

Raven GPRS

User Guide

Version 1.08

AirLink Communications, Inc.

September 29, 2003

Information in this document is subject to change without notice
© Copyright AirLink Communications, Inc, 1993-2003. All rights reserved.

Please send comments to:

email: pubs@AirLink.com

Fax: 510-226-4299

Phone: 510-226-4200

Post: AirLink Communications, Inc.
 Attention: Technical Publications Dept.
 472 Kato Terrace
 Fremont, CA 94539

Important Notice

Because of the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the AirLink Communications modem are used in a normal manner with a well-constructed network, the AirLink modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. AirLink Communications, Inc., accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the AirLink Communications modem, or for failure of the AirLink Communications modem to transmit or receive such data.

Safety and Hazards

Do not operate the AirLink Communications modem in areas where blasting is in progress, where explosive atmospheres may be present, near medical equipment, near life support equipment, or any equipment which may be susceptible to any form of radio interference. In such areas, the AirLink Communications modem **MUST BE POWERED OFF**. The AirLink Communications modem can transmit signals that could interfere with this equipment. Do not operate the AirLink Communications modem in any aircraft, whether the aircraft is on the ground or in flight. In aircraft, the AirLink Communications modem **MUST BE POWERED OFF**. When operating, the AirLink Communications modem can transmit signals that could interfere with various onboard systems. The driver or operator of any vehicle should not operate the AirLink Communications modem while in control of a vehicle. Doing so will detract from the driver or operator's control and operation of that vehicle. In some states and provinces, operating such communications devices while in control of a vehicle is an offence.

Limitation of Liability

The information in this manual is subject to change without notice and does not represent a commitment on the part of AirLink Communications, Inc. AIRLINK COMMUNICATIONS, INC. SPECIFICALLY DISCLAIMS LIABILITY FOR ANY AND ALL DIRECT, INDIRECT, SPECIAL, GENERAL, INCIDENTAL, CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR REVENUE OR ANTICIPATED PROFITS OR REVENUE ARISING OUT OF THE USE OR INABILITY TO USE ANY AIRLINK COMMUNICATIONS, INC. PRODUCT, EVEN IF AIRLINK COMMUNICATIONS, INC. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR THEY ARE FORESEEABLE OR FOR CLAIMS BY ANY THIRD PARTY.

Raven GPRS User Guide

Table of Contents

1.	Introduction	5
1.1	Raven Product Overview	6
2.	Network Connection	7
2.1	Internet (TCP/IP) Connections via GPRS	7
2.2	Data Connections	7
3.	Raven and PinPoint GPRS Configuration	9
3.1	Local Configuration	9
3.2	Modem Activation	11
3.2.1	SIM Check	12
3.2.2	PDP Context	12
3.3	Remote Configuration	13
4.	Windows Dial-Up Networking Setup	14
4.1	Add Windows Modem Driver	14
4.1.1	Setup Modem	14
4.1.2	Add Modem Driver	14
4.2	Windows Dial-Up Networking (PPP) Configuration	17
4.3	Making a GPRS Data Connection	25
5.	Dynamic IP Addresses	26
5.1	IPManager and Dynamic DNS Updates	27
5.2	Using Names in the Modem, Domain Name Resolving	27
6.	Serial Communication Modes	29
6.1	AT Mode	30
6.2	PPP Mode	30
6.3	PassThru Mode	31
6.4	UDP PAD Mode	31
6.4.1	UDP Auto Answer	32
6.4.2	Reliable UDP	32
6.4.3	Multicast UDP [Raven Only Feature]	33
6.5	TCP PAD Mode	33
6.6	TCP Auto Answer	34
6.7	Hybrid Modes	34

6.8	SLIP Mode.....	35
6.9	Modbus/BSAP Configuration [Raven Only Feature]	35
6.9.1	Configuring the Polling Host Application Raven	35
6.9.2	Configuring the Remote Ravens	36
7.	Using AT Commands	38
7.1	GPRS Specific AT Commands.....	39
7.2	Raven and PinPoint AT Command Reference.....	41
8.	Raven Installation.....	52
8.1	Mounting the Raven	52
8.2	Connecting the antenna	54
8.3	Connecting the serial cable	54
8.4	Grounding the Raven Case	54
8.5	Connecting the power cable.....	54
9.	Raven GPRS Technical Specifications.....	57
9.1	Physical Characteristics	57
9.2	Power Specifications	57
9.3	Environmental	57
9.4	RF Features	57
9.5	Status LED Display	58
9.6	Application Interface Features	58

Raven GPRS User Guide

1. Introduction

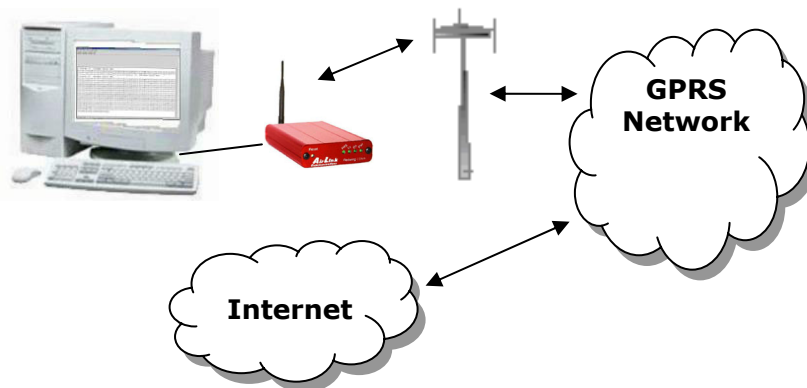
The GSM/GPRS wireless network combines the world's leading wireless standard—the Global System for Mobile Communications (GSM)—with fast, packet-switched access to data networks such as the Internet. Providing this fast access is the General Packet Radio Service (GPRS).

The AirLink GPRS modems are designed to operate in GSM/GPRS networks. Two data services are available in the GSM/GPRS networks: GPRS, a packet switched connection, and SMS, a short message service..

GPRS

GPRS is an IP-based service that offers fast, packet-switched access to data networks such as the Internet. It is a mobile service that improves the peak-time capacity of a GSM network. GPRS gives packet-switched access over GSM to external data networks with high peak transfer capacity. The main objective of GPRS is to offer access to standard data networks such as TCP/IP. GPRS is a non-voice service designed specifically for transmitting data. It breaks data messages into separate packets for transmission from the mobile device and sends them to destinations in an external network.

Most any Internet-based application or service will run on GPRS. GPRS offers peak throughputs of 40 Kbps (53.6 Kbps raw) Because GPRS capacity is shared among active users in the same coverage area, actual throughputs may vary.



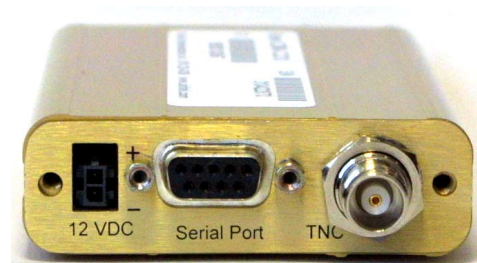
1.1 Raven Product Overview

The AirLink Raven GPRS is a rugged, full duplex GPRS modem that provides wireless transport capabilities for fixed and mobile applications. GPRS is an efficient and secure wireless technology that works well for fixed or mobile applications.

The Raven's rugged form factor is ideal for industrial and commercial applications that require real-time communications. The Raven provides wireless data communications for a variety of applications, such as telemetry, public safety, SCADA, traffic control, traffic metering, transit arrival systems and more.



Front of Raven



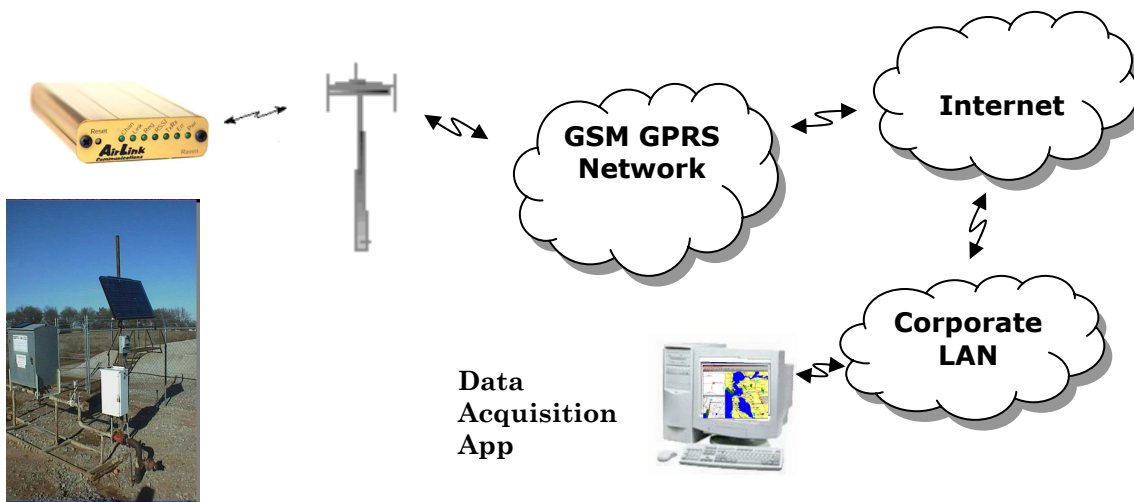
Back of Raven

2. Network Connection

The AirLink GPRS modems are capable of providing network connections for GPRS and SMS data.

