muRata
INNOVATOR IN ELECTRONICS

SNAP 2410/X/D/DX

Spread Spectrum Network Access Point

Installation Guide

Revision History

Revision	Date	Author	Change Description
1	2005	F. Perkins	Initial issue
2	01/16/2017	R. Willett	Reformatted for neww Murata V.I. and updated Copyright

Important Regulatory Information

Cirronet 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:

Andrews 24dBi parabolic dish *Andrews 18dBi parabolic dish* *Cushcraft 15dBi Yagi,* *Mobile Mark 14dBi Corner Reflector,* *Mobile Mark 9dBi Corner Reflector*	*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.*

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

Mobile Mark 12dBi omni-directional, *Mobile Mark 9dBi omni-directional,* *MaxRad 5dBi whip,* *Murata Patch antenna,* *Ace 2dBi dipole,* *Mobile Mark 2dBi Stub*	*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.*

Declaration of Conformity

CE 0889 ⓘ

ⓘ 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	**For RLAN Transceiver**
EN 55022	EN 300 328
EN 55024	EN 301 489 -1, -17
	EN 60950

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.

WARNING!!

For our Customers who wish to use this product in hazardous locations.

This SNAP2410 has been tested by Underwriters Laboratories Inc. for use in Class I, Division 2, Groups A, B, C, and D Hazardous Locations as specified in UL1604 and UL/C-UL/Zones(UL2279).

Such areas ***may*** **have Explosive Gases**.

To install this radio in this environment the following steps **must** be implemented.

1) The power supply used with the product **must** be a UL Class 2 rated device.

2) Contract a Qualified Licensed Electrician to install and run the power wiring from a screw type, hard wired 12 VDC 1A Class 2 Output power supply in a UL Listed Box and route a conduit to the radio which **must** be installed in a UL Listed Box suitable for the environment. The conduit **must** be gas tight so no gases can flow through conduit.

3) Any Murata products with outdoor radio transceivers (tower mounted) marked for Hazardous Locations **must** have the interconnecting multi-conductor cable run in approved conduit for the location. The cable **must** be in the conduit until out of the Hazardous Location and the conduit **must** be gas tight so no gases can flow through conduit.

4) Do **NOT** remove the power connector to the device while circuit is live. Disconnect power only while circuit is dead, or the location is known to be non-hazardous. Failure to do so, may result in a "**Risk of Fire or Explosion"**

Only then is the unit suitable for a hazardous location.

For more information on Hazardous Locations contact UL and ask for UL1604 requirements. www.ul.com

RF Exposure

WARNING: End Users of these systems must be informed that RF exposure limits may be exceeded if personnel come closer than 45 cm to the antenna aperture when exceeding 9 dBi of gain in conjunction with the transceiver.

Repairs

Murata does not recommend field repairs of the radio equipment. Surface Mount Technology (SMT) has been used in the production of the transceiver module, which requires specialized training and equipment for proper servicing. The equipment should be returned to the factory for any repair.

Table of Contents

INTRODUCTION

The SNAP2410 from Murata provides Ethernet connectivity to networks of WIT2410 serial radios. Built around the WIT2410, the SNAP2410 provides a 10/100BaseT connection to Ethernet networks and functions as base stations for remote devices containing WIT2410 transceivers. The SNAP2410 allows non-Ethernet serial devices to appear as Ethernet devices to network-based applications.

Each SNAP2410 can support 60 simultaneous remotes. Each remote radio has a unique ID number, so the number of remotes that can communicate with a SNAP is unlimited, subject to a limit of 60 remotes at any one time.

The communication between the SNAP and the WIT2410 remotes is performed using the WIT2410 over-the-air protocol. Thus the SNAP products are 802.3 compatible but not 802.11b compatible. By using the 460Kbps over-the-air data rate and the WIT2410 protocol, the full range of WIT2410 radios is realized, three times the range of most 802.11b products.

The SNAPs enjoy the same benefits of frequency-hopping spread spectrum technology that the WIT2410s do. Namely, the immunity to multipath fading and resistance to jamming that is provided by changing frequency every few milliseconds. Operating in the 2.4GHz ISM band, SNAPs can be used license-free.

The SNAP has three modes of operation, TCP/IP, UDP and PPP. The default mode is the TCP/IP mode. In TCP/IP mode, the SNAP acts like any other network access point as either a client or server device. This allows standard WinSocket® routines to be utilized. Remote devices are setup to be identified by either an IP address or by a port number under the IP address of the SNAP. The remote devices send and receive unformatted data to and from the SNAP which performs the encapsulation and de-encapsulation of the unformatted data into and out of Ethernet datagrams.

The UDP mode is similar to the TCP/IP mode with remotes operating as clients. This mode supports the connection-less UDP protocol.

The PPP mode is intended for applications where the remote device is equipped with a PPP client. In these applications, the SNAP functions as a PPP host providing Internet Access to the remote devices.

GETTING STARTED

The SNAP2410 is easy to install and operate. In most instances, the only installation steps will be setting IP addresses and connecting the antenna, power and Ethernet cable.

Setting up a SNAP2410 requires the following steps:

- Enter an IP address into the SNAP
- Configure the SNAP to act as a client to a server-based application or to act as a server to a client workstation.
- Set remote WIT2410 devices to be identified to the application as individual IP addresses or port numbers.

The default settings in the SNAP are sufficient to allow connection to Ethernet networks and to have remote WIT2410 devices connect with the SNAP. Other steps you may want to take include:

- Enter a default route IP address if data is to be sent off the SNAP's subnetwork (See *Ethernet Commands*)
- Change the network number (*See Radio Commands)*

Instructions on setting up the SNAP are detailed in the *Configuring the SNAP* section of this manual. Details on the various operating modes and configurations can be found the *SNAP Operation* section.

SNAP2410

Figures 1 and 2 identify the various connectors and indicators of the SNAP2410.

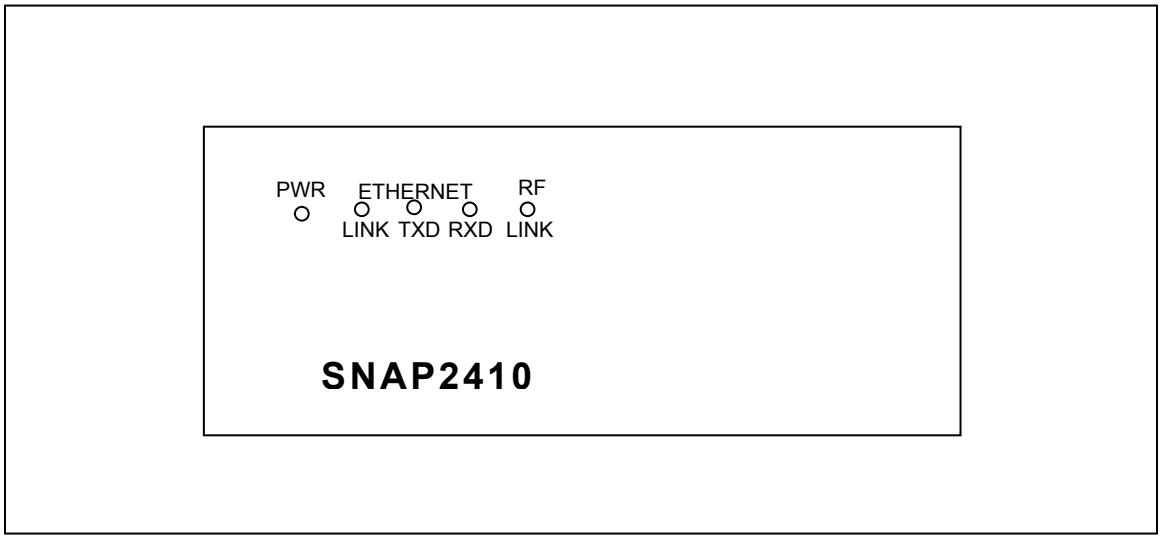


Figure 1. SNAP2410 Front Panel Diagram

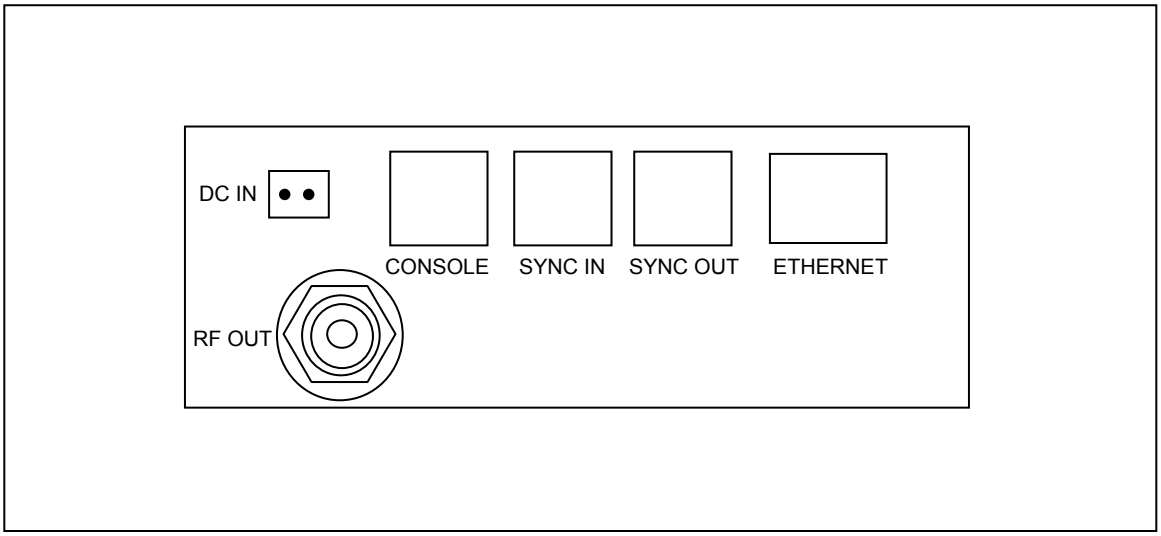


Figure 2. SNAP2410 Rear Panel Diagram

The antenna connector is a reverse polarity TNC type connector. An antenna may be connected directly to this connector. Alternatively, an antenna may be located away from the SNAP using RF cable to connect the SNAP to the antenna. Murata does not recommend using RF cables longer than 5 feet. If more distance is required between the SNAP and the antenna Murata recommends using the SNAP2410X. If the SNAP2410X is not used, high-quality, low-loss RF feed line must be used.

The 10/100BaseT Ethernet connector is the standard RJ-45 connector. The connector is wired to be able to connect directly to an Ethernet hub using a cross-over cable. If it is desired to connect the SNAP directly to a PC without a hub, the SNAP must be connected with a straight through cable. (Both cables are provided.)

The synchronizing signals are provided for special applications where multiple master SNAPs are employed. The synchronizing signals are RS-485 levels and may be connected using an RJ-11 connector. SNAPs will automatically determine which SNAP will generate the sync signal. See the section *Synchronization* for details. In most instances the synchronizing signals are not required and may be left unconnected.

The power connector is a 2-pin DIN type connector. The provided AC adapter provides a 12 volt power level to the SNAP. The SNAP can accept DC voltages ranging between 9VDC and 26VDC if alternative power supplies are to be used.

