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**HN-1010
HN-1510**



**RS-232
Serial Modbus
Radio**

User Guide

Revision History

Revision	Date	Author	Change Description
1	03/01/2008	F. Perkins	Initial issue
2	01/22/2015	R. Willett	Reformatted to comply with new Murata V.I.
3	01/13/2017	R. Willett	Updated Copyright

Important Regulatory Information

**RFM Product FCC ID: HSW-2410
IC 4492A-2410**

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

FCC s MPE Requirements

Information to user/installer regarding FCC s Maximum Permissible Exposure (MPE) limits.

Notice to users/installers using the 24 dBi parabolic dish antenna in conjunction with all Murata RF products.

*FCC rules limit the use of this antenna, when connected to Murata RF products for **point-to-point applications only**. It is the responsibility of the installer to ensure that the system is prohibited from being used in point-to-multipoint applications, omni-directional applications, and applications where there are multiple co-located intentional radiators transmitting the same information. Any other mode of operation using this antenna is forbidden.*

Notice to users/installers using the following fixed antennas, with Murata RF products:

<i>Andrews 24dBi parabolic dish Andrews 18dBi parabolic dish Cushcraft 15dBi Yagi, Mobile Mark 14dBi Corner Reflector, Mobile Mark 9dBi Corner Reflector</i>	<i>The field strength radiated by any one of these antennas, when connected to Murata RF products, may exceed FCC mandated RF exposure limits. FCC rules require professional installation of these antennas in such a way that the general public will not be closer than 2 m from the radiating aperture of any of these antennas. End users of these systems must also be informed that RF exposure limits may be exceeded if personnel come closer than 2 m to the apertures of any of these antennas.</i>
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Notice to users/installers using the following mobile antennas, with Murata RF products:

<i>Mobile Mark 12dBi omni-directional, Mobile Mark 9dBi omni-directional, MaxRad 5dBi whip, Murata Patch antenna, Ace 2dBi dipole, Mobile Mark 2dBi Stub</i>	<i>The field strength radiated by any one of these antennas, when connected to Murata RF products, may exceed FCC mandated RF exposure limits. FCC rules require professional installation of these antennas in such a way that the general public will not be closer than 20 cm from the radiating aperture of any of these antennas. End users of these systems must also be informed that RF exposure limits may be exceeded if personnel come closer than 20 cm to the apertures of any of these antennas.</i>
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Declaration of Conformity



Warning! The RLAN transceiver within this device uses a band of frequencies that are not completely harmonized within the European Community. Before using, please read the European Operation Section of the Products User's Guide for limitations.

0889 is the identification number of RADIO FREQUENCY INVESTIGATION LTD - Ewhurst Park, Ramsdell RG26 5RQ Basingstoke, United Kingdom – the Notified Body having performed part or all of the conformity assessment on the product.

The WIT2410 to which this declaration relates is in conformity with the essential requirements of the R&TTE directive 1999/5/EC and complies with the following standards and/or other normative documents:

For Interfaces

EN 55022
EN 55024

For RLAN Transceiver

EN 300 328
EN 301 489 -1, -17
EN 60950

Use Within the European Union

The WIT2410 is intended for use within the European Community States and in the following non-European Union States: Norway & Switzerland

Use of the WIT2410 in France

When used in France, the WIT2410 can only be operated with the France hopping pattern selected. This is accomplished by setting the **pe** parameter to 1. Refer to *European Union Settings* in this manual for details.

Canadian Department of Communications Industry Canada (IC) Notice

Canadian Department of Communications Industry Canada (IC) Notice

This apparatus complies with Health Canada's Safety Code 6 / IC RSS 102.

"To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding.

Equipment (or its transmit antenna) that is installed outdoors may be subject to licensing."

ICES-003

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par Industrie Canada.