2.1 Internet (TCP/IP) Connections via GPRS

When using a Raven or PinPoint GPRS modem, remote access to is done via a PPP (TCP/IP) connection to the GPRS network. The GPRS carrier actually provides Internet connectivity, and, therefore, it becomes the ISP for that session. Applications such as web browsing, email, FTP, etc., should work as they would normally.



NOTE: Connections to Internet are provided by carrier.

Corporate network connections are unique and not provided as part of service.

2.2 Data Connections

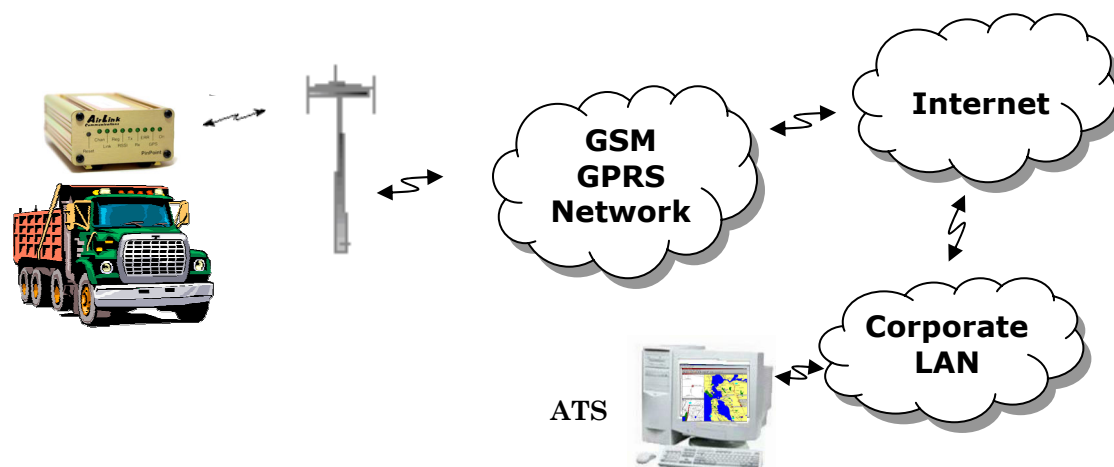
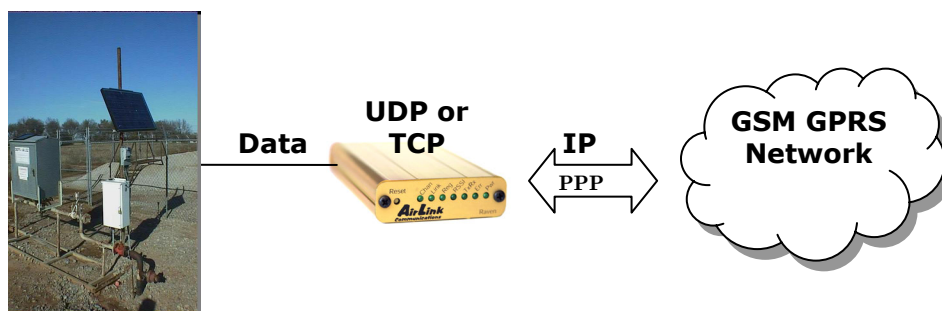
When the Raven is powered on, it automatically searches for GPRS service and establishes a PPP link between the Raven and the network. The Raven obtains its public or private IP and is ready to communicate.



If the host establishes a PPP link to the Raven, a second PPP link is created between the Raven and the host. IP packets can then be sent to and received from the GPRS network.



If the host device is to send and receive data via the Raven or PinPoint, then the modem can be configured to use either one of the UDP or TCP packet assembly/disassembly modes.



3. Raven and PinPoint GPRS Configuration

Configuration of the Raven and PinPoint GPRS modem is done using a terminal emulation program like HyperTerminal in Windows.

IMPORTANT NOTE: At this time Wireless ACE *cannot* be used to configure the GPRS modems from a Windows computer. A future version of Wireless ACE will be available with this functionality.

However, *remote* configuration of the modem is possible with a telnet application. (See Section 3.3.)

3.1 Local Configuration

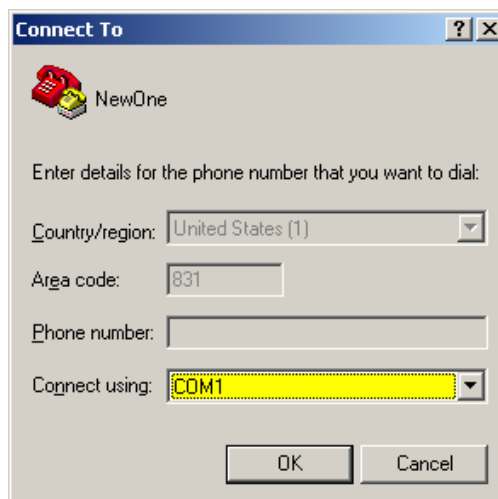
1. Attach the antennas, DB-9 cable and power to the back of the modem.
2. Power on the modem, and ensure the **On** light is lit.
3. Attach the modem to the back of the PC with the provided DB-9 cable.

(Note, if you did not order a cable with your modem, you need a straight-thru RS-232 cable to attach to the modem.)

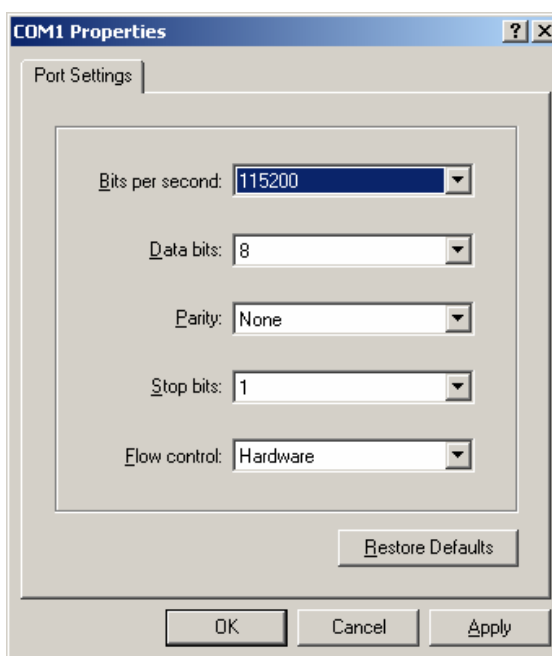
4. Select **Start→ Programs→ Accessories→ Communications→ HyperTerminal**.