The Configuration Port is an RS-232 serial port that may be used to configure the SNAP. This is useful when the default IP address of the SNAP cannot be used with the existing network preventing configuration through a telnet session. See the section *Configuring the SNAP* for details of using this port.

SNAP Status Indicators

The PWR indicator on the front panel indicates that power is applied to the SNAP. A flashing LED indicates the SNAP is executing the built-in memory test.

TXD and RXD are indicators of data activity. They indicate the transmission and reception of data over the Ethernet connection. Note that these LEDs can be active even when the SNAP has no remote radios registered.

The LINK indicator when illuminated indicates a good connection to the Ethernet network. If this LED is not on, it can indicate a cross-wired connection between the SNAP and the network. It may also indicate a faulty cable connection.

The RF LINK LED indicates a socket connection has been established.

The RF XCVR indicator (X version only) when illuminated, means the SNAP is communicating properly with the external radio.

SNAP2410X

Figures 3 and 4 show the various connectors and LEDs of the SNAP2410X. Figure 5 illustrates the remote radio assembly. Connection between the SNAP2410X enclosure and the remote radio assembly is made through the 15-pin remote radio connector on the front of the SNAP2410X. Digital signals, rather than RF signals are sent over the connecting cable which may be up to 300 feet in length. These cables may be ordered from Murata in lengths of 100 feet to 300 feet in 100-foot increments.

The remote radio assembly has mounting holes to secure the antenna. The antenna is attached to the remote radio through the included 24-inch RF cable. If the antenna is not to be mounted on the remote radio assembly, connection between the remote radio and the antenna must be made with high-quality , low-loss RF cable. Murata recommends limiting the length of the RF cable to 5 feet to minimize RF signal loss.

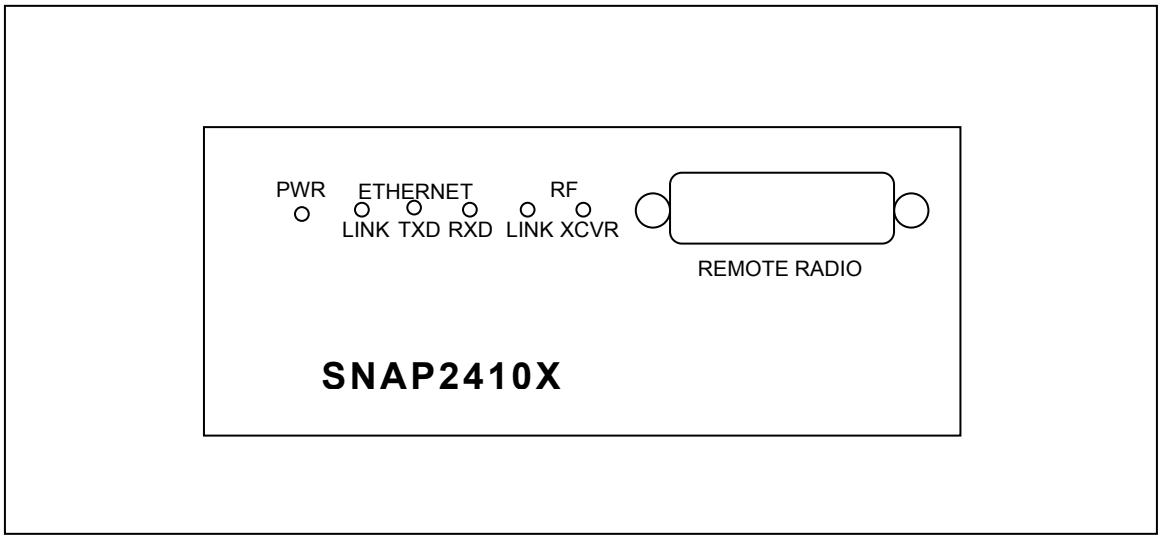


Figure 3. SNAP2410X Front Panel

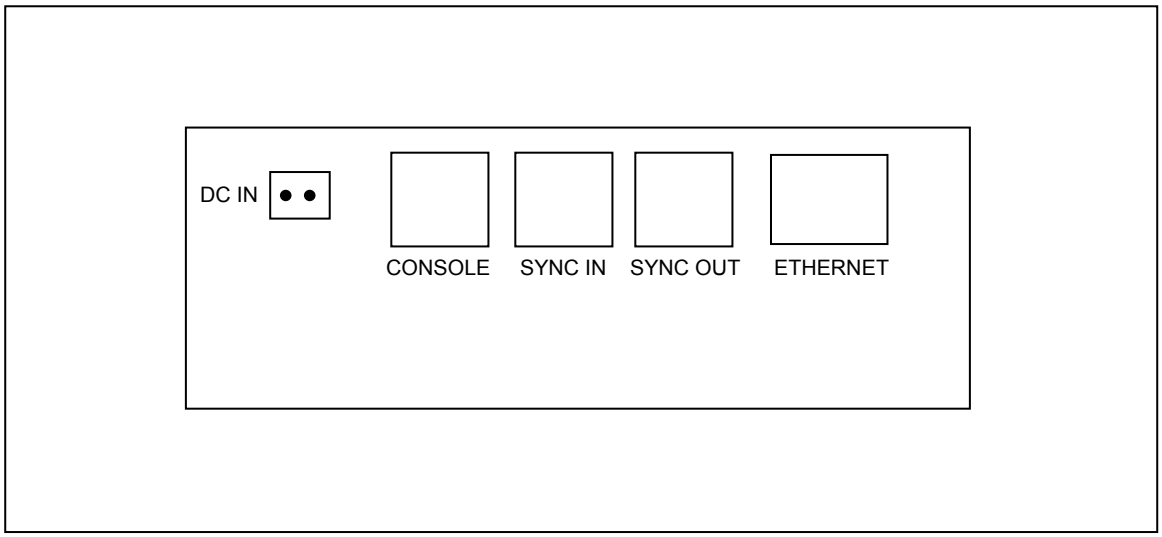


Figure 4. SNAP2410X Rear Panel

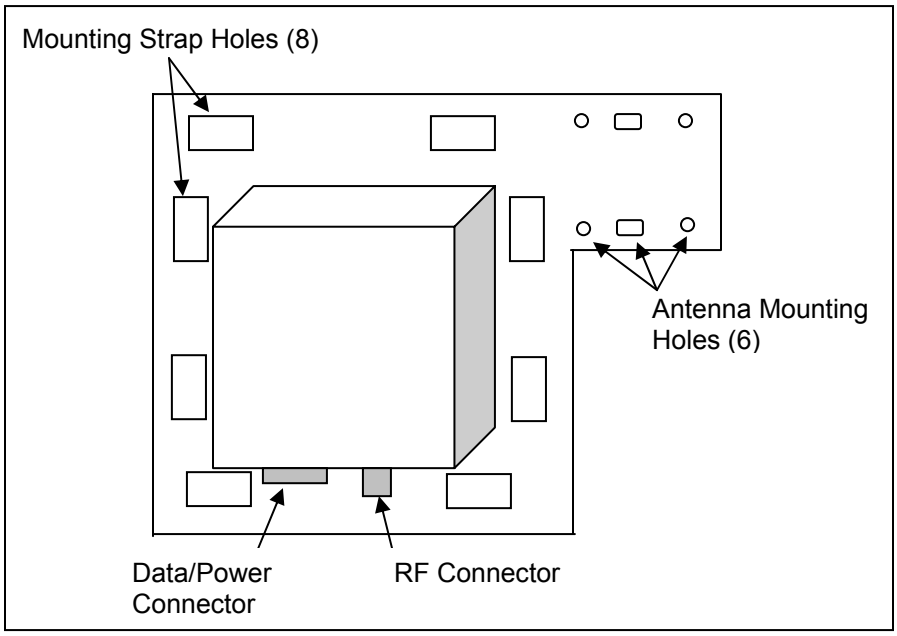


Figure 5. Remote Radio Assembly

Note that the remote radio assembly should be mounted on a tower or building top oriented as in Figure 5. It is important that the RF connector on the remote radio assembly point to the ground to avoid any issues with rain water.

Note: The SNAP2410X, it must be limited to +12-+26VDC +/-10%. Failure to meet this specification can result in damage to the remote radio assembly.

The 10/100BaseT Ethernet connector is the standard RJ-45 connector and is located on the rear of the SNAP. The SNAP is set up to use a straight through cable to connect to a PC. If a straight through cable is used to connect the SNAP to other devices through a hub, the SNAP must be connected to the uplink port on the hub.

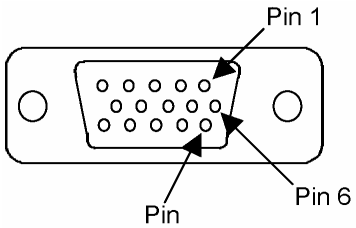
The SYNC IN and SYNC OUT signals are provided for special applications where multiple master SNAP s are co-located. The synchronizing signals are RS-485 levels and may be connected using an RJ-11 connector. SNAPs will automatically determine which SNAP will generate the sync signal. See the section *Synchronization* for details.

The Console port is an RS-232 serial port that may be used to configure the SNAP. Connection to this port is made with the 9-pin to RJ-11 serial cable included with the SNAP. This is useful when the default IP address of the SNAP cannot be used with the existing network preventing configuration through a telnet session. See the section *Configuring the SNAP* for details of using this port.

The power connector is a 2-pin DIN type connector. The provided AC adapter provides a 12 volt power level to the SNAP . The SNAP can accept DC voltages ranging between 12VDC and 26VDC if alternative power supplies are to be used.

Attaching the Data/Power Cable Connector

The figure below shows the pin numbering of the Data/Power connector. The view provided is looking into the side of the connector into which the pins will be inserted.



The cable pins are installed by choosing the appropriate conductor color and connector hole location and inserting the pin into the hole until it "clicks" into place. Verify the pin is locked into place by gently pulling on the conductor.

If a pin is installed in the wrong connector location, use the extractor tool to remove the pin. Insert the extractor tool into the connector hole such that the tool surrounds the pin. Gently push the extractor tool completely into the hole. Remove the pin by gently pulling on the conductor. If the pin does not come out easily, it is an indication the tool is not fully inserted. Do not pull on the conductor forcefully as that can pull the conductor out of the pin.

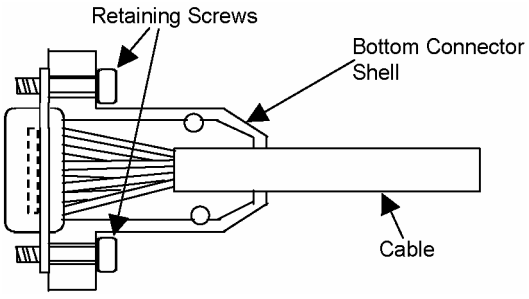
Use the following color code to insert the pins into the connector:

CONNECTOR PIN	CONDUCTOR COLOR	CONNECTOR PIN	CONDUCTOR COLOR
1	Brown	9	Green
2	Orange/Black	10	Orange
3	Black	11	Violet
4	Blue	12	Yellow
5	Tan	13	White/Black
6	Pink	14	Grey
7	White	15	White/Red
8	Red		

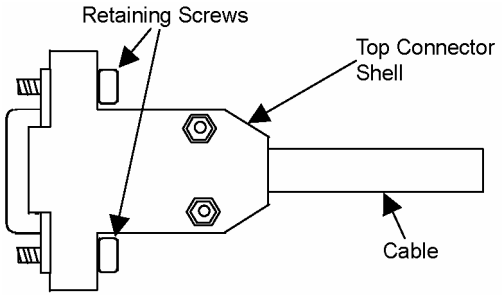
Care must be taken to follow the color code correctly. An incorrectly assembled connector can damage the radio or the card or both.