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Overview

Introduction

The HopNet 10 Series family of products provides reliable wireless connectivity for either point-to-point or point-to-multipoint applications. The HopNet products are built around the WIT2410 radio transceiver, which employs frequency hopping spread spectrum technology. This technology ensures:

- Maximum resistance to noise
- Maximum resistance to multipath fading
- Robustness in the presence of interfering signals

HopNet Products

The HopNet family of products is built with rugged enclosures compliant with IP 66 and NEMA 4X standards for outdoor and harsh industrial environments. All Hopnet products work with each other and can be mixed and matched in a single network. All HopNet Products are WIT2410 compatible and can be used with the WIT2410 OEM based products as well as with the SNAP2410 10Base T access point. The HopNet family consists of the following products:

External Antenna

HN-210X Base/Remote Unit
HN-510 Indoor Base/Remote Station
HN-1010 Outdoor Base/Remote Station
HN-1510 Indoor Base/Remote Station
HN-2010 Repeater

Built-In Antenna

HN-210 Base/Remote Unit
HN-3010 Base/Remote Unit

Accessories

Antennas
Adapter
Power Supplies

Design Features

The HopNet modems have many advanced features:

- Employ frequency hopping technology with up to 75 channels in the 2401 to 2475 MHz frequency range

-
- Support RS-232 and RS 485 interfaces (HN-210 and HN-510 are RS-232 only)
 - Support digital addressing for up to 64 networks, with 62 remotes per network.
 - Use transparent ARQ protocol
 - Use same hardware for all supported data rates
 - Supports up to 230 Kbps asynchronous data rates
 - Full Duplex
 - Stores setup configuration in nonvolatile memory (FLASH)
 - Provide fast acquisition – less than 2 seconds is the typical time to acquire hopping pattern
 - Use smart power management features

Glossary of Terms

Refer to the following list of terms that may be unfamiliar to you. These terms are used throughout this document.

Term	Definition
ARQ	Automatic Repeat Request. The operation in which the radio will re-send the data until it is received correctly.
bps	Bits-per-second. A measure of information transfer rate of digital data across a channel.
Decibel	A measure of the ratio between two signal levels. Used to express either loss or gain.
dBi	Decibels referenced to an ideal isotropic radiator in free space. Used to express antenna gain.
dBm	Decibels referenced to 1 milliwatt. An absolute unit used to measure signal power. Transmitter power output or received signal strength.
DCE	Data Communications Equipment. A device that receives data in the form of digital signals at its input. The modem side of a computer-to-modem connection.
DCD	Data Carrier Detect.
DTE	Data Terminal Equipment. A device that provides data in the form of digital signals at its output. The computer side of a computer-to-modem connection.
EIRP	Effective Isotropic Radiated Power.
ISM	Industrial, Scientific, or Medical band operating at 2.4 GHz. Allows use of a radio without a license, but the equipment must be immune to interference from other users in the band and approved for use in the intended country.
Latency	The delay between when data is received on TX until it is output on RX.
RMA	Return Material Authorization.
RTU	Remote Terminal Unit. A device used in data collection.
TDMA	Time Division Multi Access. A time slot multiplexing protocol for multinode networking.

About HopNet Products

Introduction

This section provides operational information about the HopNet products.

Operating Frequency

The HopNet family operates in the 2.4 GHz ISM band that allows for license-free use and worldwide compliance.

HopNet Frequency Hopping Spread Spectrum Advantages

In the frequency domain, a multipath fade can be described as a frequency selective notch that shifts in location and depth over time. Multipath fades typically occupy five percent of the band. A conventional radio system typically has a five percent chance of signal impairment at any given time due to multipath fading.

Frequency Hopping Spread Spectrum reduces the vulnerability of a radio system to interference from jammers and multipath fading by distributing or spreading the signal over a larger region of the frequency band.

The fade resistant, HopNet frequency-hopping technology employs up to 75 channels and switches channels over 100 times a second to achieve high reliability throughput.

HopNet Data Integrity

An on-board 3 KB buffer and error correcting over-the-air protocol ensure data integrity even in the presence of weak signals or jammers. The serial interface handles both data and control of asynchronous data rates of up to 230 Kbps.

Flexible Power Management

You can set the transmit power at 10 milliwatts or 100 milliwatts. Reduced power can reduce the size of the coverage zone, which may be desirable for multiple network indoor applications. You can also place the transceiver module in a power-save mode, which enables smart power management. Smart power management allows a remote unit to drop into a lower current standby mode during transmission or receiving gaps.

This feature also allows Hopnet products to be used in various countries where the output power requirements may vary due to regulation.