5. Enter the name of the connection and select **OK**.

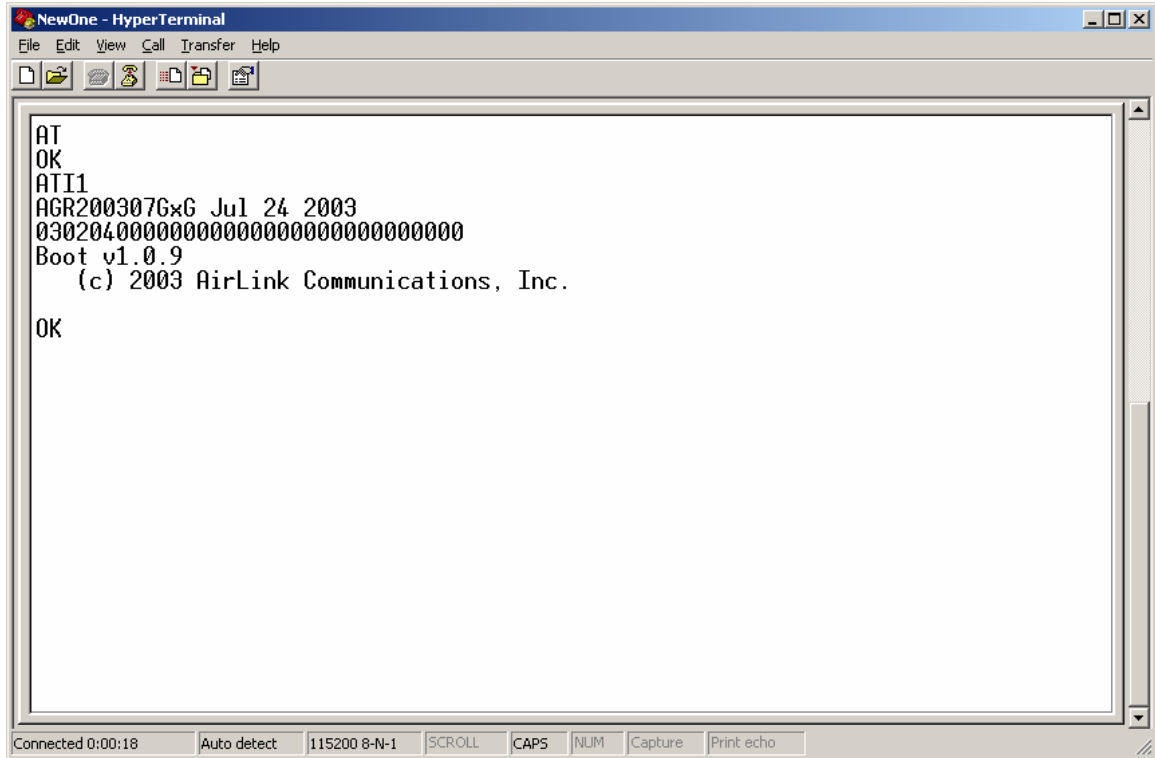


6. For "Connect using" select the COM port that the modem is on (do *not* select a modem driver), then select **OK**.



7. Select **115200** for the "Bits per second." Ensure Data Bits: **8**, Parity: **None**, Stop bits: **1** and Flow control: **Hardware**. Then select **OK**.

(These are the factory default settings for a GPRS modem. If you get garbled characters when typing AT commands, change these settings and reconnect to the modem. For example, change the baud rate to 57,600 bits per second and connect again, etc.)



8. Type **AT** followed by **[Enter]**. You should receive an "OK" in response.
9. Type **ATI1** followed by **[Enter]**. This displays the modem firmware version and you should also see "AirLink Communications, Inc." in it which ensures you are talking to the AirLink modem. (If not, try changing COM ports.)

Other AT commands may now be issued to the modem. See Section **Using AT Commands** for a list of AT commands

3.2 Modem Activation

The GPRS modem is usually already set up to register online with a phone number, etc. pre-configured into it (by AirLink Communications, Inc.). When a modem is registered on the network and working, the lights will look like the following:



Note that the **RSSI** light may be flashing or solid, showing the strength of the signal. Also the **Tx/Rx** (transmit/receive) light will flash as data is transferred to and from the modem on the network.

If your modem lights look like the above when the modem is powered on, you do NOT need to configure the modem and may *skip* this section.

If, however, the **Reg** light is not lit, your modem may need a SIM, or you may need to select the PDP context.

- Connect up to configure the modem as in Section 3.1.
- If you are unfamiliar with using AT commands, please review Section **Using AT Commands** first.

3.2.1 SIM Check

You can check if a SIM [Subscriber Identity Module] is in the modem with the AT+CIMI? command. If a SIM is in the modem, you will see a response like the following:

at+cimi?

310380006255650

OK

The number is an abbreviated form of the IMSI [International Mobile Subscriber Identity] which is unique to each SIM.

If there is no SIM, there will be a blank response like the following:

at+cimi?

OK

3.2.2 PDP Context

Check if the PDP context is correct with the command:

AT+CGDCONT?

You should get a response like:

at+cgdcont?

1,IP,proxy

OK

If you get a blank response, you need to set the PDP context. You need the APN [Access Point Name] which you can obtain from the carrier rep or from whomever you received the account. Most companies will be using a custom APN that allows them to communicate with all

To set the PDP context:

at+cgdcont=1,"IP","apn_obtained_from_carrier"

at&w

You only need to do this once. Henceforth, the modem will use this setting to attach to the GPRS network.

3.3 Remote Configuration

Once the modem is online and registered, it can be contacted from a remote location via a setup that connects to the GPRS network using the same APN as the target modem. This can be accomplished by one of the following means:

- A frame relay link to the carrier's GPRS network
- A VPN [Virtual Private Network] connection to the carrier's GPRS network
- Another GPRS modem

where each of the above means is using the same APN as the target modem.

Using a telnet application, a connection can be made to the modem and then AT commands can be issued to configure the modem, just as if a local connection were being made to the modem.

(Note: If you wish to use Wireless ACE, please see the Important Note in Section 2.)

1. From a Command Prompt, type:
telnet "Host Address" "Port Number"
2. For the "Host address" enter the IP address of the modem. (**AT*NETIP?** will reveal the current device IP address.)
3. For the "Port Number" use **2332**. This is the *default* telnet port number for the GPRS modems. So it would look something like this:
 - **telnet 192.168.100.23 2332**
4. If the correct parameters have been entered, and the modem is currently online, you will get a "Password" prompt as shown below:

AirLink AT command Interpreter
Password *****

OK

5. Enter **12345** (default password) and press **[Enter]**. You will receive an **OK**.

Now you may enter any AT commands to the modem as you would if you were doing a local connection to the modem. See Section **Using AT Commands** for AT commands and their options.

You may want to set local echo in your terminal emulator to see what you type as you type. There is no remote echo function in the modem.

Note: If the modem is configured to use a DDNS [Dynamic Directory Name Server], you could use a name in place of the IP address above, as in:

telnet remote1.eairlink.com 2332

4. Windows Dial-Up Networking Setup

This section describes the setup of Windows to enable communications over the GPRS network. Windows 2000 is used as the example because it the one Windows OS revision that carries the most similarity to both Windows 98 as well as Windows XP.

4.1 Add Windows Modem Driver

4.1.1 Setup Modem

Connect the modem to the computer with the DB-9 cable.

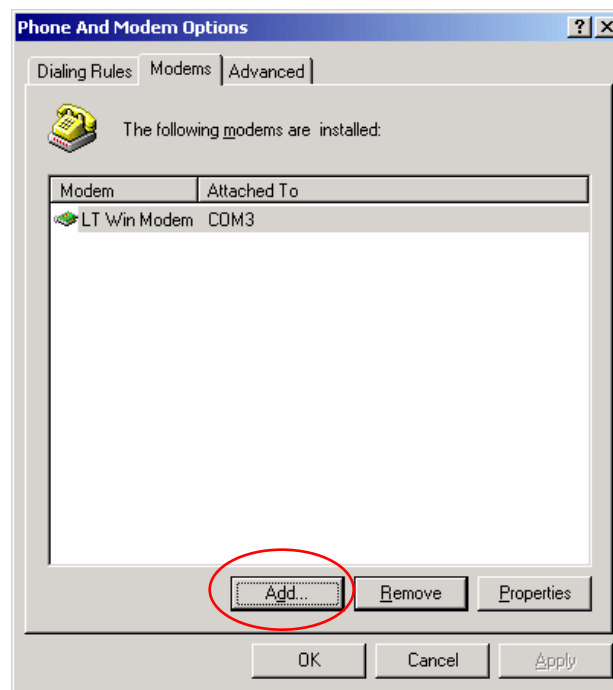
Plug in the AC adapter, connect the antenna(s) and power on the modem.

Obtain administrator privileges on your system.

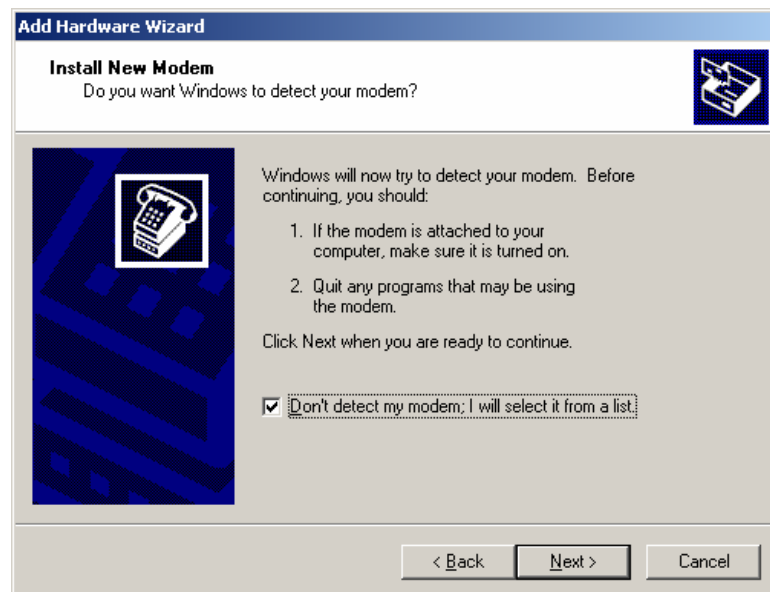
If you do not know how, check with your system administrator.