Complete the assembly by placing the connector in the slot in one of the shell halves. Install the two retaining screws on both sides of the shell and through the holes on both sides of the connector; place the other shell half over the connector so the connector lies in the shell slot. Secure the connector shell halves with the nuts and bolts provided.

Refer to the figures below.



Pinned connector in bottom connector shell



Completed connector with top connector shell attached.

SNAP2410D

Figure 6 shows the SNAP2410D with a closeup of the Status Indicators.

Figure 6. SNAP2410D

The antenna connector is a reverse polarity TNC type connector. An antenna may be connected directly to this connector. Alternatively, an antenna may be located away from the SNAP using RF cable to connect the SNAP to the antenna. Murata does not recommend using RF cables longer than 5 feet. If more distance is required between the SNAP and the antenna Murata recommends using the SNAP2410DX. If the SNAP2410DX is not used, high-quality, low-loss RF feed line must be used.

The 10/100BaseT Ethernet connector is the standard RJ-45 connector. The connector is wired to be able to connect directly to an Ethernet hub using a cross-over cable. If it is desired to connect the SNAP directly to a PC without a hub, the SNAP must be connected with a straight through cable. (Both cables are provided.)

The synchronizing signals are provided for special applications where multiple master SNAPs are employed. The synchronizing signals are RS-485 levels and may be connected using an RJ-11 connector. SNAPs will automatically determine which SNAP will generate the sync signal. See the section *Synchronization* for details. In most instances the synchronizing signals are not required and may be left unconnected.

The power connector is a 2-pin DIN type connector. The provided AC adapter provides a 12 volt power level to the SNAP. The SNAP can accept DC voltages ranging between 9VDC and 26VDC if alternative power supplies are to be used.

The Configuration Port is an RS-232 serial port that may be used to configure the SNAP. This is useful when the default IP address of the SNAP cannot be used with the existing network

preventing configuration through a telnet session. See the section *Configuring the SNAP* for details of using this port.

SNAP Status Indicators

The PWR indicator on the front panel indicates that power is applied to the SNAP. A flashing LED indicates the SNAP is executing the built-in memory test.

TXD and RXD are indicators of data activity. They indicate the transmission and reception of data over the Ethernet connection. Note that these LEDs can be active even when the SNAP has no remote radios registered.

The LINK indicator when illuminated indicates a good connection to the Ethernet network. If this LED is not on, it can indicate a cross-wired connection between the SNAP and the network. It may also indicate a faulty cable connection.

The RF LINK LED indicates a socket connection has been established.

The RF XCVR indicator (X version only) when illuminated, means the SNAP is communicating properly with the external radio.

SNAP2410DX

Figure 7 shows the SNAP2410DX and the remote radio assembly. Connection between the SNAP2410X enclosure and the remote radio assembly is made through the 15-pin remote radio connector on the front of the SNAP2410X. Digital signals, rather than RF signals are sent over the connecting cable which may be up to 300 feet in length. These cables may be ordered from Murata in lengths of 100 feet to 300 feet in 100-foot increments.

The remote radio assembly has mounting holes to secure the antenna. The antenna is attached to the remote radio through the included 24-inch RF cable. If the antenna is not to be mounted on the remote radio assembly, connection between the remote radio and the antenna must be made with high-quality , low-loss RF cable. Murata recommends limiting the length of the RF cable to 5 feet to minimize RF signal loss.

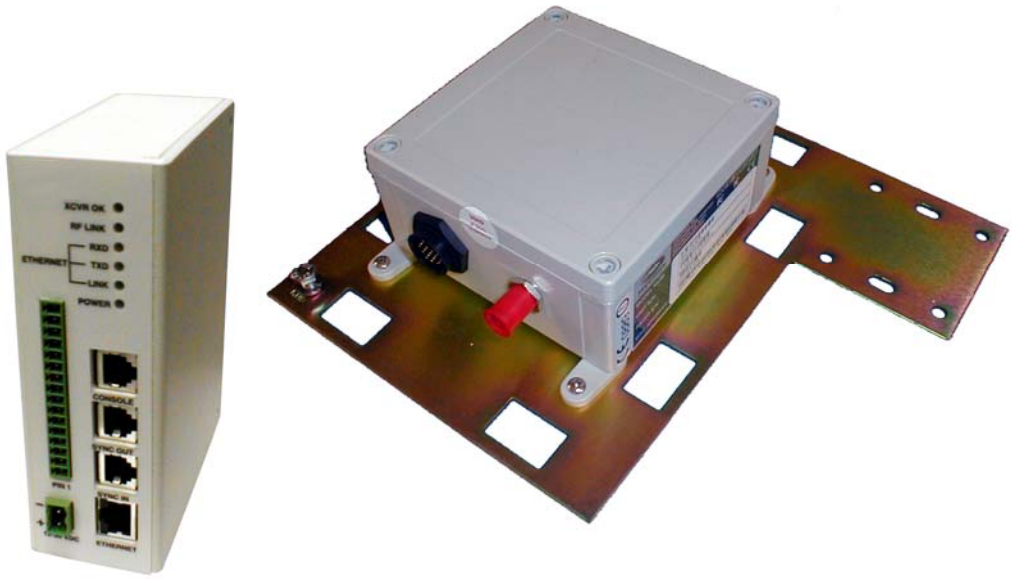


Figure 7. SNAP2410DX w/Remote Radio Assembly

Note that the remote radio assembly should be mounted on a tower or building top oriented as in Figure 5. It is important that the RF connector on the remote radio assembly point to the ground to avoid any issues with rain water.

Note: The SNAP2410X, it must be limited to +12-+26VDC +/-10%. Failure to meet this specification can result in damage to the remote radio assembly.

The 10/100BaseT Ethernet connector is the standard RJ-45 connector and is located on the rear of the SNAP. The SNAP is set up to use a straight through cable to connect to a PC. If a straight through cable is used to connect the SNAP to other devices through a hub, the SNAP must be connected to the uplink port on the hub.

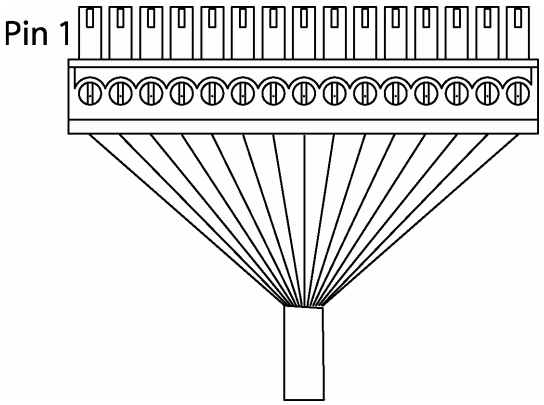
The SYNC IN and SYNC OUT signals are provided for special applications where multiple master SNAP s are co-located. The synchronizing signals are RS-485 levels and may be connected using an RJ-11 connector. SNAPs will automatically determine which SNAP will generate the sync signal. See the section *Synchronization* for details.

The Console port is an RS-232 serial port that may be used to configure the SNAP. Connection to this port is made with the 9-pin to RJ-11 serial cable included with the SNAP. This is useful when the default IP address of the SNAP cannot be used with the existing network preventing configuration through a telnet session. See the section *Configuring the SNAP* for details of using this port.

The power connector is a 2-pin DIN type connector. The provided AC adapter provides a 12 volt power level to the SNAP . The SNAP can accept DC voltages ranging between 12VDC and 26VDC if alternative power supplies are to be used.

Attaching the Data/Power Cable Connector

The figure below shows the pin numbering of the Phoenix Contact, 16 pin, 3.81mm Data/Power connector (P/N1803714). The view provided is facing the side of the connector with the screw heads showing.

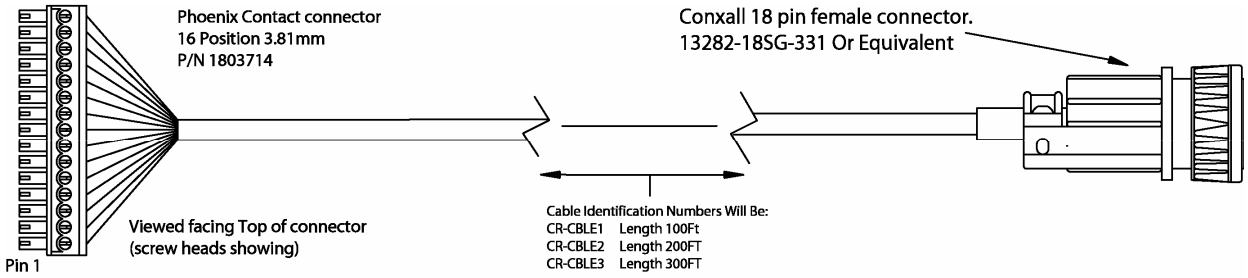


The cable comes with pins pre-crimped onto the conductors and is assembled by inserting a crimped pin into a hole location, then tightening the screw to hold the pin securely. To verify the pin is held firmly in place, gently pull on the conductor wire.

If a pin is accidentally installed in the wrong connector location, simply loosen the screw, remove the pin, re-insert it into the proper location hole and tighten the screw. Use the following color code to insert the pins into the connector:

CONNECTOR PIN	CONDUCTOR COLOR	CONNECTOR PIN	CONDUCTOR COLOR
1	Brown	9	Green
2	Orange/Black	10	Orange
3	Black	11	Violet
4	Blue	12	Yellow
5	Tan	13	White/Black
6	Pink	14	Grey
7	White	15	White/Red
8	Red		

Care must be taken to follow the color code correctly. An incorrectly assembled connector can damage the radio or the card or both. The picture below shows the completed cable assembly.



CONFIGURING THE SNAP

SNAPs are shipped from the factory with no IP address, no DNS address and no route or gateway address specified. If a BOOTP or DHCP server is not present an IP address must be assigned to the access point before connecting it to a network. To allow IP traffic to leave the particular subnet to which the access point is connected, the IP address of the gateway, bridge, router or other device that allows access outside the subnet must be entered as the routing address. If a DHCP server is present on the network, the IP, default route address and DNS server address can be set up through it. Note that while a BOOTP server can set the IP address in the SNAP, it cannot set the default router or DNS server IP addresses. See the section *BOOTP and DHCP* for details.

The network that the SNAP is connecting to must be compatible with 10/100BaseT products. Before connecting a default configured SNAP to an active network that does not have a BOOTP or DHCP server, ask the network system administrator for an IP address for the SNAP that will not cause any problems on the network.

The SNAP is shipped from the factory to try to get an IP address from a DHCP server. If a DHCP server is present, the SNAP will accept its IP address from the server and can be located on the server under the host name "Murata_AP." If a DHCP server is not to be used, the IP address must be set using the Console port.

The WinSNAP utility program is included on the CD. Alternatively, terminal programs such as HyperTerminal can be used. The settings for the serial port are 38400 baud, 8 data bits, 1 stop bit, no parity and none for handshaking. Once connection is made to the SNAP through the Console port and power is applied to the SNAP, the SNAP firmware version is displayed followed by the **`TCP>`** prompt.