HN-1010 Outdoor Base/Remote Station

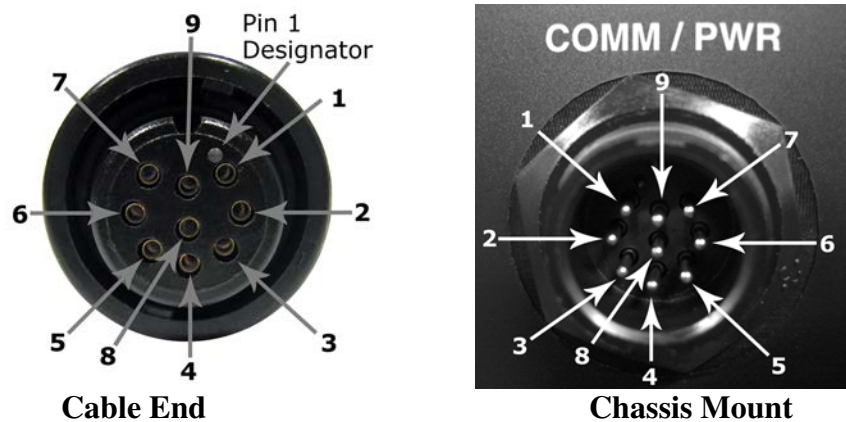
Introduction

The HopNet Outdoor Base/Remote Station (HN-1010) features a low-cost, rugged, compact, NEMA 4X/IP 66 enclosure for outdoor or harsh industrial environments. You can use the HN-1010 with all HopNet products and with any existing WIT2410 network.

Data Transmission

The HN-1010 supports up to 62 remotes on a single network. You can operate 16 different networks in the same area without conflicts. The HN-1010 can easily transmit over 1.0 mile line of sight. You can extend this range by adding a HopNet Repeater (HN-2010) or by using gain antennas.

Automatic repeat requests (ARQ) and acknowledgments inside the radio are transparent to the user equipment. User data rates of 230 Kbps are supported with built-in CRC/ARQ error protocols. See below for jumper settings. The HN-3500 adapter can be used to adapt RS-232 signals to RS-485 in situations where long data cable runs are required. The HN-1010 uses a 9-pin Conxall weatherproof connector for power, data, and control signals. See the illustration below of the 9-pin Conxall connector.



1 TXD+	4 RXD	7 DCD
2 TXD-	5 CTS	8 VCC
3 RXD+	6 DTR	9 GND

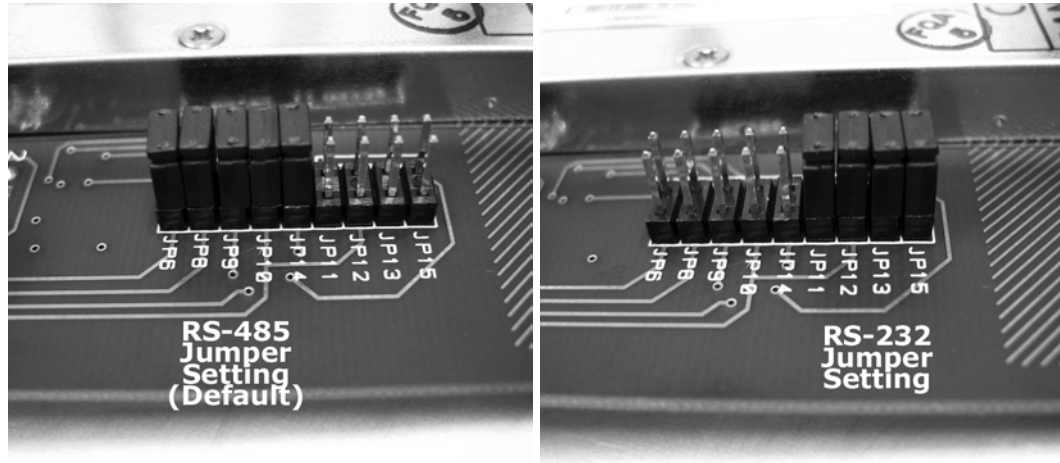
RS-485 Hybrid Pinout

Data throughput is RS-485 Hybrid or RS-232 while flow control signals are single-ended RS-232. Factory default is RS-485 Hybrid. RS-232 is selectable through internal user configurable jumpers.