4.1.2 Add Modem Driver

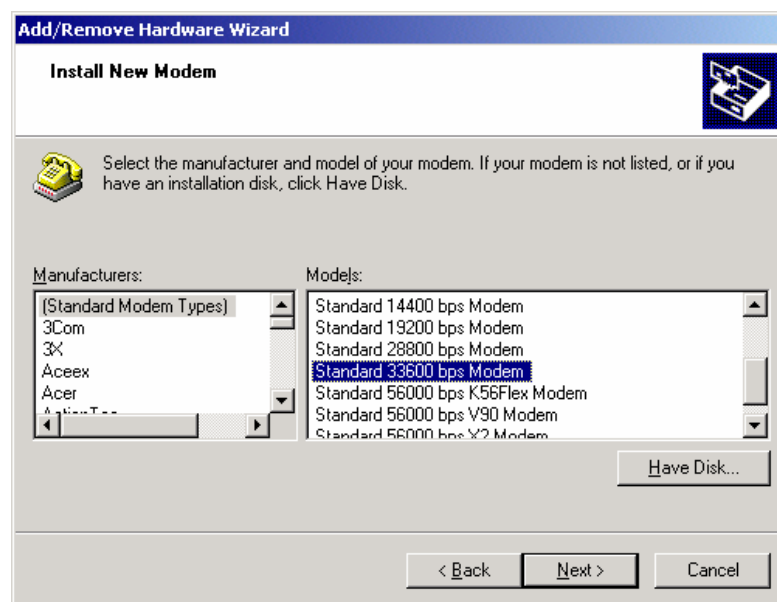
1. Select **Start→ Settings→ Control Panel→ Phone and Modems Options**.
2. You should see be in the Phone And Modem Options dialog box. Select the "Modems" tab.



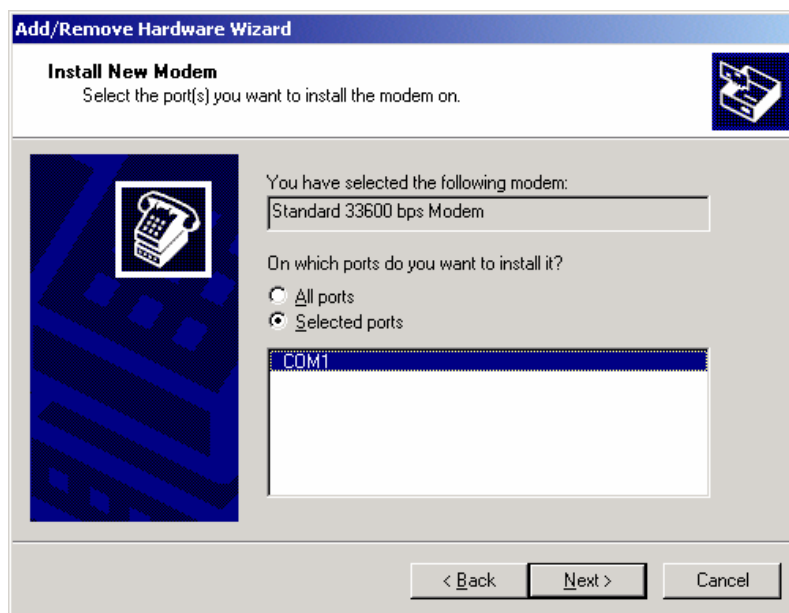
3. Select **Add**.



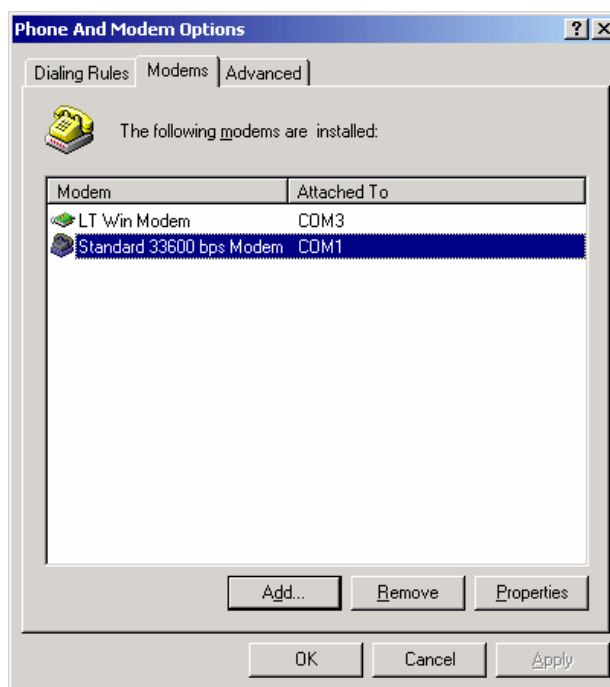
4. Check "Don't detect my modem..." and select **Next**.



5. Select "(Standard Modem Types)" from the Manufacturers and then select "Standard 33600 bps Modem" under Models.
6. Select **Next**.



7. Check Selected Ports, then select the COM port the modem is connected to and select **Next**.
8. Select **Finish** to exit the "Install New Modem" wizard.



9. You should see the modem added to the correct COM port.
10. To set the modem speed on the driver, highlight the modem driver and select **Properties**.
11. Ensure the "Maximum Port Speed" is set to **115200**, which is the default value of the GPRS modems.
12. Select **OK** to exit.

4.2 Windows Dial-Up Networking (PPP) Configuration

This section describes how to setup a Windows Dial-up Networking connection for an AirLink GPRS Modem. Windows 2000 Professional was used in this example. The connection uses PPP to communicate to the modem and gain access the Internet.

Before you start, you need the following:

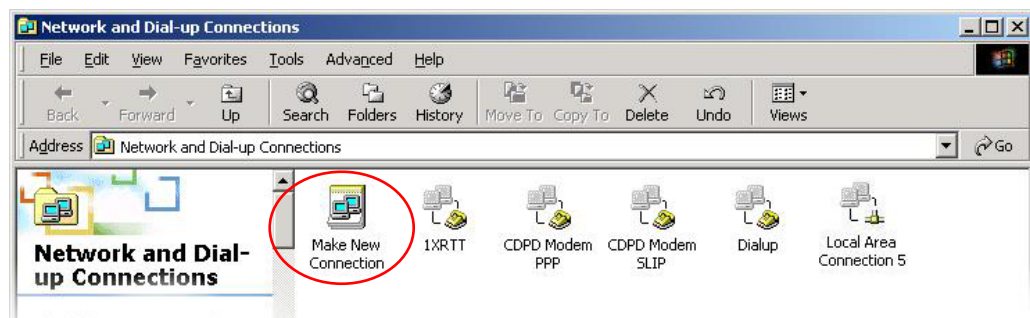
1. **Administrator** privileges to the computer you are configuring or access granted by an administrator on the network to add/remove devices to your computer. (Not necessary on Windows 98/ME.)
2. Windows COM Port and modem set up for a Standard 33600 Modem (see Section 4.1).
3. No other program is to be running that is using the serial (COM) port that your modem is attached to.

NOTE: If you have an existing LAN connection, then this dial-up connection to your GPRS modem may **interfere** with your existing connection. Once the connection is initiated it will take over as the "default route" for the majority of your LAN traffic, specifically Internet access. It's recommended to disconnect your LAN connection before using a PPP connection with your AirLink modem.

If however you want the two connections to co-exist, you can de-select "Use default gateway on remote network" (described later) and you can use the **route** command to setup routing through the modem properly. Go to a Command Prompt and type **route /?** to find out more, or talk to your administrator.

Now that the modem has been added, the Dial-up connection must be created.

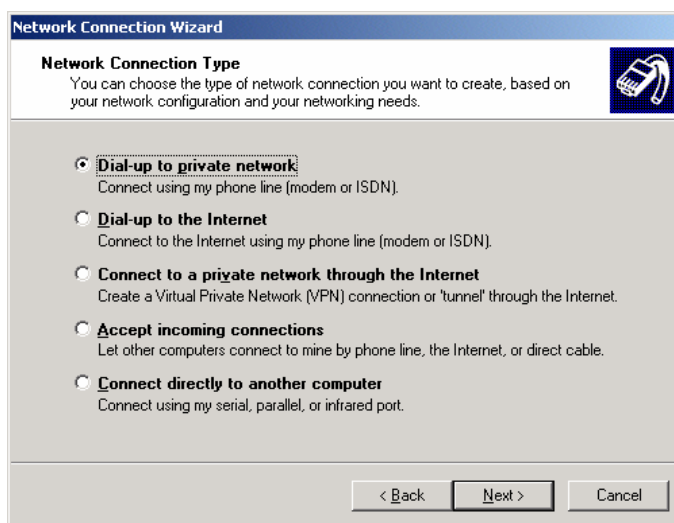
1. Select **Start→ Settings→ Control Panel→ Network and Dial-Up Connections**.