To enter an IP address in the SNAP, use the **`ip`** command.

```
ip <xxx.xxx.xxx.xxx> {yyy.yyy.yyy.yyy}
```

Where x is the IP address, and y is the optional netmask number.

Once a valid IP address has been entered in the SNAP, a second method to complete the configuration of the SNAP is through a telnet session. Most telnet programs work with the SNAP. Windows has a telnet program that works with the SNAP. A telnet session can be started by clicking on Start->Run if the TCP/IP client has been installed. For a SNAP with an IP address of 192.168.0.254, enter the following information in the dialog box:

```
telnet 192.168.0.254
```

A telnet window will open up. The first line is the version of the SNAP firmware followed by the prompt:

```
TCP>
```

The SNAP commands are the same whether they are entered through the Console port or through a telnet session.

To enter the default routing address use the **`route`** command.

```
route add default <xxx.xxx.xxx.xxx> {yyy.yyy.yyy.yyy}
```

Where `x` is the IP address of the gateway device and `y` is the optional netmask number.

To configure the SNAP to operate in client mode, use the **`tcp server add`** command to enter the IP address and port number of the server to be used.

```
tcp server add <xxx.xxx.xxx.xxx> <ppppp>
```

Where xxx.xxx.xxx.xxx is the IP address of the server and ppppp is the server port number to be used.

In server mode, the SNAP uses a control port to inform the client application of remote devices as they register with and disconnect from the SNAP. The default port number for the control port is 2430. This port number can be changed using the **`tcp control`** command.

```
tcp control <1..65,536><CR>
```

Refer to the section *Server Mode* for additional details of this mode of operation.

Store the configuration parameters in non-volatile memory with the **`save`** command:

```
save<CR>
```

The SNAP will report back the time it took for the save. Reset the SNAP by typing:

```
reset<CR>
```

The SNAP can also be reset by cycling power. Whenever a reset is executed on the SNAP, the telnet session will be lost. It will take the SNAP about 30 seconds to reinitialize after a reset or after cycling power.

Note: The save and reset commands must be entered after modifying the default configuration. Failure to do so will result in the factory defaults to be used.

European Union Settings

When operating the SNAP2410 in France, a limited frequency mode must be selected. To select the limited frequency band at the SNAP > prompt enter:

```
hop set 1 <CR>
```

Save this setting by typing:

```
save<CR>
```

The limited frequency operation will take effect immediately and will be saved into memory for use when power is cycled.

European Union Use with Gain Antennas

Use of the SNAP2410 within the European Union is limited to a maximum transmit power including antenna gain of 20dBm. The antenna supplied with the SNAP2410 is a 2dBi antenna. The transmit power of the SNAP2410 in the default mode is 18dBm. Thus the supplied antenna meets the EU limit. If gain antennas are to be used, the low power setting of the SNAP2410 must be selected. This setting sets the transmit power at the antenna connector to 10dBm. In this setting a maximum of 10dB of antenna gain may be used. To select low power mode, at the command line prompt enter:

```
radio power 10<CR>
```

To save this parameter in non-volatile memory type:

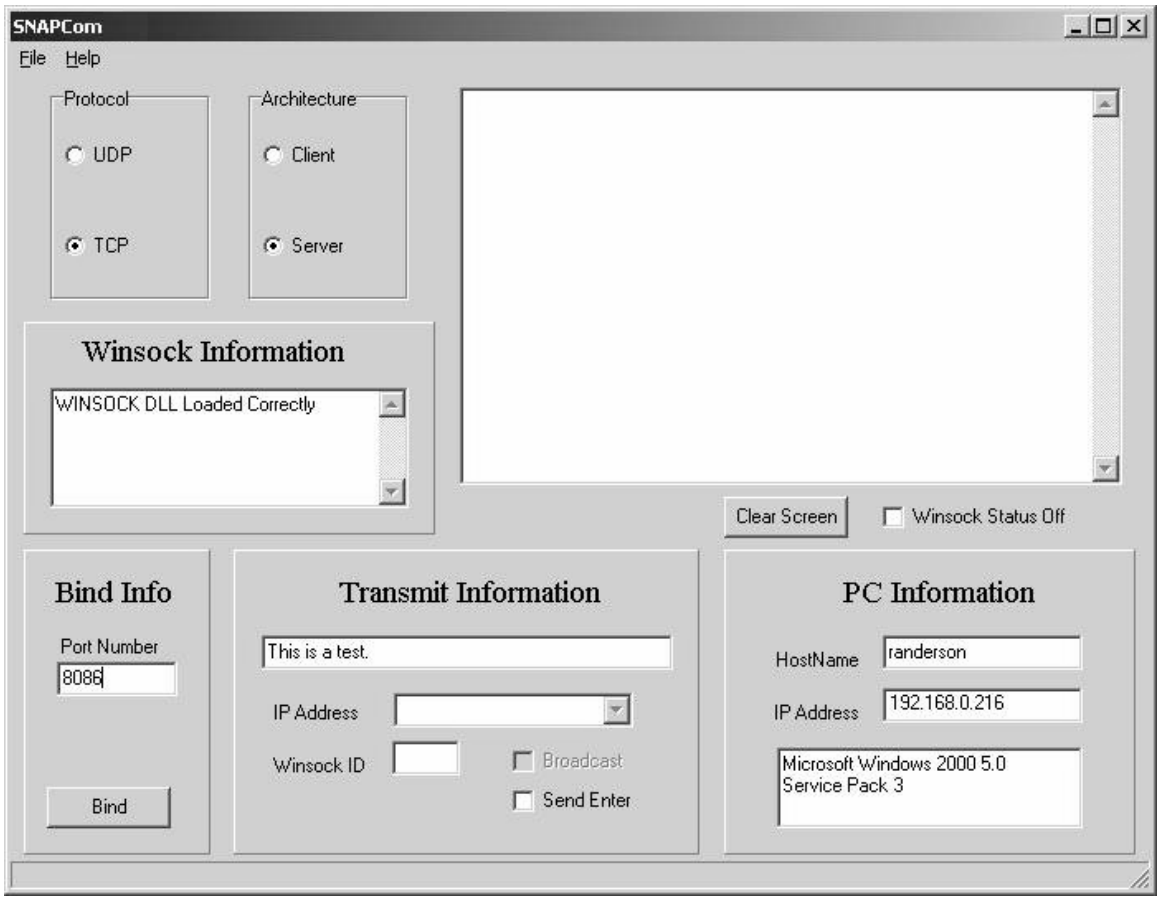
```
save<CR>
```

This parameter will take effect immediately and will be saved into memory for use when power is cycled.

SNAPCOM UTILITY

SNAPCom is a simple TCP/UDP utility program to help familiarize the user with the SNAP and its operation. SNAPCom can be executed off the CD or copied onto a PC. There is no need to install the program. SNAPCom is not a configuration utility and assumes the SNAP has previously been configured using WinSNAP and/or a telnet session.

The SNAPCom screen is shown below:



TCP Client Operation

When the SNAP is set to operate as a client in TCP mode, select TCP and Server in the SNAPCom window. The PC running SNAPCom will act as the server. The IP address of the PC running SNAPCom must be entered into the SNAP as the server using the **`tcp server`** command. In the Bind Info block of the SNAPCom screen, enter the port number to be used to listen to the SNAP in the Port Number window. Click on the Bind button to apply this setting.

At this point, SNAPCom is listening for open socket requests from the SNAP. The SNAP will initiate an open socket request whenever a remote connects with the SNAP. When the first remote links with the SNAP, a message indicating the remote has linked along with the IP address of the remote will be displayed in the Winsock Information window. The IP address of the remote and the Winsock number will be displayed in the Transmit Information block of the

SNAPCom window. A Transmit button will appear only when a socket has been established with a remote device.

Data can be sent to the remote by entering the data in the Transmit Information window and clicking on Transmit. When multiple remotes have opened sockets with SNAPCom, specific remotes can be selected for transmission by selecting their IP address from the pop-down IP address menu. When IP addresses are selected in the IP address window, their associated Winsock number will be displayed in the Winsock ID window.

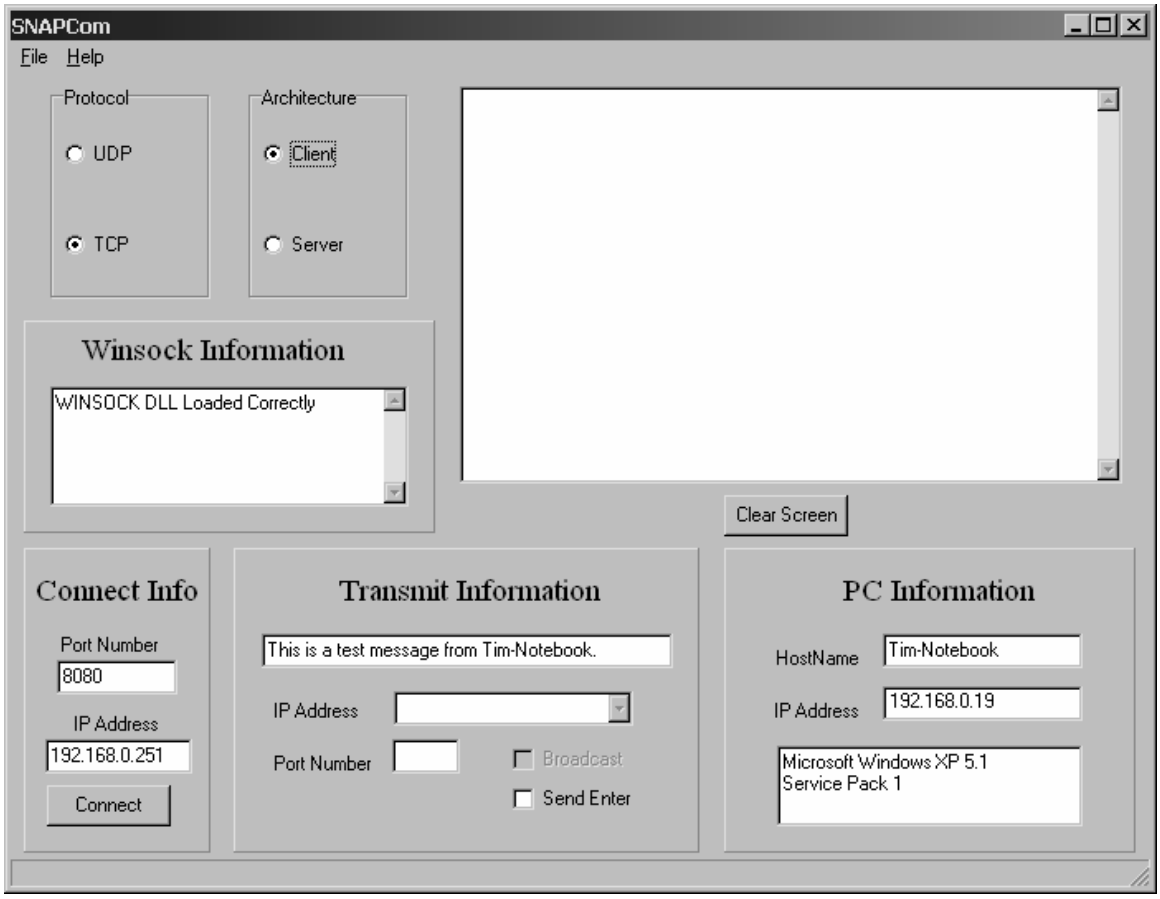
Data sent from remote devices is displayed in the main display area of the SNAPCom screen. Since multiple remote devices can send data simultaneously, the Winsock ID of the transmitting remote will be displayed at the beginning of each transmission in brackets. If data is entered slowly, as in typing at a keyboard, the transmission will be broken up into multiple transmissions by the radio. If only one remote is sending data, there can be a Winsock ID displayed for each byte of data sent. To prevent this from happening, click in the Winsock Status Off box to stop displaying the Winsock ID.

