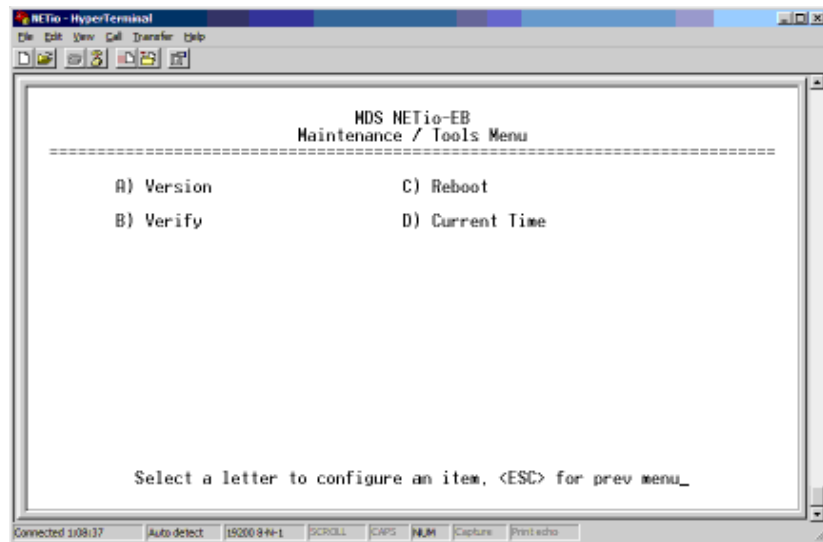
Figure 7-6. Maintenance/Tools Menu

7.3   WeXP & NETio MODULE MAINTENANCE

Most of the user-settable parameters for WeXP and NETioE Modules are covered in earlier chapters of this guide. The few remaining parameters are accessed from the I/O Module Configuration Menu shown in Figure 7-7 (**Main Menu>I/O Network>I/O Module Configuration**).
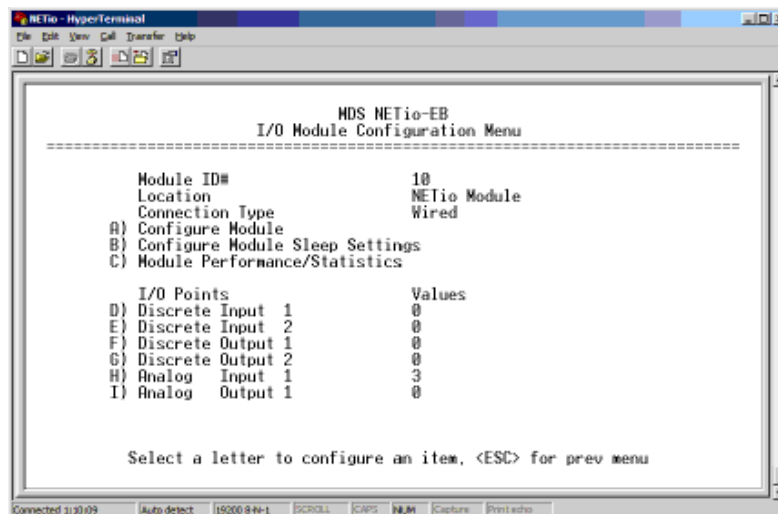
Figure 7-7. I/O Module Configuration Menu

7.3.1 View/Set NETioE Module WeXP RF Power

The Module Menu (**Main Menu>I/O Network>I/O Module Configuration>Configure Module**) allows viewing or changing the WeXP's RF output power level. Figure 7-8 shows this menu.