Jumper Settings

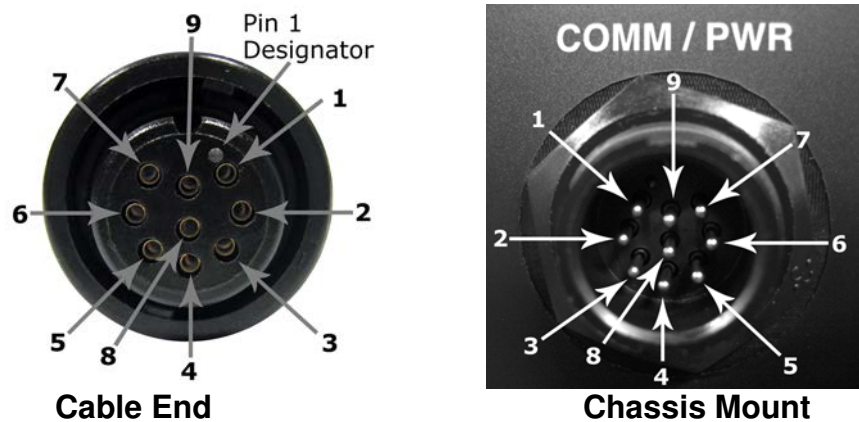
The HN-1010 is shipped from the factory as an RS-485 Hybrid device with jumpers pre-installed on pins JP6, JP8, JP9, JP10 and JP14. To change the interface to the RS-232 option the following tasks must be performed:

- Remove Top cover.
- Remove jumpers from JP6, JP8, JP9, JP10 and JP14.
- Re-install jumpers on pins J11, J12, J13 and J15 only.
- Replace top cover.



RS-485/RS-232 Jumper Configurations for the HN-1010

The RS-232 option allows the HN-1010 to operate as a true RS-232 device, here is the illustration of the 9-pin Conxall connector in RS-232 option.



1 TXD	4 DSR	7 DCD
2 RTS	5 CTS	8 VCC
3 RXD	6 DTR	9 GND

RS-232 Pinout

Power Connection

You can operate the HN-1010 from any well-filtered 7.5 to 24 VDC power source. The power supply should be capable of providing 750 mA peak current. Power connects through the 9-pin connector. A polyfuse on the transceiver board protects against short circuits.

Antenna Connection

The RF signal is brought in on a standard female TNC jack connector located on the front panel. Use the following guidelines when installing the antenna:

- Be sure to strictly follow the antenna manufacturer's installation instructions for proper operation of the antenna.
- Be sure that you use the proper polarization for a gain type antenna. If you orient the antenna with wrong polarization, a signal reduction of greater than 20 dB could result.
- Use a low-loss RF feedline between the antenna and the HN-1010. Make the feedline as short as possible to keep signal loss to a minimum.
- When installing the feedline, do not twist, stretch, or kink the cable.
- Be sure to securely fasten the cable and only use connectors that have been recommended by the cable manufacturer.

Technical Specifications

Refer to the following table for the technical specifications for the HN-1010.

General

Specification	Value
Frequency Band	<ul style="list-style-type: none">• 2401-2475 MHz (USA)• 2448-2478 MHz (France)• 2448-2473 MHz (Spain)• 2473-2495 MHz (Japan)• 2452-2478 MHz (Canada)
Number of Channels	<ul style="list-style-type: none">• 75 US; 25 France, Spain, Japan & Canada
Approvals	<ul style="list-style-type: none">• US FCC: Part 15. 203• European Community: ETS 300.328 Compliance
Data Rate	<ul style="list-style-type: none">• Up to 230 Kbps Async Throughput
RF Channel Data Rate	<ul style="list-style-type: none">• 460 Kbps
Serial Data Interface	<ul style="list-style-type: none">• RS-232 / RS-485 Async
Network Protocol	<ul style="list-style-type: none">• ARQ: Elastic TDMA (E/TDMA)
Connector	<ul style="list-style-type: none">• 9-pin Conxall 4282-9PG-300
Mating Connector	<ul style="list-style-type: none">• 3282-9SG-Sxx
TX Power Output	<ul style="list-style-type: none">• +18 dBm
Receive Sensitivity	<ul style="list-style-type: none">• -93 dBm
RF Bandwidth	<ul style="list-style-type: none">• 750 KHz
Modulation Type	<ul style="list-style-type: none">• GMSK
Output Impedance	<ul style="list-style-type: none">• 50 Ω
Input Power at Connector	<ul style="list-style-type: none">• 9 VDC Nominal• 7.5-24 VDC Operating• 160 mA Typical (750 mA surge) Remote