TCP Server Operation

When the SNAP is set to operate as a server in TCP mode, select TCP and Client in the SNAPCom window. The SNAPCom screen will change to reflect the client mode. The PC running SNAPCom will now act as a client of the SNAP and will be responsible for initiating the open socket requests.

In the Connect Information block, the IP address and the port number of the remote device to request a connection with must be entered. To initiate the open socket request, click on the Connect button. When the socket is established a status message will be displayed in the Winsock Information window and the IP address and port number of the remote device will be displayed in the Transmit Information block. A Transmit button will appear when a connection is established. Data received from the remote device is displayed in the main SNAPCom window.

SNAPCom can establish only one socket connection at a time. To communicate with another remote, the existing connection must be terminated. When the connection was established, the Connect button changed to a Disconnect button. Click on the Disconnect button in the Connect Information block to terminate the connection. Enter the IP address and port number of the next remote and click on the Connect button as earlier.



UDP Operation

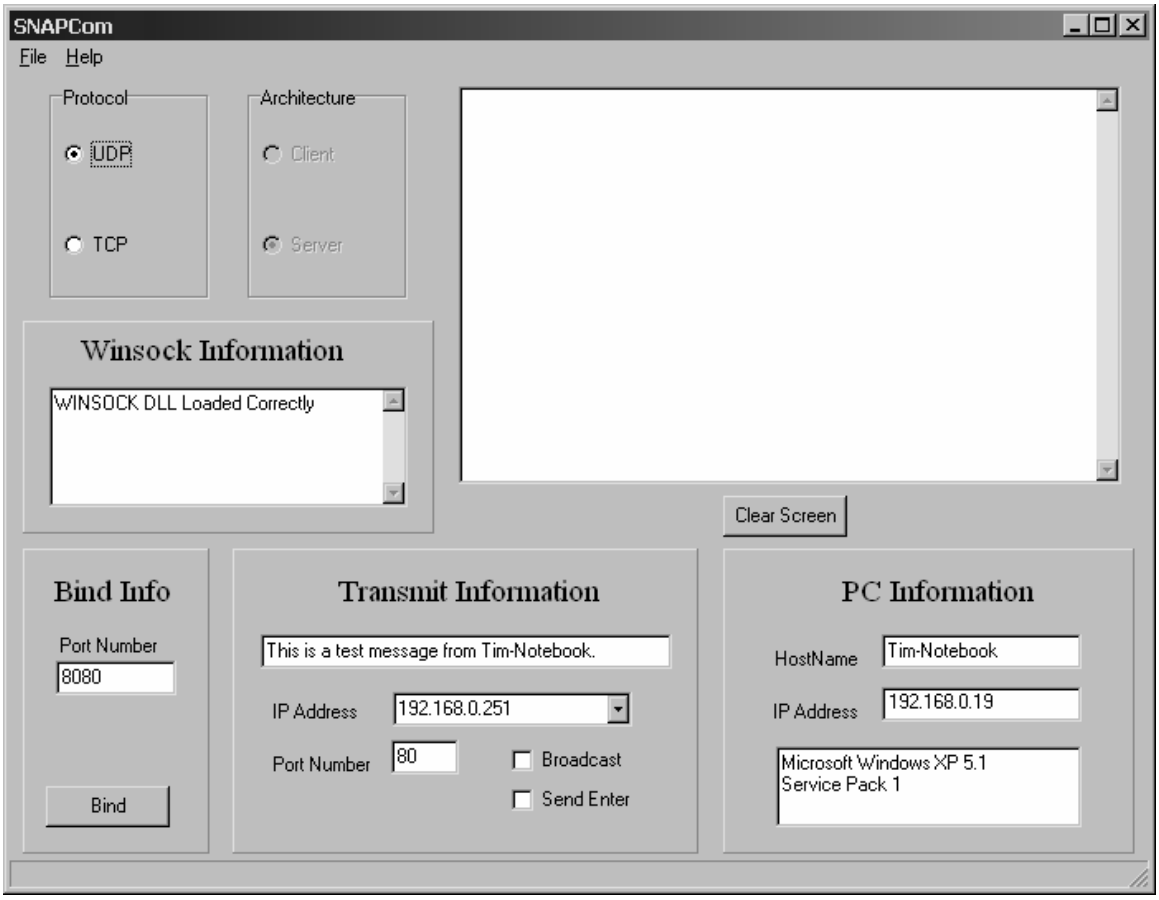
UDP is a “connection-less” protocol that requires no handshaking between devices before transmitting data. As such, there is no verification through the UDP protocol that a transmission was successfully received. The benefit of UDP is the simplified protocol stack that is needed to implement it.

Since there is no connection, there is no hierarchy between devices running the UDP protocol. Thus the concept of servers and clients does not exist in UDP. When UDP is selected in SNAPCom, the Server and Client buttons are grayed out.

In order to learn what remote devices are linked to the SNAP, SNAPCom must bind to the port assigned in the SNAP. This port number is entered in the Port Number window in the Bind block on the SNAPCom screen. The Bind button must be clicked to apply the port number setting.

To transmit to a specific remote, enter its IP address and Port Number in the respective windows in the Tranmsit Info block in the SNAPCom screen. Once an address and port number have been entered, the Broadcast button will become active. Enabling Broadcast will have data broadcast to the entire subnet, but the port numbers of the devices on the subnet must match for them to receive the broadcast.

Received data will be displayed in the main SNAPCom window.



SNAP OPERATION

Overview

At the most basic level, SNAPs can be thought of as Ethernet-to-serial interface adapters. That is, they take data from a host application over a 10/100BaseT Ethernet connection, remove the Ethernet header information, format the data for WIT2410 radios and transmit the data to the on-board WIT2410 through a high-speed serial interface. In the other data flow direction, the on-board WIT2410 receives data from a remote WIT2410 device. The SNAP takes this data and provides the necessary Ethernet datagram encapsulation and transmits the datagram to the host application over the connected network.

A SNAP can be used standalone, or a group of SNAPs can be connected together through a 10/100BaseT hub.

Communication between the host application and a SNAP can occur in one of three modes. In the default TCP/IP mode, the SNAP operates as either a client to a server application running on a workstation or as a server to a client application running on a workstation. Remote radios communicating with the application are assigned either IP addresses or port numbers by the SNAP. The SNAP routes data to and from the remotes to the designated application destination. The TCP/IP mode allows use of WinSocket routines to handle communications between the host application and the remotes. TCP/IP mode is the default mode.

In PPP mode, the SNAP hosts PPP sessions with remote WIT2410 devices. To use this mode, the remote host must be capable of establishing and supporting PPP sessions.

UDP (User Datagram Protocol) is one of the protocols for data transfer that is part of the TCP/IP suite of protocols. UDP is a "connectionless" protocol, because, unlike TCP, it does not require the sender and receiver to establish a connection before data is transmitted. It's considered "unreliable," because it doesn't guarantee that data grams will arrive in the same order they were sent, or even that they will arrive at all. If reliability is desired, it's up to the application using UDP to provide it.

DHCP

A DHCP server also can be used to set the SNAP IP address as well as the default route and DNS server IP addresses. This is accomplished by setting the desired default route IP address in the DHCP server using Option 3 and the desired DNS IP addresses using Option 6. The DHCP server will not overwrite a previously entered default router IP address in the SNAP.

If the DHCP server is not used to set the default router IP address, one must be entered using the *route* command. See the previous section for details of the route command.

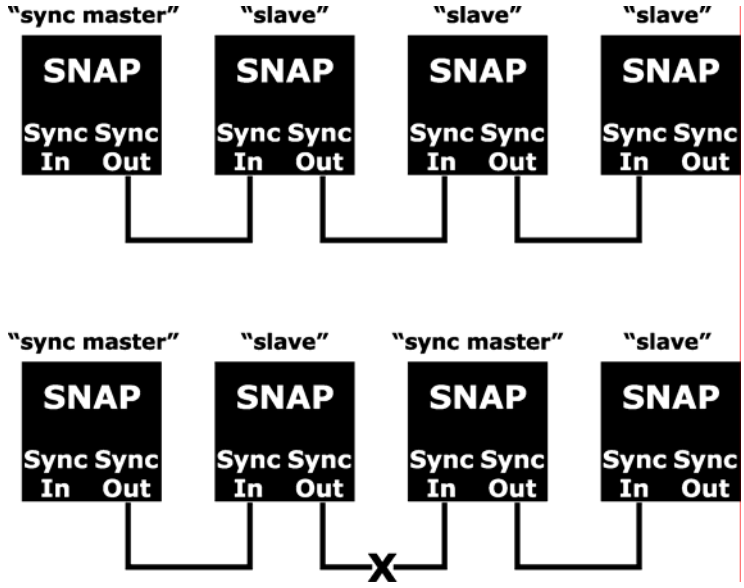
BOOTP

The SNAP can obtain its IP address from a BOOTP server if one is present in the network. The BOOTP server will require the Ethernet hardware MAC address to be able to assign the IP address to the SNAP. The Ethernet hardware MAC address of the SNAP is configured as 00:30:66:XX:YY:ZZ, where XX:YY:ZZ is the unique ID of the SNAP's radio. The MAC address is displayed on a label on the bottom of the SNAP.

Synchronization

Synchronization is only required when multiple SNAPs are co-located. This allows the co-located SNAPs to transmit at the same time and listen to remotes at the same time. This reduces interference between SNAPs that would occur if one SNAP was transmitting when a co-located SNAP was listening to remotes.

When a SNAP is powered up, it listens for a sync signal from another SNAP. If it does not hear a sync signal after a predetermined amount of time, it will broadcast a message over the Ethernet indicating it wants to be come a "sync master" responsible for generating the sync signal. If no response is received to this broadcast message, the SNAP will issue another broadcast message indicating it is now the sync master. The sync signal will be available on the Sync Out connector on the rear of the SNAP. All co-located SNAPs must have the Sync connectors daisy-chained together using standard RJ-11 cables in the manner shown below.



Note: If the daisy chain is broken in the middle, two separate "sync masters" will initiate and no longer be in synchronization thereby causing minimal interference.

SNAP System Commands

The SNAP supports a series of commands that allow for configuring the Ethernet interface as well as the radio parameters of the on-board WIT2410. These commands can be entered during a telnet session or by using the WinSNAP utility when the > prompt is displayed. The commands are summarized here with detailed explanations following.