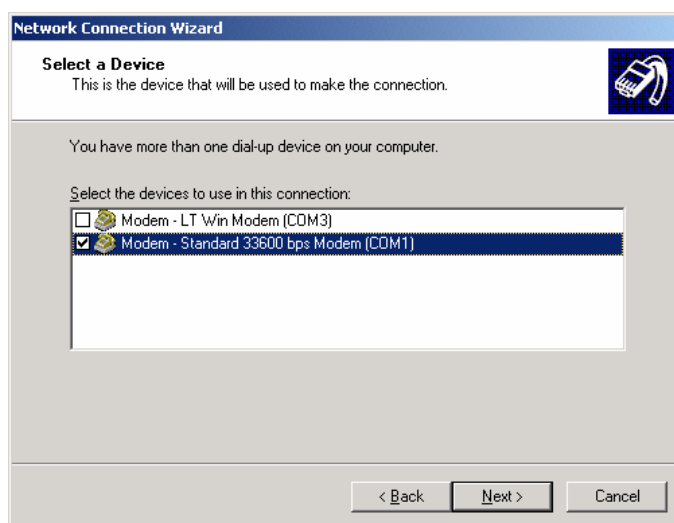
2. Double-click on the "Make New Connection" icon.



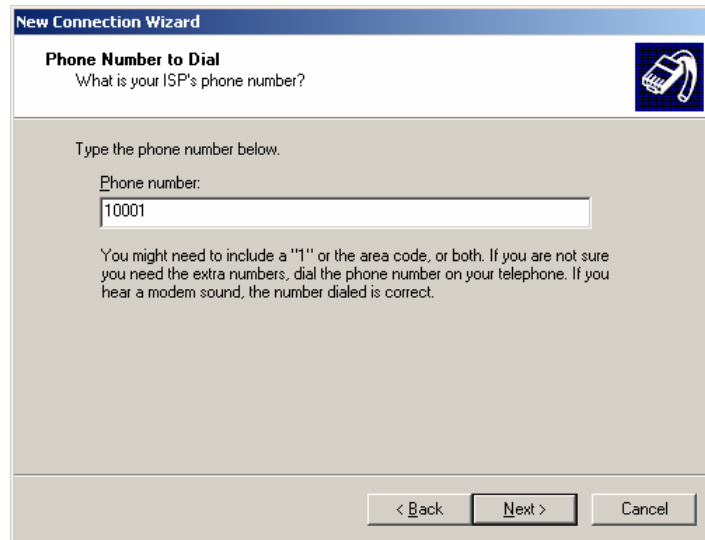
3. When the Connection Wizard starts, select **Next**.



4. Select "Dial-up to private network" and select **Next**.



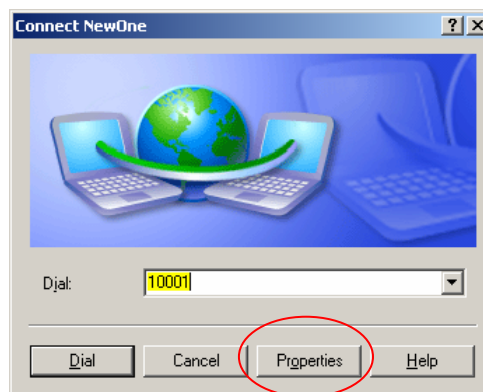
5. Check the box next to "**Modem – Standard 33600bps**" and select **Next**.



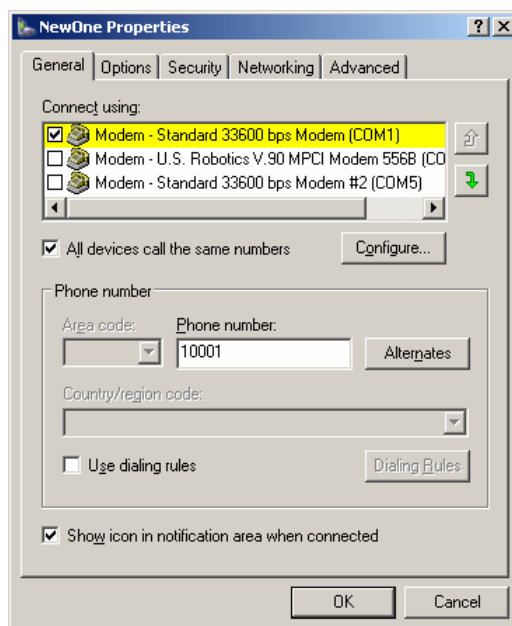
6. Enter the **Phone Number: 10001** and then select **Next**.
7. Select whether you want **all users** or just yourself to have access to this connection, and select **Next**.
8. Enter **NewOne** for the name of the connection. If you want to add an icon for this connection on the desktop, check "**Add a shortcut to my desktop.**"
9. Select **Finish** to exit the "Network Connection Wizard."

Note: Now some manual configuration changes need to be made to the connection before it can be used.

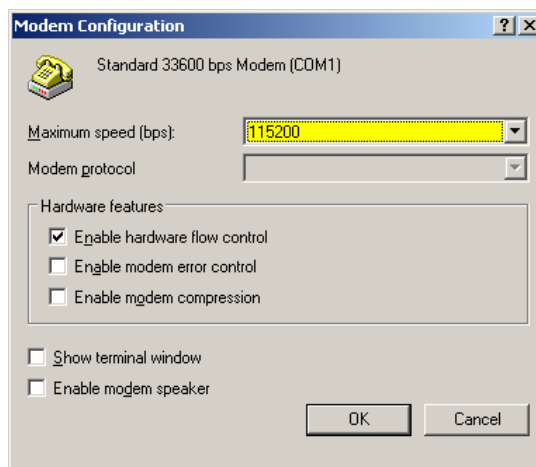
10. The "**Connect NewOne**" dialog box should come up next.
11. Leave the **User name** and **Password** blank.
12. Select **Properties**.



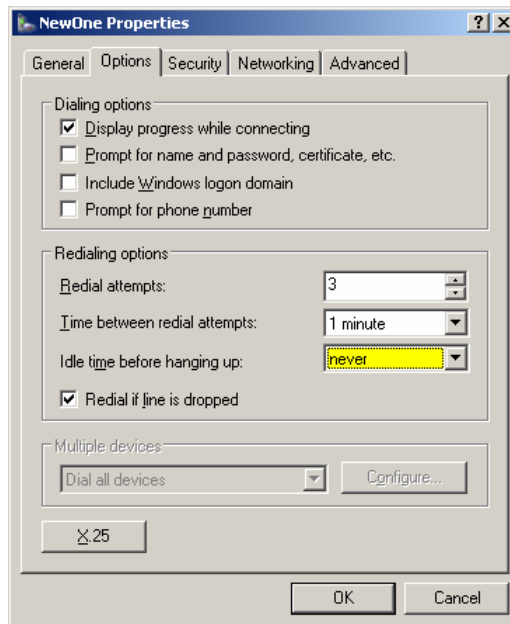
13. Examine the **General** tab settings.



14. “**Connect using**” should have a check next to “**Modem – Standard 33600bps Modem (COMx).**”
15. Enter “**10001**”for the “**Phone number**”.
16. Uncheck “**Use dialing rules**” and check “**Show icon in taskbar when connected.**”
17. Select the **Configure** button.



18. Maximum Speed: **115200**.
19. Check **Enable hardware flow control**.
20. Uncheck all other options.
21. Select **OK**.
22. Select the **Options** tab.