To change the power level, select **WeXP Power Level** and use the spacebar to cycle through the available output power settings.
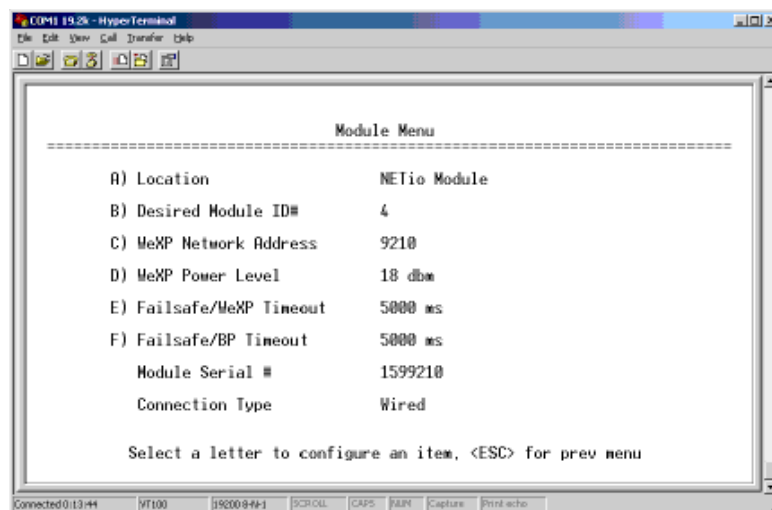
Figure 7-8. Module Menu

7.3.2 Changing NETioB Module WeXP RF Output Power

The WeXP output power for a NETioB Module is configured from the WeXP Configuration Menu shown in Figure 7-9 (**Main Menu>Wireless Configuration>WeXP Configuration**).

Select **WeXP Power Level** and use the spacebar to cycle through the available settings.
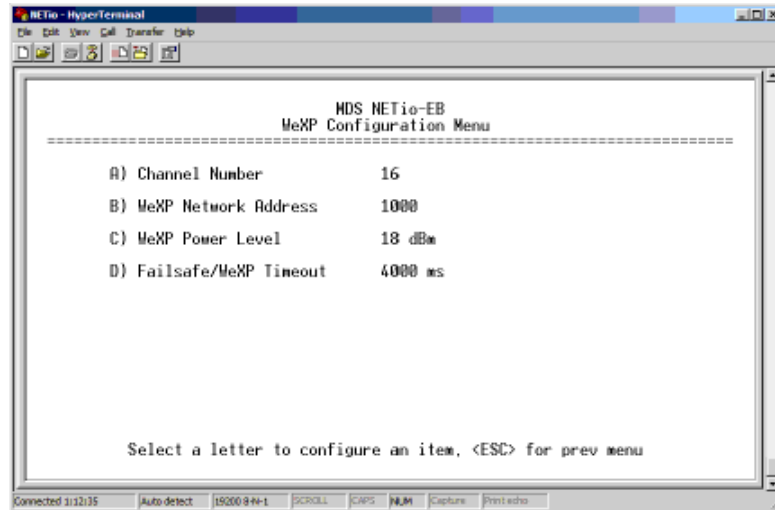
Figure 7-9. WeXP Configuration Menu

7.3.3 Changing WeXP RF Channel

The WeXP RF channel for a NETioB Module is set using the WeXP Configuration Menu shown in Figure 7-9 (**Main Menu>Wireless Configuration>WeXP Configuration**). To change the channel, select **Channel Number** and enter any number between **12** and **23**.