Command	Description
`echo`	Toggles user screen echo mode
`help`	Displays command help screen
`reset`	Resets the SNAP activating changed configuration parameters
`save`	Stores current configuration to memory
`sys [help` `mode [TCP|PPP|UDP]`	Displays help screen for command Sets SNAP to TCP, Access Point, UDP or PPP server mode
`version`	Displays SNAP firmware version

echo — Toggles the user screen mode to echo characters typed by the user. Default is on. If echo is turned off, characters typed will not be displayed on the screen unless echoed by the terminal program.

help — Displays a list of all the SNAP commands. Most commands that require a parameter also have a help mode that displays the help screen for that command.

reset — Resets the SNAP and loads saved parameters into active memory. Also causes the SNAP to reinitialize which can take 30 seconds. If reset is issued before the save command, the new parameters are lost and the last saved parameters are used.

save — Saves changed parameters in non-volatile memory to be loaded on power up. Must be issued before the reset command or cycling power to have changed parameters take effect.

sys — These commands modify system operation parameters. The **`mode`** subcommand is used to select the TCP, UDP or PPP mode of operation.

version — Displays the SNAP firmware version.

Ethernet Commands

Command	Description
`arp –a`	Displays arp table
`-d <ipaddr>`	Deletes arp entry
`-s <ipaddr> <eaddr>`	Adds arp entry
`dns [`	Show current DNS server ip addresses
`[0|1] <ipaddr>]`	Sets DNS server ip addresses
`ip [`	Displays current SNAP IP address
`<ipaddr> <netmask>]`	Sets SNAP IP address and optionally the netmask
`ping <ipaddr>`	Pings TCP/IP host
`route [ help`	Displays help screen for command
`add <ipaddr|default> <gwaddr> <netmask>`	Adds IP address and netmask to route list
`del <ipaddr>`	Deletes IP address from route list
`list ]`	Lists route IP addresses
`socks`	Displays network socket information

arp — Manipulates the address resolution procedure table. This command is provided primarily as a debugging tool for setting up networks. **`ipaddr`** is the device IP address and **`eaddr`** is the physical Ethernet address of the device

dns — Sets or displays the ip addresses to be used for the primary and backup DNS servers. If not set, DNS name resolution must be handled by a proxy server or a DNS server ip address must be set in the subscriber PCs.

ip — Sets the IP address of the SNAP. The default IP address is 0.0.0.0. When specified **`netmask`** sets the netmask number. The default netmask is 255.255.255.0.

ping — sends inquiry packets to TCP/IP host specified in <ipaddr> and displays the amount of time that elapsed before a response was received. Continuously sends requests until a key is pressed. When a DNS server is present whose IP address has been entered into the SNAP, it is possible to use URLs rather than IP addresses to ping sites.

route Displays and manipulates gateway IP addresses to route IP traffic off the subnet. *Default* sets the default gateway IP address. When an IP address is entered instead of *default*, the gateway IP address specified will be used only for traffic destined for that IP address. If no default route is entered and a DHCP server is present, the DHCP server can add the default route IP address.

socks Displays the network socket information.

SNAP Radio Commands

The SNAP Radio Commands manage how the radio interfaces and synchronizes with the SNAP processor. While the hop command changes a radio parameter as well as a SNAP processor parameter, other radios parameters must be changed using the Radio Commands detailed in the next section.

Command	Description
`hop [help`	Displays help screen for command
`set <hoppattern>`	Sets/displays hopping pattern
`remote [help|`	Displays help screen for command
`list|`	Displays remotes currently registered with the SNAP
`sync [help`	Displays help screen for command
`disable`	Turns sync off (default)
`enable`	Turns sync on
`settings`	Displays synchronization settings

hop Shows available hop sets.

remote Displays the serial numbers of the radios in the SNAPs that are currently registered with the SNAP.

sync These commands set the operation of the synchronization signal used in co-located SNAP networks. The default mode is the sync OFF. Sync is enabled by selecting sync enable. The slave SNAPs will listen for a sync signal from the master. If no sync is heard, a slave SNAP will make itself a master and provide a sync signal.

Radio Commands

The “radio” command provides access to several sub-commands that are useful in configuring the WIT2410 in the SNAP. The command **`radio banner`** can be used to display the banner from the radio. This is useful in determining the unique ID of the radio and the version of firmware running in the radio.

The radios in the SNAP devices are set with factory defaults which should be sufficient for most applications. For other applications, the following radio commands can be used to fine tune the performance of the SNAP.

Command		Description
`radio`	`help`	Displays command list
	`banner`	Displays power on banner for the radio in the SNAP
	`defaults`	Resets the radio parameters to the factory shipped values
	`maxremotes [ 0..60]`	Displays value currently in use Sets the maximum number of subscribers the SNAP will allow to register. Default = 60
	`network [ 0..63]`	Displays current SNAP network number Sets the network number for the SNAP Default = 0
	`show`	Displays radio parameters that have been modified from factory settings

help — Displays list of sub-commands under the radio command.

banner — Displays the power on banner of the radio inside the SNAP.

defaults — Replaces any modified parameters with the factory default values.

maxremotes — Sets a limit to the number of remotes that an access point radio can have registered simultaneously. The default is 60 but the parameter can range from 1 to 60. If more than *maxremotes* subscribers attempt to connect to the access point, they will be denied.

network — The radio in the SNAP has 64 preprogrammed hopping patterns or network numbers. By using different network numbers, nearby co-located networks can avoid interfering with each other’s transmissions. Even if both networks tried to use the same frequency, on the next hop they would be at different frequencies. *nwt* can range from 0 to 63.

show — This command displays a list of the current radio parameters including the network number, maxremotes and the sys outmax value.

TCP/IP MODE OPERATION

The default operating mode of the SNAP is the TCP/IP mode. In this mode, the command line prompt is **TCP>.** If the command prompt is **PPP>**, it is an indication the SNAP is in the PPP mode of operation. To change to TCP/IP mode, at the prompt type:

```
sys mode tcp<CR>
save<CR>
reset
```

After the post-reset self-test, the command line prompt will change to **TCP>.** If a telnet session is being used to communicate with the SNAP, it will be necessary to close and reopen the session.

The TCP/IP mode is designed to allow the remotes communicating with the SNAP to appear as Ethernet devices when in fact, they are serial devices transmitting and receiving unformatted data. The SNAP can function as a client device or a server device. When functioning as a client device, the IP address of the server running the host application is entered into the SNAP. The remote devices can be addressed as individual IP addresses or as ports on a single IP address.

Client Mode

Although the SNAP in TCP/IP mode can be set up to act as a server to a client workstation on the network, the typical use will have the SNAP (and the connected remotes) as the client to an application running on a server. The SNAP operates as a client device once a server IP address and port number have been entered. If no server IP address is entered into the SNAP, the SNAP will default to assume the role of the server. Enter the server IP address and port number by typing at the TCP> prompt:

```
tcp server add <ipaddr> <port><CR>
```

where **ipaddr** is the IP address and **port** is the port number of the desired server. Two server IP addresses may be entered. Information on the server IP addresses is displayed by typing:

```
tcp server list<CR>
```

To remove a server IP address, type:

```
tcp server delete <ipaddr><CR>
```

Where **ipaddr** is the IP address of the server to be deleted. If all server IP addresses are deleted, the SNAP will enter server mode.

It is possible to designate servers using domain names rather than IP addresses if a DNS server is present. Before adding or deleting servers by domain name, the IP address of the DNS server must be entered into the SNAP. Two DNS servers can be specified. Enter a DNS server IP address by typing:

```
dns [0:1] <ipaddr><CR>
```

Where 0 and 1 identify the first and second DNS servers to be used and **ipaddr** is the corresponding IP address of the DNS server. In this mode, servers are added and deleted by using the domain name in place of the IP address in the **tcp server add** and **tcp server delete** commands.

When a remote device registers with the SNAP, the SNAP will open a socket with the server using the IP address or port number assigned to the remote. As data is received from the remote

device, it will be transmitted to the server over this socket. Data to be sent to the remote device is sent to the SNAP over the same socket. The SNAP determines to which remote device the data is intended and translates the IP address or port number to the correct radio ID.

When a remote logs off from the SNAP, the socket to the server is closed. When that remote registers with the SNAP the next time, the IP address or port number assignment can be different from the original assignment unless static assignment or a DHCP server is used. Refer to the section *Assigning Remotes IP Addresses* below for details.

If a server closes a socket, the SNAP will attempt to re-open a socket when data is next received from the remote device associated with the closed socket. If the server does not accept the request to open a socket, the SNAP will repeat the request once every minute.

It is possible to have some remotes operating as clients while others operate as servers. To override the default setting for a remote, use the **`tcp remote mode`** command. Refer to the section *TCP/IP Commands* for details.

Server Mode

In server mode, the SNAP uses a control port to inform the client application of remote devices as they register with and disconnect from the SNAP. The default port number for the control port is 2430. This port number can be changed using the **`tcp control`** command.

```
tcp control <1..65,536><CR>
```

The format of the registration message is:

```
+02:67:95 192.168.0.212 5002
```

Where **`+`** indicates the beginning of a registration message, **`02:67:95`** is the factory serial number of the remote radio and **`192.168.0.212`** is the IP address and **`5002`** is port number to be used to communicate with the remote device.

When a remote device drops connection with the SNAP, a disconnect message is sent using the following format:

```
-02:67:95
```

Where **`–`** indicates the beginning of a disconnect message and **`02:67:95`** is the factory serial number of the radio in the remote device.

In server mode, the client application is responsible for opening sockets with the SNAP for each remote that registers with the SNAP. The client application can wait until it is notified over the control port of a remote registering before opening a socket. Alternatively, the client application can open sockets ahead of time for remotes it expects will be registering with the SNAP. Data transmitted from a remote to the SNAP before the client application opens a socket will be discarded.

It is possible to have some remotes operating as servers while others operate as clients. To override the default setting for a remote, use the **`tcp remote mode`** command. Refer to the section *TCP/IP Commands* for details.

Assigning Remotes IP Addresses

Remote devices can be identified to applications by either an IP address or Port number. Remote devices can have IP addresses assigned in one of three ways: dynamic assignment by the SNAP, static assignment by the SNAP, or by a DHCP server.

To have remote devices assigned IP addresses dynamically by the SNAP, a pool of consecutive IP addresses must be available. The lowest IP address of the pool is entered in the SNAP as the **`ipbase`**. The first remote device that registers with the SNAP will be assigned that IP address. The next remote device that registers with the SNAP will be assigned the next higher IP address and so on.

Note: When using the SNAP to dynamically assign IP addresses to remotes, if a remote leaves the coverage area of the SNAP and then re-enters, it may be assigned a different IP address than initially.

Enter the first IP address by typing at the TCP> prompt:

```
tcp server ipbase <xxx.xxx.xxx.xxx><CR>
```

where `xxx.xxx.xxx.xxx` is the first IP address to be assigned. If the remote devices are to be identified as a port number of the IP address of the SNAP, do not enter an **`ipbase`** address. If an **`ipbase`** has previously been entered, re-enter the **`ipbase`** with a value of 0.0.0.0. This will cause the SNAP to use port numbers to identify the remotes.

The size of the pool must be equal to the maximum number of remotes that will register with the SNAP at a given time. The default setting is 16 but the SNAP can support a maximum of 62. The number of remotes that can be simultaneously registered with the SNAP can be modified using the **`tcp server ipcount`** command.

```
tcp server ipcount <1..62><CR>
```

When using IP addresses to identify remote devices, the SNAP will assign a port number. If a specific port number is desired, the number can be specified using the **`tcp server ipport`** command.

```
tcp server ipport <1..65,536><CR>
```

To display the current settings of the ipbase, ipcount, ipport and the server IP address and port number, at the TCP> prompt type:

```
tcp server list<CR>
```

If no server IP address has been entered, no server information will be displayed.