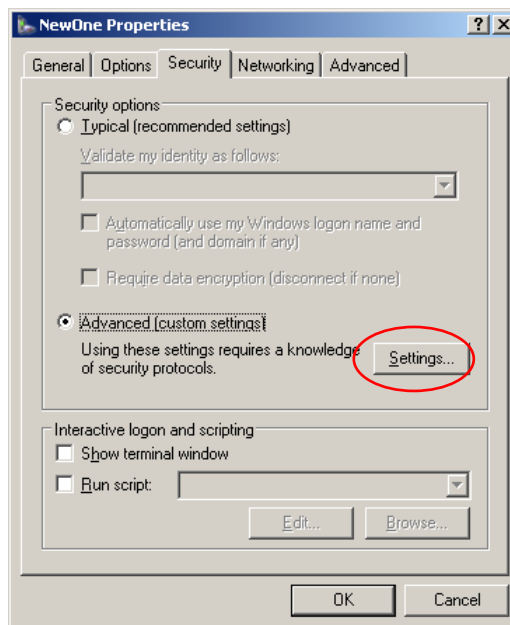


23. Check or Uncheck options as your application requires.

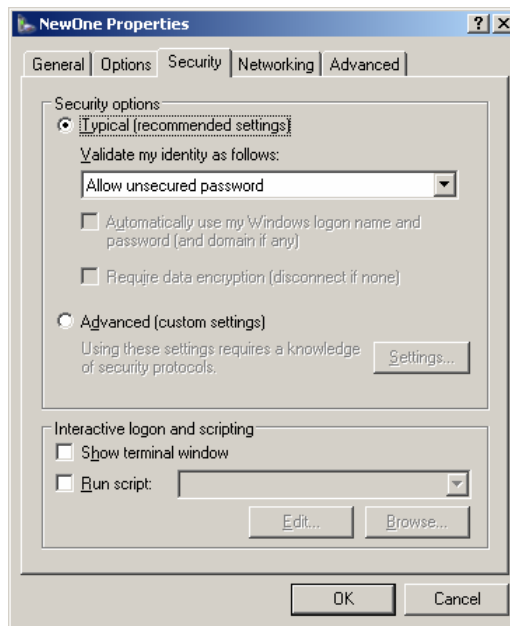
24. Set the "Redialing options" that will meet your needs.

Note: The options shown here should work for most applications. Consult your Network Administrator for more help on connection options.

25. Select the **Security** tab.



26. Select "Advanced (custom settings)."

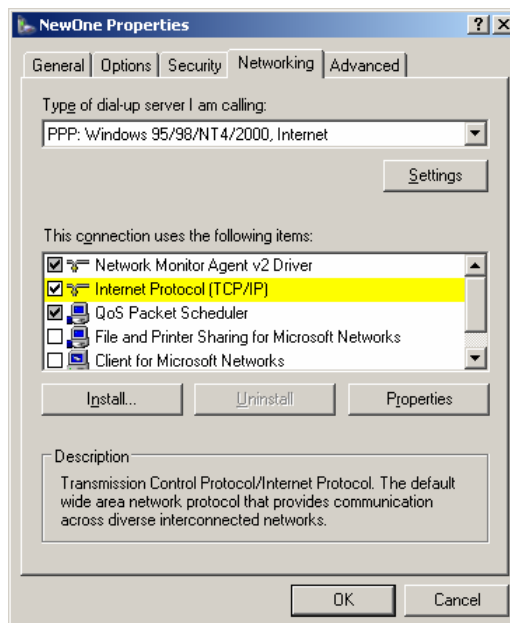


27. For "Security Options" check **"Typical recommended settings"**

28. In **"Validate my identity as follows:"**, select **"Allow unsecured password"**. Your identity and security is taken care of in the SIM.

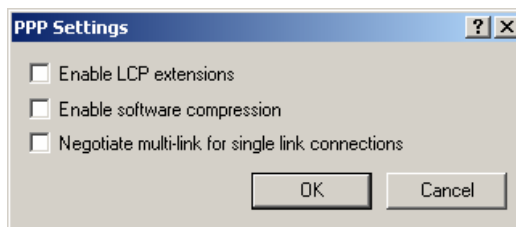
29. Select **OK**.

30. Select the **Networking** tab.

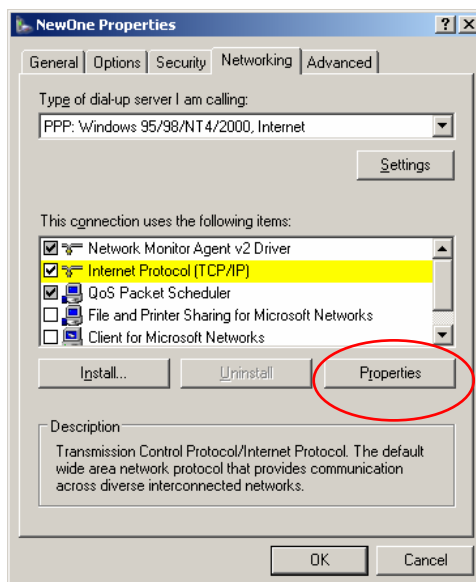


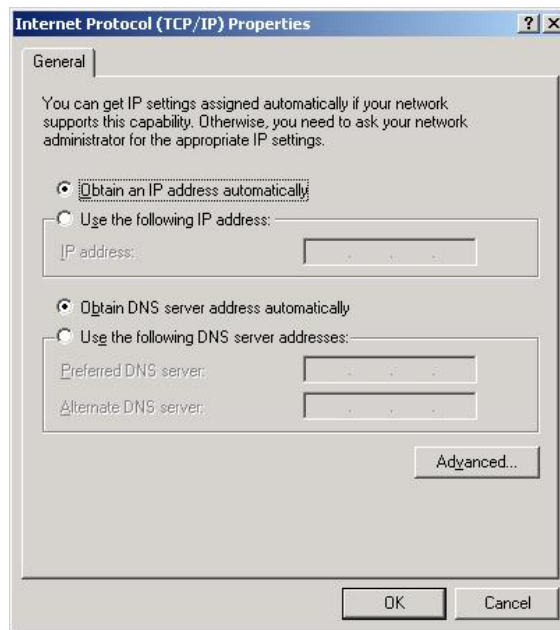
31. Type of dial-up server should show **"PPP: Windows 95/98/NT 4/2000, Internet."**

32. Select the **Settings** button.

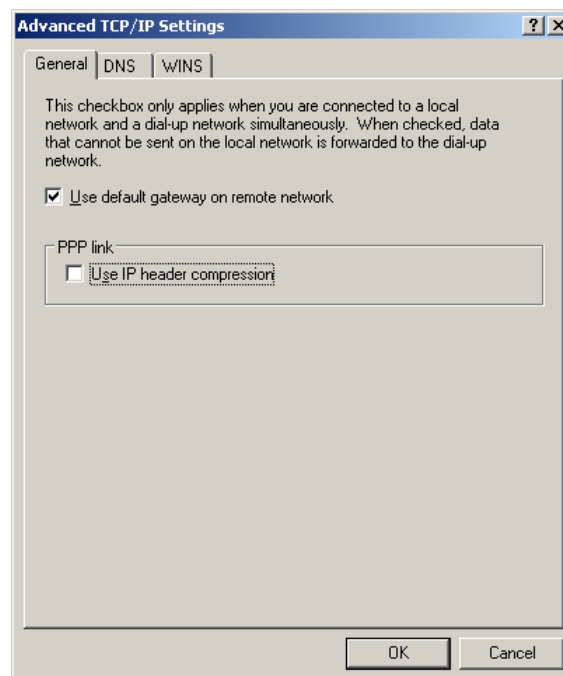


33. Uncheck all three of the PPP Settings options.
34. Select **OK**.
35. In the Components section of the Networking tab, **Internet Protocol (TCP/IP)** should be checked.
36. Select (highlight) **Internet Protocol (TCP/IP)** and then select **Properties**.





37. **"Obtain an IP address automatically"** should be checked.
38. Normally, DNS server addresses are provided during PPP negotiations. If it is necessary for you to enter DNS entries, check/enable **"Use the following DNS server addresses"** and put in the proper addresses. *(See your carrier or Network Admin for details.)*
39. Select the **Advanced** button.



40. Check **Use default gateway on remote network** and uncheck **Use IP header compression**.

41. Select **OK**.
42. Leave the options under the **Sharing** tab unchecked.
43. Select **OK**.

4.3 Making a GPRS Data Connection

To make a GPRS data connection.