7.3.4 WeXP RSSI and Backplane Communication Statistics

The communications performance for WeXP and the NETio Backplane can be viewed via the I/O Module Configuration Menu (Figure 7-7 on Page 117). To view the performance, select **Module Performance/Statistics** from this menu. If this selection is made from a NETioB Module then the menu shown in Figure 7-10 is displayed. If the selection is made from a Wireless NETioE Module then the menu shown in Figure 7-11 appears.
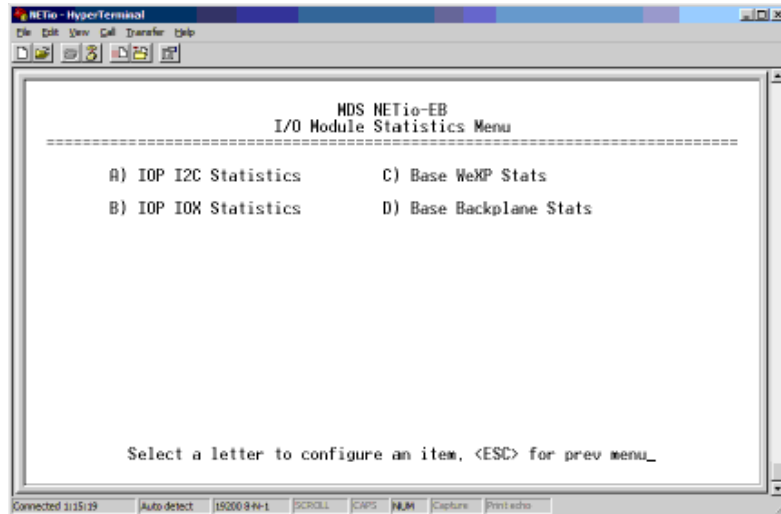
Figure 7-10. I/O Module Statistics Menu
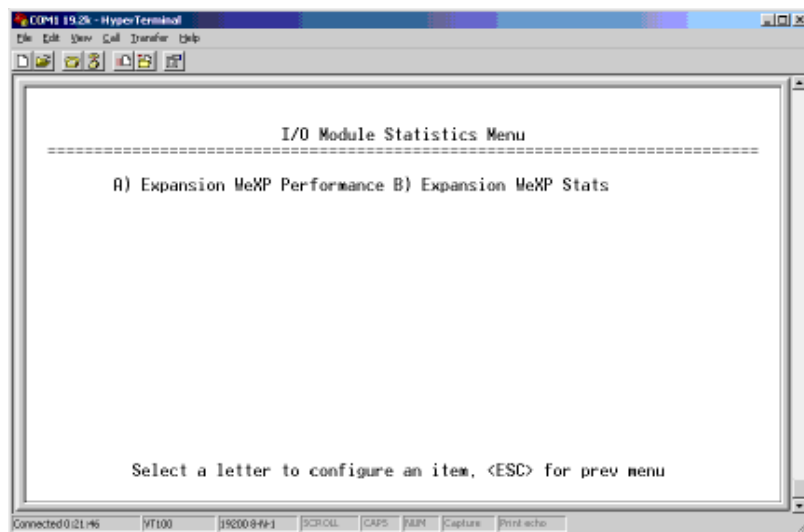
Figure 7-11. I/O Module Statistics Menu

Selecting **NETioE WeXP Performance** presents the screen shown in Figure 7-12.
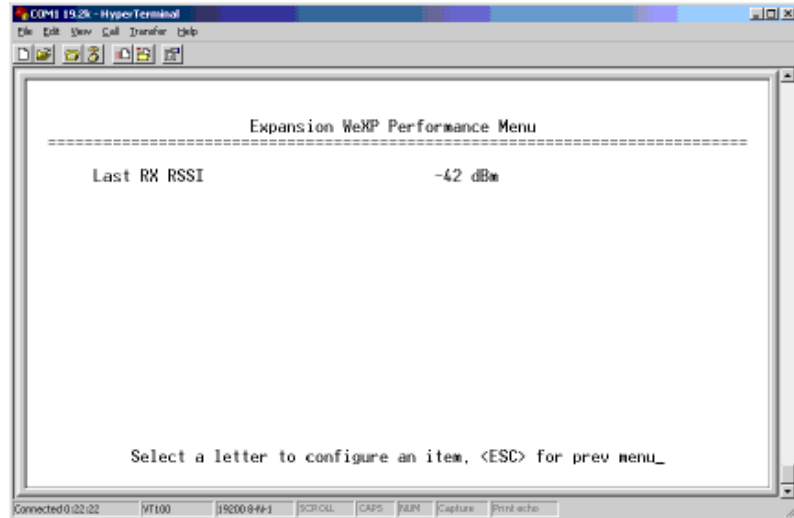
Figure 7-12. NETioE WeXP Performance Menu

7.4 DEVICE, MODULE and I/O POINT DESCRIPTIONS

NETio allows users the ability to customize the names for a NETio Remote Unit, Module and I/O Point. This is useful when the user wants to identify devices or I/O Points by their location, type of service, or signal ID.