Mechanical

Specification	Value
Case	<ul style="list-style-type: none">• NEMA 4X Standards, IP66
Antenna Connector	<ul style="list-style-type: none">• TNC RF
Size	<ul style="list-style-type: none">• 5.6 in. x 2.09 in. x 8.39 in.• 142mm x 53mm x 213mm
Weight	<ul style="list-style-type: none">• 1.8 lb• 816.5 g

Environmental

Specification	Value
Temperature	<ul style="list-style-type: none">• -30° to 70° C
Humidity	<ul style="list-style-type: none">• 95% at + 40°C, Non-condensing

HN-1510 Outdoor Base/Remote Station

Introduction

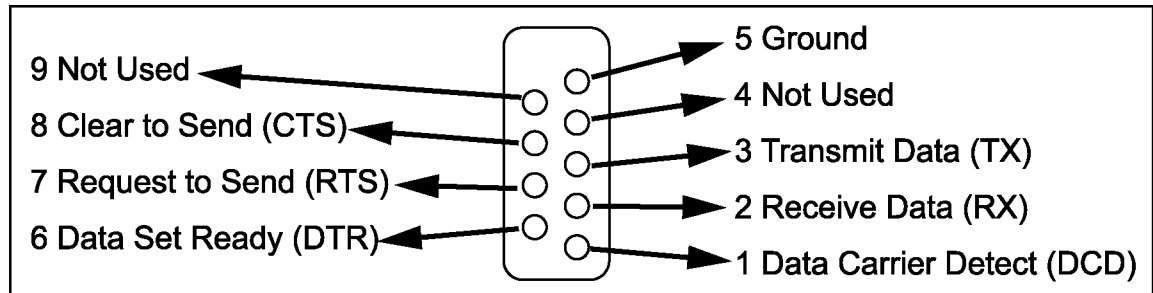
The HopNet Indoor Base/Remote Station (HN-1510) features a rugged, compact, enclosure for indoor or harsh industrial environments.

Data Transmission

The HN-1510 supports up to 62 remotes on a single network, with up to 16 different networks in the same area. The HN-1510 can usually transmit over a range of 300 to 1000 feet indoors with obstructions. You can extend this range by adding a HopNet Repeater (HN-2010) or using gain antennas.

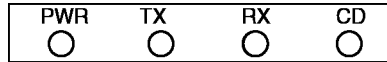
The automatic repeat requests (ARQ) and multinode protocol are transparent to the user equipment. User data rates of 230 Kbps are supported with built-in CRC/ARQ error protocols. Data signals are EIA RS-232 standard for Data Communications Equipment (DCE) devices.

Data and control of the radio are passed through a standard DB9 connector. See the following illustration for the signal description.



LED Status

Four LED indicators are included on the front panel to provide the status of the HN-1510 Indoor Base/Remote station. See the illustration below. These built-in flow control indicators allow you to quickly check the operational status.



The table below describes the function of each LED.

Name	Color	Description
PWR	Green	Continuous DC power is applied
TX	Red	RS-232 signal input
RX	Red	RS-232 signal output
CD	Red	Normal operation is asserted

Power Connection

The HN-1510 is supplied with a 110/ 220 wall mount power supply. However, you can operate the HN-1510 from any well-filtered 7.5 to 24 VDC power source. The power supply should be capable of providing 500 milliamperes of current.

The indoor base station uses a separate 2-pin power connector that accepts 7.5 to 24 VDC. Power connects to the 2-pin connector on the front panel of the transceiver. A polyfuse is on the transceiver board to protect against short circuits.

Antenna Connection

The RF signal is brought in on a standard female TNC jack connector located on the front panel.

Use the following guidelines when installing the antenna:

- Strictly follow the antenna manufacturer's installation instructions for proper operation of the antenna.
- Be sure to use proper polarization for any system using a gain type antenna. If you orient the antenna with the wrong polarization, a signal reduction of greater than 20 dB could result.
- Use a low-loss feedline with the HN-1510. Keep the feedline as short as possible to minimize signal loss.
- Use proper care when installing the feedline to prevent damage. Do not twist, stretch, or kink the cable.
- Be sure to securely fasten the cable and only use connectors that have been recommended by the cable manufacturer.