1. Go to Network and Dial-Up Connections and double-click on the NewOne icon.
2. Click on **Dial**.

If you have enabled the connection progress display, you will see the connection being made:

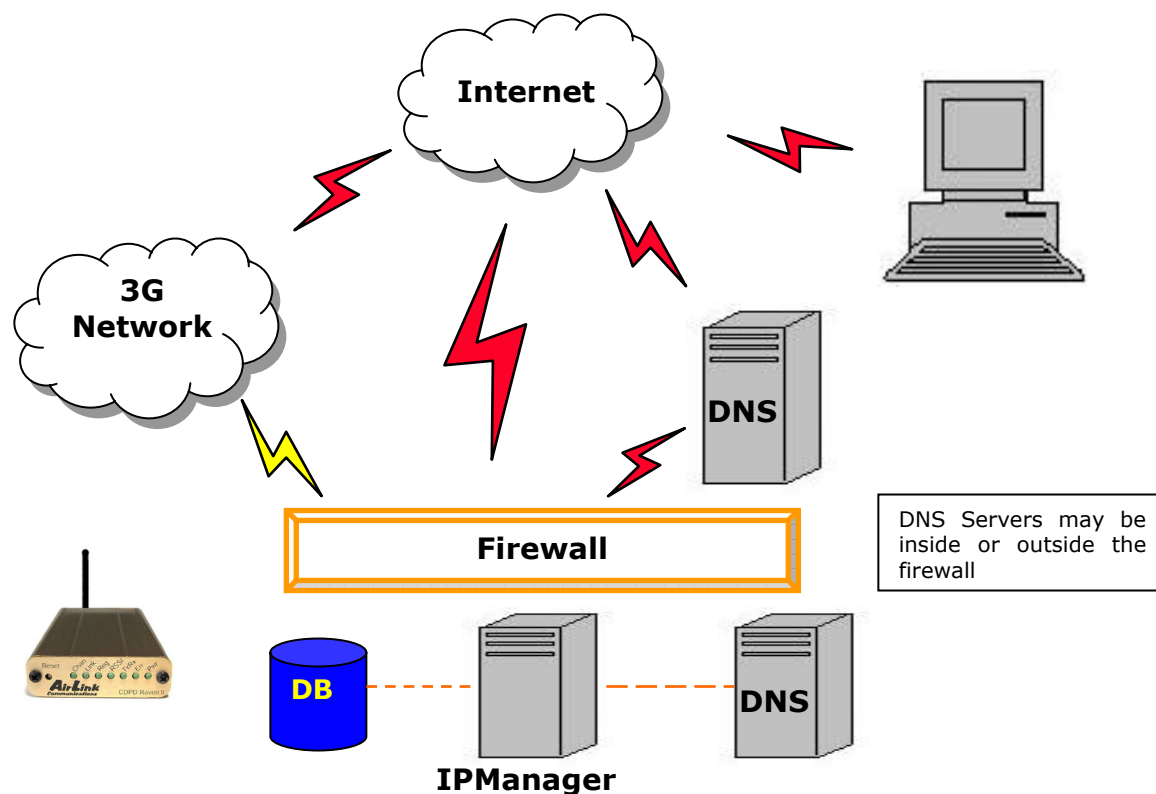
Once connected, you will see the connection status displayed in the System Tray on the Task Bar.

5. Dynamic IP Addresses

Many modern wireless data technologies use dynamic IP addresses rather than static IP addresses. This poses a problem for AirLink customers since they cannot contact their modems unless their addresses are known. AirLink offers a family of solutions designed for the different situations existing with our customers. One of the solutions, an IPManager System that implements a wireless Dynamic Domain Name Server, DDNS.

IPManager is a system which tracks the current IP address which a modem has been assigned. The DDNS system consists of three main components. One component is a task in the modem firmware which issues an update notification to the IPManager server when the modem is assigned a new IP address. The second component is the IPManager server which receives IP change notifications from all modems and updates a DNS server, the third component. It may, optionally, log the latest known IP address in a database, which may be accessed to see a history of the IP updates.

Customers may then use the wireless Dynamic DNS server to obtain the current IP of an AirLink modem. The following diagram shows the IPManager system elements.



5.1 IPManager and Dynamic DNS Updates

The IPManager system provides a mechanism to implement a wireless Dynamic DNS service. If the IPManager settings are configured, the modem will send IP change notification messages to AirLink IPManager servers. These servers will then acknowledge the notifications and dynamically update a DNS server, thus allowing users to access a modem by domain name. The ***IPMANAGER1** and ***IPMANAGER2** settings can be set to either the domain name or IP address of a server to notify. The ***MODEMNAME** setting should be set to the name to prefix to the domain zone for which the IP Manager server is responsible. For example, if ***MODEMNAME=mymodem** and ***IPMANAGER1** points to a server responsible for the **eaairlink.com** domain zone, then the modem's fully qualified domain name will be: **mymodem.eaairlink.com**.

To configure your AirLink modem to be addressed by name, the modem needs to have 4 elements configured:

1. Modem name
2. Domain
3. IPManager IP Address
4. IPManager update interval

The following illustrates a way to configure an AirLink modem to be addressed by name:

at*modemname=mymodem

at*domain=eaairlink.com

at*ipmanager1=eaairlink.com

at*ipmgrupdate=60 [to update the DNS server at least hourly]

5.2 Using Names in the Modem, Domain Name Resolving

The AirLink modems have an integrated DNS resolver, which uses the DNS entries specified by the ***DNS1**, ***DNS2**, and ***DNSUSER** settings. This allows the use of names in the AirLink modems instead of IP addresses.

Both regular and reverse DNS lookups are supported. **ATNSLOOKUP** command will allow the lookup of an address or domain name. (e.g. **atnslookup=www.microsoft.com** will return the IP address for **www.microsoft.com**, while **atnslookup=64.163.70.10** should return **airlink.com**). If a name resolution is performed on a name which is not fully qualified (i.e. contains no dotted portions), the value from ***DOMAIN** will be concatenated to the end.

Typically the ***DNS1** and ***DNS2** values will be automatically filled in when a connection is negotiated with the carrier. The ***DNSUSER** value is provided to allow the user to specify a DNS server to check with before resorting to the carrier provided servers. If ***DNSUSER** is set to 0.0.0.0, it will be ignored and only the carrier DNS's will be consulted. If it is set, the name server at the provided address will be queried first. If it doesn't respond (within the timeout period, 10s) or can't find the requested entry, the carrier DNS's will then be queried.

The special domain name "**ppp-peer**" will always resolve to the address to use to communicate with the PPP (or SLIP) host peer connected to the host port. If there is no PPP (or SLIP) peer (i.e. modem is not in PPP or SLIP mode), then "**ppp-peer**" will resolve to 0.0.0.0. If, for example, you wanted to report IP address changes to the

host connected via the serial link, you could set **AT*IPMANAGER2=ppp-peer** to cause updates to be sent to the serial host.

6. Serial Communication Modes

In this section the following terminology is used:

Host:	This is the computer or terminal that is attached to the serial port of the Raven. Also known as the DTE.
Modem:	The Raven GPRS. The DCE to the host.
OEM Modem:	The embedded communications transceiver module.
Server:	A computer to which a Raven is communicating wirelessly.

An AirLink modem can be in one of six serial communication modes with the attached Host:

AT:	The modem accepts and responds to standard, Hayes-style AT commands. This is the default.
PPP:	Modem is using PPP to communicate with the Host.
PassThru:	Direct connection to internal OEM Module.
UDP PAD:	Any data received on the serial port is assembled into UDP packets and send to the session's associated IP and Port (described later). Any responses received from the associated IP and port destined for the modem's Device Port are unwrapped and sent out the serial port.
TCP PAD:	Any data received on the serial port is packaged into TCP messages and sent to the associated connection's IP and Port (described later). Any data received from the TCP peer is unwrapped and sent out the serial port.
SLIP:	Modem is using SLIP to communicate with the Host.

The default mode is AT command. If the modem is in any of the other modes, the AT command mode can be re-entered by:

- Deactivating DTR (if **&D2** or **Ignore DTR, S211**, is not set)
- Issuing the **+++** escape sequence (if **Disable AT Escape, DAE**, is not set)
- Resetting or Power cycling the modem.

The **PassThru** mode can only be exited by resetting the modem

The modem can be programmed to enter one of the other modes automatically on power up. This is done setting the **Startup Mode Default (MD)** to the desired mode. If this setting is non-zero, the modem will enter the specified mode after 5 seconds. If you want to cancel this behavior, the **ATMD0** command can be used before the 5-second timeout expires.

The modes are described in more detail in the following sections.

6.1 AT Mode

AT commands are used to configure the modem, command it to do something, or query a setting.

AT commands must always be terminated by **<CR>** (ASCII character 0x0D).

If **E=1** (Echo On), the AT command (including the terminating **<CR>**) will be output before any responses defined in the next section.

Response Framing

Two settings affect the format of AT command output: **V (Verbose)** and **Q (Quiet)**.

If **Q=1** (Quiet On), no result codes are output whatsoever, so there is no response generated by a (non query) command. If **Q=0** (Quiet Off), result codes are output. The format of this output is then affected by the **Verbose** setting.

If Quiet mode is off, the result code is affected as follows: For **V=1** (Verbose mode), the textual result code is surrounded by **<CR><LF>** and any AT query response is also surrounded by **<CR><LF>**; for **V=0**, (Terse mode), a numeric result code is output with a single trailing **<CR>** (no **<LF>** is output), while any AT query response is followed by **<CR><LF>** (there is no preceding output).