7.4.1 Changing the NETio Device Name

The Owner, Device Name and Device Location can be modified in the Device Menu shown in Figure 7-13 (**Main Menu>Device**).
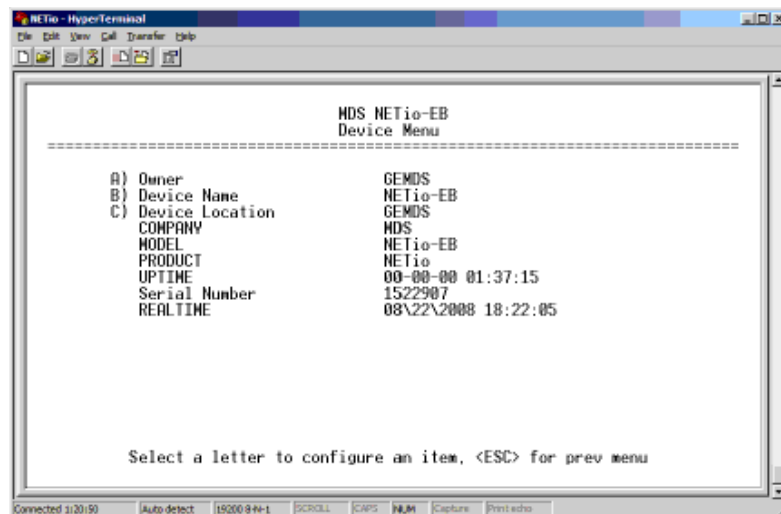
Figure 7-13. Device Menu

7.4.2 Changing NETio Module and I/O Point Names

NETio Module Names are changed by selecting **Location** at the Module Menu shown in Figure 7-8 on Page 117. I/O Point Names are changed by selecting **Point ID Tag** in the I/O Point Menus, an example of which is shown in Figure 7-14.
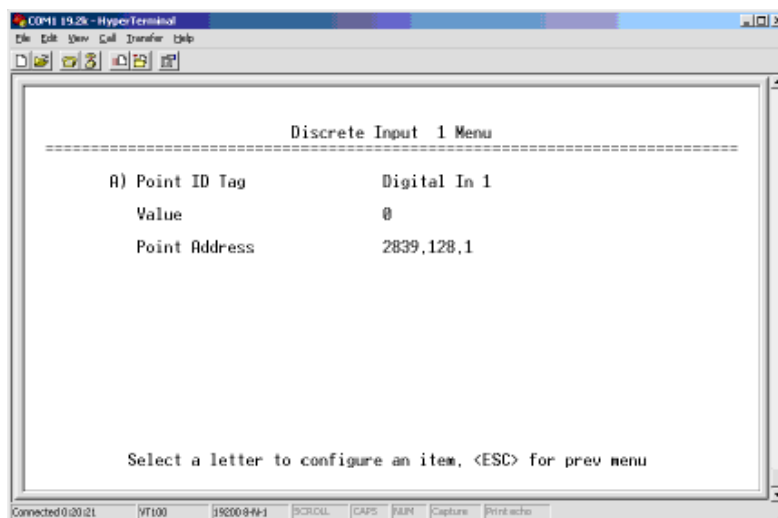
Figure 7-14. Example of Point ID Tag Selection
(This example shows Discrete Input Menu)

7.5   UPGRADING NETio FIRMWARE

You can upgrade NETio Firmware using the *Remote Firmware Upgrade Utility*. This utility is available in the MDS Toolbox located under Software/Firmware and Downloads at www.gemds.com.

Firmware upgrades are also available in this section of the Web site.

NOTE: A serial connection is required for this operation.

7.6   TECHNICAL SPECIFICATIONS

General

*These are **NETioB** Module specifications. For NETioE Module ratings, see Table 7-1 below.*

- Power: 7-30 Vdc
- Current Draw
  - Transmit: less than 450 mA (@13.8 Vdc)
  - Receive: less than 200 mA (@13.8 Vdc)

Table 7-1. NETioE Module Ratings
(Power: 7-30 Vdc, TX/RX Current Draw)

Expansion Type	Current Draw Avg. (mA) @ 13.8 Vdc	Sleep Current Draw Avg. (mA) @ 13.8 Vdc (Assumes default 1000 ms wakeup time)
1	80	50
2	50	25
3	55	25
4	100	90
6	50	30
7	65	35

NOTE: Temperature range for all above ratings is -40 to +70 degrees Celsius.