Technical Specifications

Refer to the following table for the technical specifications for the HN-1510.

General

Specification	Value
Frequency Band	<ul style="list-style-type: none">• 2401-2475 MHz (USA)• 2448-2478 MHz (France)• 2448-2473 MHz (Spain)• 2473-2495 MHz (Japan)• 2452-2478 MHz (Canada)
Number of Channels	<ul style="list-style-type: none">• 75 US; 25 France, Spain, Japan, Canada
Approvals	<ul style="list-style-type: none">• US FCC: Part 15. 203• European Community: ETS 300.328 Compliance• CE Marked
Data Rate	<ul style="list-style-type: none">• Up to 230 Kbps Async Throughput
Channel Data Rate	<ul style="list-style-type: none">• 460 Kbps
Serial Data Interface	<ul style="list-style-type: none">• RS-232 Async
Network Protocol	<ul style="list-style-type: none">• ARQ: E/TDMA
TX Power Output	<ul style="list-style-type: none">• + 18 dBm
Receive Sensitivity	<ul style="list-style-type: none">• -93 dBm
RF Bandwidth	<ul style="list-style-type: none">• 750 KHz
Modulation Type	<ul style="list-style-type: none">• GMSK
Output Impedance	<ul style="list-style-type: none">• 50 Ω
Antenna Connector	<ul style="list-style-type: none">• TNC RF Jack
Input Power at Connector	<ul style="list-style-type: none">• 9 VDC Nominal• 7.5-24 VDC Operating• 160 mA Typical (750 mA surge)

Mechanical

Specification	Value
Case	<ul style="list-style-type: none">Aluminum
Size	<ul style="list-style-type: none">7.9 in. x 5.7 in. x 2 in.201mm x 145mm x 51mm
Weight	<ul style="list-style-type: none">1.6 lb726 g
Data Connector	<ul style="list-style-type: none">DB-9 Receptacle
2-pin Power Connector	<ul style="list-style-type: none">Conxall 1728822PG-300
Mating Connector	<ul style="list-style-type: none">Conxall 16282-2SG-3xx

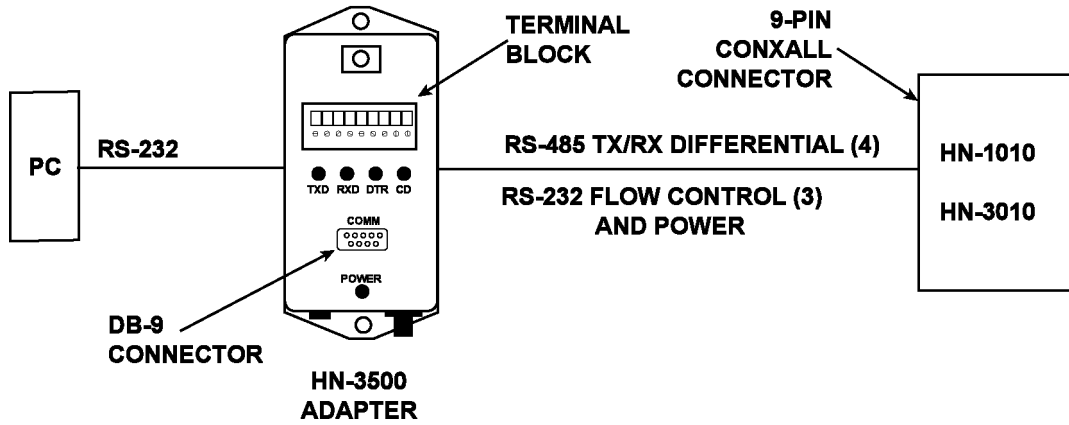
Environmental

Specification	Value
Temperature Range	<ul style="list-style-type: none">-30° to 70° C
Humidity	<ul style="list-style-type: none">95% at +40°C, Non-condensing

HN-3500 Adapter

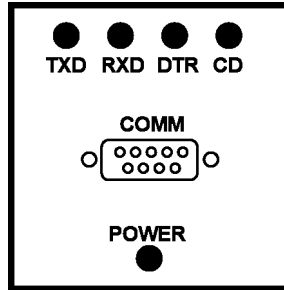
Introduction

The HN-1010 and HN-3010 can be used with an RS-232 to RS-485 adapter (the HN-3500). The HN-3500 enables you to configure the HN-1010 and HN-3010 for RS-485 operation yet drive them from an RS-232 controller. The adapter housing is designed for an indoor environment.