To have the SNAP staticly assign IP addresses, the **`tcp remote add`** command is used. The IP addresses are assigned to remotes using the unique factory serial number of the WIT2410 radio in the remote device. For example, to staticly assign a remote device with a WIT2410 radio with serial number 104050 the IP address 192.168.0.230 using port 5000, at the TCP> prompt type:

```
tcp remote add 10-40-50 5000 192.168.0.230<CR>
```

Whenever that remote device registers with the SNAP, it can be accessed using IP address 192.168.0.230 and port 5000. To have the SNAP dynamically assign the port, enter a value of 0 for the port number. To remove a static IP assignment type:

```
tcp remote delete <remote-id><CR>
```

where remote-id is the radio serial number with hyphens between each two digits as in the above example.

To use a DHCP server to assign IP addresses to remote devices, the ipbase must be set to 255.255.255.255. Set the ipbase as above using the **tcp server ipbase** command:

```
tcp server ipbase 255.255.255.255<CR>
```

Assigning Remotes Port Numbers

Remote devices can be identified to applications be either an IP address or a port number of the IP address of the SNAP. There are two ways to assign port numbers to remote devices: dynamic assignment by the SNAP and static assignement by the SNAP. If no **ipbase** value is entered into the SNAP, the remote devices will be identified by dynamically assigned port numbers of the IP address of the SNAP. As remotes register with the SNAP, the SNAP will dynamically and randomly assign port numbers. The SNAP will not assign a remote device port numbers reserved for standard services, such as FTP.

To make a static assignment of a port number to a specific remote device, use the **tcp remote add** command but do not enter an IP address. For example, to assign port number 5000 to a remote device with radio serial number 104050, type:

```
tcp remote add 10-40-50 5000<CR>
```

If an **ipbase** has previously been entered but remote identification by port number is desired, re-enter the **ipbase** with a value of 0.0.0.0. This will cause the SNAP to use port numbers to identify the remotes.

TCP/IP Commands

The following commands are specific to the TCP mode of operation.

Command		Description
tcp	help	Displays help screen for command
	control	Displays control port setting for server mode
	<1-65536>	Sets control port for server mode
	remote help	Displays help screen for command
	add <remote-id> <portnum> <ipaddr>	Add a remote with a static IP address assignment. Remote ID must be broken up by dashes after every two numbers
	delete <remote-id>	Remove a static IP address assignment
	list	Displays a list of remotes with static IP addresses
	mode <remote-id> [client|server}	Allows a configured remote to be set to operate as a client or a server.
	server help	Sets base IP address for SNAP
	add <ipaddr> <port>	Add a server IP address
	delete <ipaddr>	Delete a server IP address
	id [enable|disable]	Enable/disable connect message on remote registration
	ipbase <ipaddr>	Set beginning IP address for dynamic IP assignment
	ipcount <1-60>	Set number of remotes that can be connected to servers simultaneously
	ipport <1-65536>	Set port number to use when IP address used to identify remotes
	list	List servers entered
	status	Displays status of servers and remotes

help — Displays the help screen listing of the **tcp** commands.

control — Displays and sets the port to be used to send remote connect messages to a client or server application.

remote — Displays and manages table of remotes registered with the SNAP. Allows static IP address assignment on a per remote basis. remote-id is the 6-digit serial number of the WIT2410 in the remote device with a dash separating each two digits. For example, serial number 201457 must be entered as 20-14-57. The **mode** command

allows individual remotes to be designated as servers or clients independently of the default setting for the remainder of the remotes.

server — Sets up and manages server or servers to be communicated with when the SNAP is in client mode. The `id` command turns on a connect message whenever a remote registers with the SNAP. When not enabled, the SNAP will open a socket for each remote as they register but will not provide any other indication of a remote registering.

status — Displays the status of servers and remotes.

UDP MODE OPERATION

The UDP mode of the SNAP operates similar to the TCP/IP mode when the remotes are acting as clients. The assignment of IP addresses and/or port numbers to remotes is accomplished using the same commands as in TCP/IP mode. The UDP commands are identical in function to the TCP/IP commands but are repeated below.

The main differences between the TCP/IP mode and the "connection-less" UDP mode are that the remotes can act only as clients and that the handshaking used in TCP/IP is not used in the UDP protocol. In order to operate the SNAP in UDP mode, the following sequence of commands must be entered.

```
sys mode PPP<CR>
save<CR>
reset<CR>
```

UDP Commands

Command			Description
udp	help		Displays help screen for command
	control		Displays control port setting for server mode
		<1-65536>	Sets control port for server mode
	remote	help	Displays help screen for command
		add <remote-id> <portnum> <ipaddr>	Add a remote with a static IP address assignment. Remote ID must be broken up by dashes after every two numbers
		delete <remote-id>	Remove a static IP address assignment
		list	Displays a list of remotes with static IP addresses
	server	help	Sets base IP address for SNAP
		add <ipaddr> <port>	Add a server IP address
		delete <ipaddr>	Delete a server IP address
		id [enable|disable]	Enable/disable connect message on remote registration
		ipbase <ipaddr>	Set beginning IP address for dynamic IP assignment
		ipcount <1-60>	Set number of remotes that can be connected to servers simultaneously
		ipport <1-65536>	Set port number to use when IP address used to identify remotes
		list	List servers entered
	status		Displays status of servers and remotes

help	Displays the help screen listing of the **`tcp`** commands.
control	Displays and sets the port to be used to send remote connect messages to a client or server application.
remote	Displays and manages table of remotes registered with the SNAP. Allows static IP address assignment on a per remote basis. remote-id is the 6-digit serial number of the WIT2410 in the remote device with a dash separating each two digits. For example, serial number 201457 must be entered as 20-14-57.
server	Sets up and manages server or servers to be communicated with when the SNAP is in client mode. The **`id`** command turns on a connect message whenever a remote registers with the SNAP. When not enabled, the SNAP will open a socket for each remote as they register but will not provide any other indication of a remote registering.
status	Displays the status of servers and remotes.

PPP MODE OPERATION

The SNAP can be configured to operate as a PPP (Point-Point Protocol) server. PPP is a dial-in network connection that allows TCP/IP communication. A PPP connection allows a remote connected to a computer to be connected to network that the SNAP is on using the TCP/IP protocol. In order to operate the SNAP as a PPP server, the following sequence of commands must be entered.

```
sys mode PPP<CR>
save<CR>
reset<CR>
```

After the post-reset self-test, the command line prompt will change to **`PPP>.`** If a telnet session is being used to communicate with the SNAP, it will be necessary to close and reopen the session.

In addition to supporting DHCP and RADIUS servers, the SNAP will also allow the user to specify the starting IP address for the remotes that logon. The first remote to logon will receive the IP address specified below. The SNAP will then add one to the IP address for the next remote to login. Alternatively, the SNAP supports static IP assignment based on username. Details of the commands for these modes are in the section *PPP Commands* below.

Included in the appendix is a listing of a Windows modem definition file. This inf file will work on Windows 95/98/ME/2000/NT/XP for a remote WIT2410 modem device connected to a serial port. The WIT2410-based modem device needs to be added as a new modem using the standard Windows procedures. When installed, Windows dial-up networking can be used to create a PPP session between the remote PC and the SNAP. The PPP mode of the SNAP also works with various versions of UNIX and LINUX. Contact Murata Technical Support for details.

PPP Commands

These commands are unique to the PPP mode. They are preceded by **ppp**.

Command		Description
ppp	help	Displays help screen for command
	acct method	Displays accounting method currently in use
	[local|radius]	Sets accounting method to local or Radius
	auth [chap	Enables CHAP authentication protocol when method is set to RADIUS.
	method [local|radius]	Set authentication method to local or Radius
	settings	Displays authentication settings
	upap]	Enables UPAP authentication procotol when method is set to RADIUS
	base <ipaddr>	Sets base IP address for SNAP
	count	Displays PPP base allocation count
	<1-60>	Set to max number of remotes parameter of radio
	ip <usr> <ipaddr>	Sets static IP address for specified user
	radius help	Displays help screen for command
	add [auth|acct] <ipaddr> [port]	Adds IP address of Radius server for authentication or accounting
	delete [auth|acct] <ipaddr>	Deletes IP address of Radius server
	port [auth|acct] <ipaddr> <port-number>	Sets the port number for a Radius server
	retries <value>	Sets the RADIUS number of retries
	secret [auth|acct] <ipaddr> <secret>	Sets the secret for a Radius server
	settings	Displays Radius servers settings
	timeout <value>	Sets the RADIUS timeout in
	status	Displays status of registered users
	timeout <time>	Sets idle time timer in tenths of seconds

	user help	Displays help screen for command
	add <usr>	Adds a PPP user
	delete <usr>	Deletes a PPP user
	disable <usr>	Disables a PPP user
	enable <usr>	Enables a PPP user
	list	List current PPP users, both enabled and disabled
	password <usr> <pwd>	Set PPP user password

help — Displays the subcommands for the PPP mode.

acct — Displays/sets the accounting method to be used for IP traffic. When set to local, the SNAP keeps track of the amount of data traffic and time used by each user. When set to radius, the accounting information is sent to the designated accounting Radius server.

auth — Displays/sets the authentication method to be used when users sign on. When set to local, the password entered by the user when establishing the PPP session must agree with the password entered for that user in the SNAP. When set to Radius, the password entered by the user is sent to the designated authentication Radius server. When using a RADIUS server, either CHAP or UPAP must be enabled.

base — Sets base IP address for IP addresses to be assigned to remotes when in PPP server mode. The base address is assigned to the first remote that registers with the SNAP. The next remote to register is assigned the base IP address incremented by one.

count — Displays/sets the PPP base allocation count. This number must be equal or larger than the maximum number of remotes the radio as it determines the number of buffers the SNAP will set up to asSNAPble SNAP datagrams.

ip — Sets static IP assignment for the designated *usr* where *usr* is the username assigned to the subscriber in the SNAP. The IP assignment remains valid after cycling power to the SNAP or issuing resets.

radius — These commands are used to set up one or more Radius servers to perform authentication and accounting functions. Separate servers may be used for each function. The *retries* parameter sets the number of attempts the SNAP will make to contact a RADIUS server before denying access to a user. The *timeout* parameter sets the length of time, in xx of seconds, that the SNAP will wait for a response from a RADIUS server before denying access to a user.

status — This command displays the status for all currently registered users including the IP address assigned to the user, the serial number of the remote radio, the number of bytes and packets received and sent as well as bad packets.

timeout — This command allows the SNAP to terminate the PPP session of an idle remote after the specified amount of time. Time is specified in tenths of seconds, thus a value of 600 corresponds to one minute. If the value is set to zero, the timeout feature is disabled.

user	Manipulates users that are entitled to connect to the SNAP. Also sets the password for each entered user. **`usr`** and **`pwd`** can be any alphanumeric string up to 32 bytes in length. When a new user is added, a password must be assigned and the user must be **`enabled`** before access will be granted. A user and password must be assigned only if local authentication is user. If a Radius server is to perform authentication, usernames and passwords are not required. There is no way to display passwords. If a password is forgotten, a new password must be entered.

TROUBLESHOOTING

Connect LED is not on.

Check the power LED on the SNAP. Check the Ethernet cable, making sure that it is fully connected.