NETioB module

- NETioB:
  - I/O Capacity: 1 AI, 1 AO, 2 DI, 2 DO

    + AI Type: Configurable as 4-20mA, 0-5 Vdc, 0-10 Vdc
    + AO Type: 4-20 mA

  - Supports IP/Ethernet and serial communication
  - Compatible with MDS entraNET AP's and networks
  - Supports I/O Signal Extender functions between NETioB modules or over WeXP to Wireless NETioE Modules
  - One IP/Ethernet RJ45 connector for separate device
  - One serial RJ45 connector for separate device

NETio NETioE Module models

- NETioE1 capacity: 1 AI, 1 AO, 2 DI, 2 DO
  - AI Type: Configurable as 4-20mA, 0-5 Vdc, 0-10 Vdc
  - AO Type: 4-20mA
- NETioE2 capacity: 6 DI
- NETioE3 capacity: 6 DO
- NETioE4 capacity: 2 AI, 4 DI
  - AI Type: Configurable as 4-20mA, 0-5 Vdc, 0-10 Vdc
- NETioE6 capacity: 2 AI, 2 AO, 2 DI, 2 DO
  - AI Type: 0.1-5 Vdc
  - AO Type: 0.1-5 Vdc
- NETioE7 capacity: 2 AI, 1 DI, 3 DO
  - AI Type: 4-20mA

Analog Input
- Externally powered 4-20 mA loop
- Accuracy ± 0.1% full scale
- Input Impedance: Type 6—50k Ohms (nominal); NETioB, Type 1, and Type 4—100k Ohms (nominal)
- A/D Resolution: 22 bit
- Isolation: 1400 V input to power
- Note that inputs on XM6 are *not* isolated

Digital Inputs
- Type: 5-36 Vdc
- Isolation: 3000 V to ground terminal
- Input Current: 16 mA @ 36 Vdc (at 24V nominal operation)

Analog Outputs
- Accuracy ± 0.2% full scale
- Nominal Output Impedance: Type 6 (A01)—100 Ohms; Type 6 (A02)—10 Ohms
- Isolation: 1400 V output to power
- D/A Resolution: 16 bits

Digital Outputs
- Hold off voltage: 36 Vdc
- FET Relay
- Load Current: 2A continuous per output
- Isolation: 3700 V to chassis ground

900 MHz Model Radio specifications
- Data Rate: 106 Kbps over-the-air
- Frequency Band: 902-928 MHz ISM band
- Spreading Mode: Frequency Hopping Spread Spectrum
- Range[1]:
  - 30 miles (typical); 60 miles (maximum)
- System Gain: 136 dB
- Carrier Power: 0.1 to 1 watt (20 to 30 dBm)
- Receiver Sensitivity: -106 dBm (1 x 10-6 BER) typical

2.4 GHz Model Radio specifications
- Data Rate: 106 Kbps over-the-air
- Frequency Band: 2.4016-2.4778 GHz ISM band
- Spreading Mode: Frequency Hopping Spread Spectrum
- Frequency Bands (2.4 GHz): Selectable A, B, and C (See Page 25 for band frequency ranges.)
- Range[1]:
  - 6 miles (typical); 15 miles (maximum)
- System Gain: 131 dB

- Carrier Power: 0.1 to 0.5 watts (20 to 27 dBm)
- Receiver Sensitivity: -104 dBm (1 x 10-6 BER) typical

WeXP radio specifications - 802.15.4
- Frequency Band: 2.4 GHz to 2.4835 GHz
- Modulation: OQPSK
- Range: 3,000 feet (914 meters) typical; longer ranges with LOS
- Carrier Power: 60 mW (18 dBm)
- System Gain: 118 dBm
- Receiver Sensitivity: -100 dBm (1% packet error rate)

Mechanical
- Case: High impact plastic
- DIN Rail Mounting
- Dimensions (NETioB Module): 14.6 H x 4.14 W x 11.4 D cm. (5.75 H x 1.63 W x 4.5 D in.)
- Dimensions (NETioE Module): 14.6 H x 3.00 W x 11.4 D cm (5.75 H x 1.18 W* x 4.5 D in.)
- Weight: 226 g (.5 lb.)
- MTBF (Reliability): Consult factory for on-file data