Flow Control Indicators

The HN-3500 has flow control indicators for testing and as a way to quickly check the operation of the adapter. Refer to the illustration below.

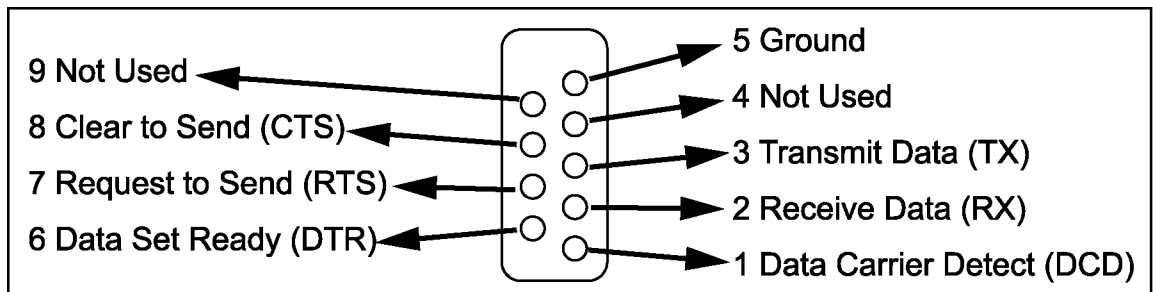


The table below describes the function of each LED.

Name	Color	Description
TXD	Red	Transmit Data
RXD	Red	Receive Data
DTR	Red	Data Terminal Ready
CD	Red	Carrier Detect
PWR	Green	Continuous DC power is applied

DB-9 Connector

The HN-3500 is equipped with a DB-9 connector to link the RS-232 interface to a terminal block for the RS-485 interface. See the following illustration for the signal description.

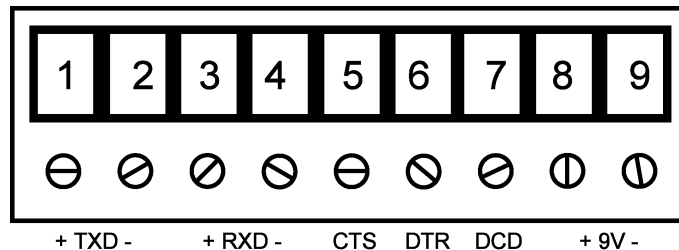


Terminal Block

The terminal block on the connector converts RX and TX RS-232 signals into RS-485 differential. The terminal block also passes the following signals to the HN-1010 and HN-3010:

- CTS
- DTR
- DCD
- 9 VDC

See the illustration below of the terminal block.



Power Supply

Introduction

The HN-3500 provides the power necessary to operate the HopNet products. This power supply can also power the HN-2010. The power supply is designed for an indoor environment. The part number for this power supply is A-3200-1000.

AC to DC Conversion

The external power supply connects to a 2-pin Conxall connector on the HN-3500 adapter. The adapter converts 115 AC to +9 VDC.

Alternate Power Sources

Any filtered 9v to 24 VDC supply can be used to power HopNet products directly. Solar panels may be used provided they are capable of providing sufficient power. Configuring the Network

Overview

Introduction

You can configure the HopNet network using a PC and the WinCom 24 software provided by Murata, Inc. WinCom24 is a software package that runs under Windows 95/98/NT/2000/XP. This chapter provides the information you need to configure your network.

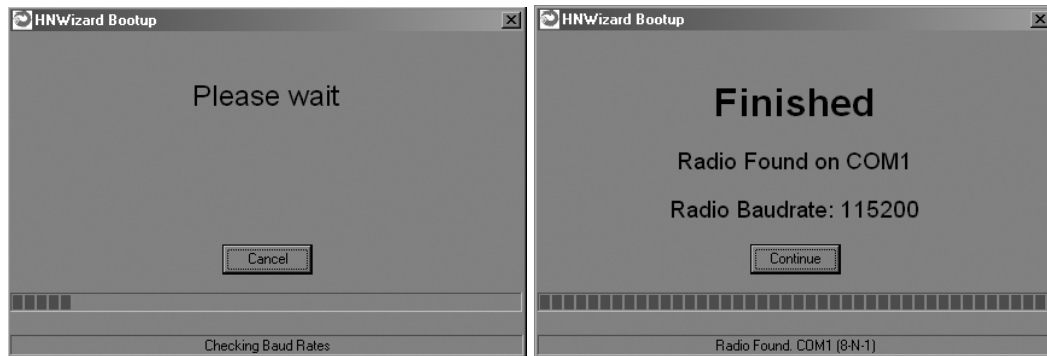
Five Command Types

The WinCom24 software enables you to configure five types of commands:

- Serial Interface Commands
- Network Commands
- Protocol Commands
- Status Commands
- Memory Commands

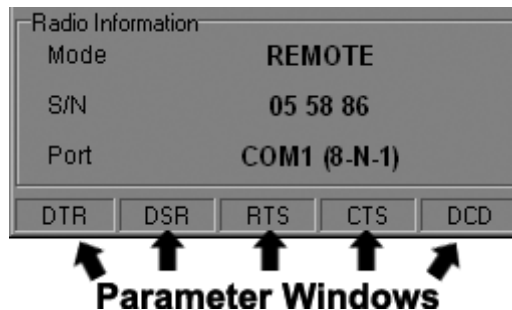
HopNet Configuration Wizard (5.0 or later)

If you haven't already installed the Wizard program, refer to the *Getting Started* section of this manual for instructions. Open the Wizard by double-clicking on the icon on the desktop. When the Wizard boots up, it will automatically detect the serial port to which the HopNet radio is connected and its baud rate. This process takes a few seconds to complete. During this process, the "Please wait" screen is displayed. Once the radio has been found and the Baudrate determined, the "Finished" screen is displayed. Click on the Continue button to enter the Wizard.



NOTE: The HopNet configuration Wizard is used with a variety of Murata radios. Not all radios support all the functions and features of every Murata radio. Thus, some selections in the Wizard will be grayed out if they are not applicable to the radio in use.

After detecting the serial port and baud rate of the HopNet radio, the Wizard reads the settings of the HopNet radio that is connected to the PC and will display them in the various parameter windows. In the bottom left corner of the Wizard window, the Base/Remote status, the serial number and the communication port are always displayed.



NOTE: The S/N displayed in the bottom left corner is the serial number of the radio inside the unit and is different from the serial number of the HopNet unit. Both the HopNet unit serial number and the radio serial number are on the radio unit of the HopNet product. The Wizard will also prompt to save the configuration settings to a file.

When a parameter value is changed from the value currently in the HopNet radio, the parameter label and value will turn red and the Apply Settings button will appear. When the value is changed back to the value that is currently in the attached HopNet radio, the label and parameter value will return back to black. When new values are applied to the HopNet radio, the red values will turn black indicating the updated values in the radio.

NOTE: The changes are not sent to the HopNet radio until the Apply Settings button is clicked.

Context sensitive help is available through the F1 key or Help menu.

About the INIT.INI File

One of the files unpacked with the program is the INIT.INI file. It contains the entries below and an explanation has been included on how each parameter may be used.

ErrorLevel=0

Leave this value as is. Only change it at the request of Murata Tech Support.

BiDirectionalHigh=55

BiDirectionalMedium=40

ReceiveHigh=55

ReceiveMedium=40

These parameters change the color levels (in percent) on the RF Tools bar graphs/pie charts.

RFToolsInterval=1000

This parameter sets the how often bar graphs / pie charts will update (in msec)

RSSIMarginal=-60

RSSIPoor=-80

These parameters set the levels (in dBm) of color the bars on the RSSI bar chart will display. Above the level set by **RSSIMarginal**, the bars will be green in color. Between the levels set by **RSSIMarginal** and **RSSIPoor**, the bars will be yellow in color and below the level set by **RSSIPoor**, the bars will be red in color.

FullShow=0, 1, 2

This changes the number of options that are viewable

0 (default) = Shows minimum amount of options.

1 = Adds all other options.

2 = Adds WinCom.

AutoDetect=1

1 = Auto-detects radio,

0 = User-defined inputs

The parameters below should not be changed as they are specific to different radios. These parameters will come from the factory set for your radio.

-40dBm=125

-95dBm=55