Cannot telnet to SNAP.

Check the power LED on the SNAP. Check the Ethernet cable, making sure that it is fully connected. Make sure the SNAP has a unique IP number on the network and one that is valid for the network, i.e. that can be seen through switches, hubs and routers.

Cannot communicate with a remote radio.

Check the list of registered remotes on the SNAP to make sure the remote is registered using the remote list command. If the remote is not registered, check that the remote is not is sleep mode. Verify that the remote is in range of the SNAP.

Technical Support

Technical Support is available from Murata from 8:30am to 5:30pm Eastern Time, Monday through Friday. Contact Technical Support at (678) 684-2000 or by email at tech_sup@murata.com.

QUICK REFERENCE

SNAP System Commands

`echo`	Toggles user screen echo mode
`help`	Displays command help screen
`reset`	Resets the SNAP to activate new parameters
`save`	Stores current configuration in non-volatile memory
sys help	
`mode [TCP|UDP|PPP]`	Sets SNAP operating mode
`version`	Displays SNAP firmware version number

Ethernet Commands

`arp -a`	Displays arp table
`-d <ipaddr>`	Deletes arp entry
`-s <ipaddr> <eaddr>`	Adds arp entry
`dns`	Displays current DNS server IP address
`<ipaddr> <netmask>`	Sets DNS server IP address
`ip <ipaddr> <netmask>`	Sets SNAP IP address and optional netmask
`ping <ipaddr>`	Pings TCP/IP hosts
`route help`	
`add <ipaddr|default> <gwaddr> <netmask>`	Adds IP address and netmask to route table
`del <ipaddr>`	Deletes IP address from route table
`list`	Lists route table IP addresses
`socks`	Diplays network socket information

SNAP Radio Commands

`hop set help`	
`remote help`	
`list`	Displays remotes currently registered
`send <hnd> <data>`	Sends data to the specified remote
`sync help`	
`disable`	Turns sync off (default)

Radio Commands

radio	help	
	banner	Displays power on banner for radio in SNAP
	defaults	Resets radio to factory shipped values
	maxremotes [0..15]	Sets maximum number of remotes SNAP allows
	network [0..63]	Sets the network number for the SNAP
	show	Displays modified radio parameters

TCP Commands

tcp	help	
	control <1-65536>	Sets control port for server mode
	remote help	
	add <remote-id> <ipaddr>	Add remote with static IP assignment
	delete <remote-id>	Remove a static IP assignment
	list	Displays remotes with static IP assignment
	server help	
	add <ipaddr> <port>	Add a server IP address
	delete <ipaddr>	Delete a server IP address
	id [enable|disable]	Enable/disable remote connect message
	ipbase <ipaddr>	Set beginning IP address for dynamic IP assignment
	ipcount <1-62>	Set number of remotes that can connect to server simultaneously
	ipport <1-65536>	Set port number to use when identifying remotes with IP addresses
	list	List servers entered
	status	Display status of servers and remotes

PPP Mode Commands

ppp	help	
	acct method [local|radius]	Sets accounting method to be used
	auth chap	Enables CHAP protocol when RADIUS selected
	method [local|radius]	Sets authentication method to be used
	settings	Displays authentication settings
	upap	Enables UPAP protocol when RADIUS selected
	base <ipaddr>	Sets base IP address for remotes
	count <1-62>	Set to max number of remotes pararmeter of radio
	ip <usr> <ipaddr>	Sets static IP address for specified user
	radius help	
	add [auth|acct] <ipaddr> [port]	Adds IP address of Radius server
	delete [auth|acct] <ipaddr>	Deletes IP address of Radius server
	retries <value>	Sets the RADIUS number of retries
	port [auth|acct] <ipaddr> <pnumber>	Sets the port number for a Radius server
	secret [auth|acct] <ipaddr> <secret>	Sets the secret for a Radius server
	settings	Displays Radius server settings
	timeout <value>	Sets RADIUS timeout in tenths of a second
	status	Displays status of registered users
	timeout	Sets idle time timer in tenths of a second
	user help	
	add <usr>	Adds a PPP username
	delete <usr>	Deletes a PPP username
	disable <usr>	Disables a PPP username
	enable <usr>	Enables a PPP username
	list <usr>	Lists current PPP users
	password <usr> <pwd>	Sets PPP user password

WIT2410 Command Summary

Serial Commands

`sd[?|00..ff]`	Set Data Rate Divisor	
`sp[?|00..14]`	Set Protocol Mode	

Network Commands

`wb[?|0|1]`	Set Transceiver Mode	
`wd[?|0..3f]`	Set Default Handle	
`wn[?|00..3f]`	Set Hopping Pattern	
`wg[?|0|1]`	Enable Global Network Modes	
`wp[?|0|1]`	Set Transmit Power	
`wr?`	Read Receive Signal Strength	(remote only)
`dx[?|0..ff]`	Set Range Optimization	(remote only)

Protocol Commands

`pe[?|0..4]`	Set Alternative Frequency Band	
`ph[?|00..fe]`	Set Hop Duration	(base only)
`pl?`	Get Maximum Data Length	
`pn[?|01..3e]`	Set Maximum Number of Remotes	(base only)
`pk[?|00..d4]`	Set Minimum Data Length	
`pr[?|00..ff]`	Set Packet Attempts Limit	
`pt[?|00..ff]`	Set Data Transmit Delay	(remote only)
`pv[?|0|1]`	Set Slot Assignment Mode	(base only)
`pw[?|00..34]`	Set Base Slot Size	(base only)
`px[?|0|1]`	Set ARQ Mode	

Status Commands

`zb[?|0|1]`	Banner Display Disable	
`zc[?|0..2]`	Set Escape Sequence Mode	
`zh?`	Read Factory Serial Number High Byte	
`zm?`	Read Factory Serial Number Middle Byte	
`zl?`	Read Factory Serial Number Low Byte	
`zp[?|0..4]`	Set Duty Cycle	(base only)
`zq[?|0|1]`	Enable Low Power Acquisition	(remote only)
`z>`	Exit Modem Control Mode	

Memory Commands

`m0`	Recall Factory Defaults
`m<`	Recall Memory
`m>`	Store Memory
`m!`	Display non-default settings

APPENDIX A.

inf file listing for PPP mode.

```
AddReg=All, Common, DWC00Reg, 115200, EXTERNAL

[All]
HKR,,FriendlyDriver,,Unimodem.vxd
HKR,,DevLoader,,*VCOMM
HKR,,PortSubClass,1,02
HKR,,ConfigDialog,,modemui.dll
HKR,,EnumPropPages,,"modemui.dll,EnumPropPages"

[EXTERNAL]
HKR,, DeviceType, 1, 01

[Common]
HKR, Answer, 1,,""
HKR, Hangup, 1,, "Bye"
HKR, Hangup, 2,, "NoResponse"
HKR, Settings, DialSuffix,, ""

; DCB's - dwords and words are byte reversed
;                                                                    ByteSize (Number of bits/byte, 4-8)
;                                                                  Parity (0-4=None,Odd,Even,Mark,Space)
;                                                                       StopBits (0,1,2 = 1, 1.5, 2)
;            |DCBLength    |BaudRate    |Bit Mask    |Rsvd  |XonLim|XofLim|   |   |   Xon|Xof|Err|Eof|Evt
[115200]
HKR,, DCB, 1, 1C,00,00,00, 00,c2,01,00, 15,20,00,00, 00,00, 0a,00, 0a,00, 08, 00, 00, 11, 13, 00, 00, 00

[DWC00Reg] ; Null-Modem
HKR, Init, 1,, "<cr><cr>"
HKR, Init, 2,, "NoResponse"
HKR, Settings, Prefix,,""
HKR, Settings, DialPrefix,, "HELLO<cr>"
HKR, Settings, Terminator,, "<cr>"
HKR, Monitor, 1,, "None"
HKR, Answer, 1,, "HELLO"
HKR, Answer, 2,, "NoResponse"
; Properties - dwords and words are byte reversed
;                   |Dial Options             |InactivityTimeout        |Speaker Mode             |Max DTE Rate
;                                |CallSetupFailTimeout     |Speaker Volume           |Modem Options            |Max DCE Rate
HKR,, Properties, 1, 00,00,00,00, 00,00,00,00, 00,00,00,00, 00,00,00,00, 00,00,00,00, 30,00,00,00, 00,c2,01,00, 00,c2,01,00
HKR, Responses, "<h00>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
```

```
; 23 May 98 added
HKR, Responses, "<hff>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
HKR, Responses, "<cr>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
HKR, Responses, "<lf>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
HKR, Responses, "<cr><lf>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
; end of 23 May 98 addition


[Strings]
DWC = "Murata"
Man = "Murata"
```

SPECIFICATIONS

Radio Specifications

Model	SNAP2410	SNAP2410X	SNAP2410D	SNAP2410DX
Data Throughput	230Kbps			
Total over-the-air bandwidth	460Kbps			
Enclosure	Aluminum	Aluminum (network interface unit) UV stabilized polycarbonate (remote radio unit)	ABS	ABS (network interface unit) UV stabilized polycarbonate (remote radio unit)
Dimensions	201x144 x53mm	201x144x53 mm (network interface unit) 130x79x35 (remote radio unit)	140x118 x48mm	140x118x48 mm (network interface unit) 130x79x35 (remote radio unit)
Operating Temperature	-30°C to +70°C	-30°C to +70°C (remote radio unit) -40°C to +70°C	-30°C to +70°C	-30°C to +70°C (remote radio unit) -40°C to +70°C
Network Interface	10/100BaseT			
SNAP Network Topologies	Point-to-Point or Multipoint			
Repeater	Use Murata HN-2010			
RF Output Power	100mW with included whip antenna, 400W EIRP with gain antenna			
RF Modulation	Frequency hopping, up to 64 user selectable hopping patterns			
Frequency Range	2400MHz to 2483.5MHz			
Operating Voltage Range	9VDC to 26VDC (12VDC for X version)			
Licensing	Type certified for Worldwide License-free operation under FCC Part 15.247 and CE marked			

Connectors

Power	2-Pin Connector
Ethernet	RJ-45
Configuration Port	RJ-11
Antenna	Reverse-TNC Male
Sync (2)	RJ-11

Indicators

Power
Ethernet Transmit Data
Ethernet Receive Data
Ethernet Link Status
RF Link
RF Xcvr

WARRANTY

Seller warrants solely to Buyer that the goods delivered hereunder shall be free from defects in materials and workmanship, when given normal, proper and intended usage, for twelve (12) months from the date of delivery to Buyer. Seller agrees to repair or replace at its option and without cost to Buyer all defective goods sold hereunder, provided that Buyer has given Seller written notice of such warranty claim within such warranty period. All goods returned to Seller for repair or replacement must be sent freight prepaid to Seller's plant, provided that Buyer first obtain from Seller a Return Goods Authorization before any such return. Seller shall have no obligation to make repairs or replacements which are required by normal wear and tear, or which result, in whole or in part, from catastrophe, fault or negligence of Buyer, or from improper or unauthorized use of the goods, or use of the goods in a manner for which they are not designed, or by causes external to the goods such as, but not limited to, power failure. No suit or action shall be brought against Seller more than twelve (12) months after the related cause of action has occurred. Buyer has not relied and shall not rely on any oral representation regarding the goods sold hereunder, and any oral representation shall not bind Seller and shall not be a part of any warranty.

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