Agency Approvals
- FCC Part 15.247
- IC - Industry Canada - RSS210
- CSA Class 1 Div. 2 Groups A, B, C and D for hazardous locations (ANSI/UL equivalent) [2]

1. Typical fixed range calculation assumes a 6 dBd gain Omni-directional antenna on a 100 ft. tower at the AP, a 10 dBd gain Yagi antenna on a 25 ft. mast at the Remote, with output power decreased to yield maximum allowable EIRP (36 dBm), a 10 dB fade margin, and a mix of agricultural and commercial terrain with line-of-sight transmission path. Actual range depends on the interaction of several factors in a network and transmission distances may vary from the figures stated here.

2. The transceiver is not acceptable as a stand-alone unit for use in the hazardous locations described above. It must either be mounted within another piece of equipment, which is certified for hazardous locations, or installed within guidelines, or conditions of approval, as set forth by the approving agencies.

7.7 dBm-WATTS-VOLTS CONVERSION CHART

Table 7-2 is provided as a convenience for determining the equivalent voltage or wattage of an RF power expressed in dBm.

Table 7-2. dBm-Watts-Volts Conversion—for 50 ohm systems

dBm	V	Po
+53	100.0	200W
+50	70.7	100W
+49	64.0	80W
+48	58.0	64W
+47	50.0	50W
+46	44.5	40W
+45	40.0	32W
+44	32.5	25W
+43	32.0	20W
+42	28.0	16W
+41	26.2	12.5W
+40	22.5	10W
+39	20.0	8W
+38	18.0	6.4W
+37	16.0	5W
+36	14.1	4W
+35	12.5	3.2W
+34	11.5	2.5W
+33	10.0	2W
+32	9.0	1.6W
+31	8.0	1.25W
+30	7.10	1.0W
+29	6.40	800mW
+28	5.80	640mW
+27	5.00	500mW
+26	4.45	400mW
+25	4.00	320mW
+24	3.55	250mW
+23	3.20	200mW
+22	2.80	160mW
+21	2.52	125mW
+20	2.25	100mW
+19	2.00	80mW
+18	1.80	64mW
+17	1.60	50mW
+16	1.41	40mW
+15	1.25	32mW
+14	1.15	25mW
+13	1.00	20mW
+12	.90	16mW
+11	.80	12.5mW
+10	.71	10mW
+9	.64	8mW
+8	.58	6.4mW
+7	.500	5mW
+6	.445	4mW
+5	.400	3.2mW
+4	.355	2.5mW
+3	.320	2.0mW
+2	.280	1.6mW
+1	.252	1.25mW

dBm	V	Po
0	.225	1.0mW
-1	.200	.80mW
-2	.180	.64mW
-3	.160	.50mW
-4	.141	.40mW
-5	.125	.32mW
-6	.115	.25mW
-7	.100	.20mW
-8	.090	.16mW
-9	.080	.125mW
-10	.071	.10mW
-11	.064	
-12	.058	
-13	.050	
-14	.045	
-15	.040	
-16	.0355	

dBm	mV	Po
-17	31.5	
-18	28.5	
-19	25.1	
-20	22.5	.01mW
-21	20.0	
-22	17.9	
-23	15.9	
-24	14.1	
-25	12.8	
-26	11.5	
-27	10.0	
-28	8.9	
-29	8.0	
-30	7.1	.001mW
-31	6.25	
-32	5.8	
-33	5.0	
-34	4.5	
-35	4.0	
-36	3.5	
-37	3.2	
-38	2.85	
-39	2.5	
-40	2.25	.1µW
-41	2.0	
-42	1.8	
-43	1.6	
-44	1.4	
-45	1.25	
-46	1.18	
-47	1.00	
-48	0.90	

dBm	mV	Po
-49	0.80	
-50	0.71	.01µW
-51	0.64	
-52	0.57	
-53	0.50	
-54	0.45	
-55	0.40	
-56	0.351	
-57	0.32	
-58	0.286	
-59	0.251	
-60	0.225	.001µW
-61	0.200	
-62	0.180	
-63	0.160	
-64	0.141	

dBm	µV	Po
-65	128	
-66	115	
-67	100	
-68	90	
-69	80	
-70	71	.1nW
-71	65	
-72	58	
-73	50	
-74	45	
-75	40	
-76	35	
-77	32	
-78	29	
-79	25	
-80	22.5	.01nW
-81	20.0	
-82	18.0	
-83	16.0	
-84	11.1	
-85	12.9	
-86	11.5	
-87	10.0	
-88	9.0	
-89	8.0	
-90	7.1	.001nW
-91	6.1	
-92	5.75	
-93	5.0	
-94	4.5	
-95	4.0	
-96	3.51	
-97	3.2	

dBm	µV	Po
-98	2.9	
-99	2.51	
-100	2.25	.1pW
-101	2.0	
-102	1.8	
-103	1.6	
-104	1.41	
-105	1.27	
-106	1.18	

dBm	nV	Po
-107	1000	
-108	900	
-109	800	
-110	710	.01pW
-111	640	
-112	580	
-113	500	
-114	450	
-115	400	
-116	355	
-117	325	
-118	285	
-119	251	
-120	225	.001pW
-121	200	
-122	180	
-123	160	
-124	141	
-125	128	
-126	117	
-127	100	
-128	90	
-129	80	.1ƒW
-130	71	
-131	61	
-132	58	
-133	50	
-134	45	
-135	40	
-136	35	
-137	33	
-138	29	
-139	25	
-140	23	.01ƒW

IN CASE OF DIFFICULTY...

GE MDS products are designed for long life and trouble-free operation. However, this equipment, as with all electronic equipment, may have an occasional component failure. The following information will assist you in the event that servicing becomes necessary.

TECHNICAL ASSISTANCE

Technical assistance for GE MDS products is available from our Technical Support Department during business hours (8:00 A.M.–5:30 P.M. Eastern Time). When calling, please give the complete model number of the radio, along with a description of the trouble/symptom(s) that you are experiencing. In many cases, problems can be resolved over the telephone, without the need for returning the unit to the factory. Please use one of the following means for product assistance:

       Phone: 585 241-5510   E-Mail: TechSupport@GEmds.com

       FAX: 585 242-8369   Web: www.GEmds.com

FACTORY SERVICE

Component level repair of this equipment is not recommended in the field. Many components are installed using surface mount technology, which requires specialized training and equipment for proper servicing. For this reason, the equipment should be returned to the factory for any PC board repairs. The factory is best equipped to diagnose, repair and align your radio to its proper operating specifications.

If return of the equipment is necessary, you must obtain a Service Request Order (SRO) number. This number helps expedite the repair so that the equipment can be repaired and returned to you as quickly as possible. Please be sure to include the SRO number on the outside of the shipping box, and on any correspondence relating to the repair. No equipment will be accepted for repair without an SRO number.

SRO numbers are issued online at **www.GEmds.com/support/product/sro/**. Your number will be issued immediately after the required information is entered. Please be sure to have the model number(s), serial number(s), detailed reason for return, "ship to" address, "bill to" address, and contact name, phone number, and fax number available when requesting an SRO number. A purchase order number or pre-payment will be required for any units that are out of warranty, or for product conversion.

If you prefer, you may contact our Product Services department to obtain an SRO number:

Phone Number: 585-241-5540
Fax Number: 585-242-8400
E-mail Address: productservices@GEmds.com

The radio must be properly packed for return to the factory. The original shipping container and packaging materials should be used whenever possible. All factory returns should be addressed to:

      GE MDS, LLC
      Product Services Department
      (SRO No. XXXX)
      175 Science Parkway
      Rochester, NY 14620 USA

When repairs have been completed, the equipment will be returned to you by the same shipping method used to send it to the factory. Please specify if you wish to make different shipping arrangements. To inquire about an in-process repair, you may contact our Product Services Group using the telephone, Fax, or E-mail information given above.