For example, possible output to the AT command “**AT<CR>**” (assuming quiet mode is not on) is:

0**<CR>** - if V=0

<CR><LF>OK<CR><LF> - if V=1

6.2 PPP Mode

In PPP mode, the modem acts as a PPP server, providing an IP address, and DNS servers (if available) to the Host.

PPP mode is entered from the AT mode by using any of the following commands:

- **AT\APPP<CR>**
- **ATDT10.0.0.1<CR>**
- **ATDT10001<CR>**
- **ATD#19788<CR>**
- **CLIENT<CR>**

In response to any of the preceding commands, the modem will respond with

CONNECT<CR><lf>

and is ready for the host to begin PPP negotiations.

The IP received by the host in the resulting negotiation will either be a private (non-routable) IP or a public (network-routable) IP provided by the network, depending on the settings of ***USEPRIVATEIP [S300]**. If ***USEPRIVATEIP =1**, the value of the private IP can be determined beforehand by querying **S110**. The private IP to be used

can be defined with the command **AT*PRIVATEIP=192.168.100.33** substituting the desired IP address.

Using a private IP insulates the PPP client from changes in IP addresses of the underlying network, as the AirLink modem will perform basic NAT-like address translation on all packets.

If a public IP address is being used, any changes in the IP (as determined by the wireless network) will result in the PPP link to the host being disconnected, requiring the host to reinitiate it. The public IP is passed to the host in the PPP negotiations, so when the network forces a change, the modem has to force the host to renegotiate the PPP link to make this happen.

The host can exit PPP mode by deactivating DTR (if **S211=0** or **&D2**) or issuing the **+++** escape sequence.

Note that DTR needs to be asserted (or **S211=1** or **&D0**) by the host before PPP mode can be entered.

6.3 PassThru Mode

In PassThru mode, all serial traffic is sent directly between the internal OEM Module and the host. In this mode, the modem does not behave normally. This mode can be used to configure OEM Module-specific settings (e.g., for provisioning, etc.)

Issuing the **"AT\APASSTHRU"** enters this mode. The modem responds with **CONNECT**, at which point a direct connection to the OEM Module is established.

Note that some OEM Modules requires upwards of 20 seconds before AT commands can be entered, so be patient if there seems to be no response to AT commands.

This mode can only be exited by resetting or power-cycling the modem. This mode cannot be entered via a telnet session.

6.4 UDP PAD Mode

When the modem is in UDP PAD (Packet Assembly and Disassembly) Mode, all characters received on the serial port are assembled into UDP packets and sent to the mode's remote IP address/port, and any packets received from the same IP/port--destined for the modem's Device Port (see ***DPORT**)--are disassembled and dumped onto the serial line. Note that DTR needs to be asserted (or **S211=1** or **&D0**) by the host before a UDP session can be entered.

A UDP session is initiated by one of the following events:

- Using the Dial UDP (**DP**) AT command (as in **ATDP192.168.3.23/3456**)
- Setting the Startup Mode Default (**MD**) to **3** (UDP) so that a UDP session is entered automatically when the modem powers up. Serial data will be sent to the **IP/port** specified in **S53**.
- An incoming UDP packet is received and
 - UDP auto answer is enabled (**S82=2**)
 - The destination IP address matches that in **S53**
 - Or **allow any IP** is set (**AIP=1**)

- The modem is in AT mode [not in a current UDP or TCP session]

UDP packet assembly is affected by the values of **S50** (PAD Forwarding Timeout) and **S51** (PAD Forwarding Character). Data received in the serial buffer will be transmitted when the idle inter-character timeout specified in **S50** (in tenths of seconds) occurs or when a character is received that matches **S51** (if non-zero).

The host can exit UDP mode by deactivating DTR (if **S211=0** or **&D2**) or by issuing the **+++** escape sequence.

6.4.1 UDP Auto Answer

UDP auto answer (previously called UDP half-open) is set with **S82=2**. When set, the modem will automatically establish a UDP session to the source IP address and port of the UDP packet received. The modem will remain “locked” to this one remote IP/port until no data is sent or received for the time interval defined in the UDP auto answer timeout (**S83**). During this session, packets from other IP/port addresses will be rejected, unless ***UALL** is set. Whether or not an incoming packet will cause the modem to enter a UDP session is always dependent on the **S53** and **AIP** settings.

When idle, after the timeout has occurred, the modem is in AT command mode on the serial port, and any valid AT command may be entered during this time.

The **Normal UDP Mode (MD3)** can be combined with **UDP auto answer** to cause the incoming serial data to be sent in UDP packets (instead of being treated as AT commands), while allowing sessions to be established from different UDP sources. A UDP session will be initiated either by incoming serial data or by an incoming UDP packet. The session, started by either method, will be terminated when no data has been sent or received for the **S82** period. Once the session terminates, another may be initiated by either means.

When the session is initiated by serial data, the new session will be established using the destination address specified in **S53**. The **S53** setting can be changed if the **connect to last UDP** setting (***UDPLAST=1**) is set. The address in **S53** will be updated to reflect the address of the last session initiated by an incoming UDP packet. So that when new data is received over the host serial port while in the idle state, a session will be re-established with the last address. (This behavior is the same as the previous Hybrid2 (**MD6**) mode).

Note that **TCP auto answer (S0=[1|2])** may also be set simultaneously with **UDP auto answer**. Then, when in the idle state, the modem will accept either a **TCP** or **UDP** incoming packet, and enter a **TCP** or **UDP** session as appropriate.

6.4.2 Reliable UDP

Reliable UDP adds a simple protocol on top of UDP to provide reliable deliver of data. When data is received from the host serial port, a 2 byte header is added to the data, containing a message type and a sequence number. The modem will continue to send this data (buffering any received data in the meantime) until it receives an acknowledgement with this sequence number. If an acknowledgement is not received within the timeout period (specified in **S7**), the data will be retransmitted. This will continue until an acknowledgement is received or the modem is reset. Likewise any UDP packets received by the modem are expected to have this simple header. The modem will issue an acknowledgement for any valid packets which are received.

Configure the modem as for a normal UDP session. Set the **Startup Mode Default** to **3**, and the **UDP Mode Default** to **7 [ATMD73]**. If using two modems, configure

the Destination IP and Port in each to point to each other. Serial data will then be sent reliably between the two

Although it adds reliability, the simple implementation of the Reliable UDP mode in the modem does not check for duplicate packets.

6.4.3 Multicast UDP [Raven Only Feature]

Multicast UDP results in any data received from the host serial port being sent to all the clients in the Modbus list. The remote port number is taken from **S53**. To avoid flooding the network, the packets are sent to each client with a 20ms pause in between. The receipt of UDP packets works as in normal UDP mode (i.e. bound by the value **S53** and/or **AIP**). Since it may take a while to transmit the data to all hosts (especially if all 20 Modbus entries are used and name resolutions are required), new data received from the host port is buffered until current transmissions to all hosts are finished.

Enter the list of target IPs in the Modbus IP list. The index numbers in the IP list aren't used. Configure the Raven as for a normal UDP session. Set the **Startup Mode Default** to **3**, and the **UDP Mode Default** to **8 [ATMD83]**. Configure the Destination port to match the device port of the remote modems.

6.5 TCP PAD Mode

When the modem is in a TCP session, all characters received on the serial port are assembled into TCP packets and sent to the mode's remote IP address/port, and any packets received from the remote end of the TCP connection are disassembled and dumped onto the serial line. Note that DTR needs to be asserted (or **S211=1** or **&D0**) by the host before a TCP session can be entered.

A TCP connection is established by one of the following methods:

- Using the **Dial TCP (DT)** AT command (as in, **ATDT192.168.3.23/3456**)
- TCP auto answer is enabled (**S0=1 | 2**), a TCP connection request is received, and the modem is not in a data session.
- Data is received on the serial port and
 - The Startup Mode Default (**MD**) is **4 (auto TCP)**
 - The remote TCP destination, as defined in **S53**, successfully responds to the TCP connection request.

The value of **S7** (TCP Connection Timeout) specifies the number of seconds to wait, after initiating a TCP connection attempt, for a successful connection to be established. If the connection has not been successfully established before the timeout occurs, **ERROR/BUSY** is returned.

TCP packet assembly is affected by the values of **S50** (PAD Forwarding Timeout) and **S51** (PAD Forwarding Character). Data received in the serial buffer will be transmitted when the idle inter-character timeout specified in **S50** (in tenths of seconds) occurs or when a character is received that matches **S51** (if non-zero).

The TCP session will be terminated if no data is transmitted or received for the time interval specified in **TCPT** and **TCPS**. **TCPT** is the number of minutes [**TCPS=0**] or seconds [**TCPS=1**] used for this idle timeout.

TCPT should never be 0 when using the TCP mode. A broken TCP session can result in the modem being left with a TCP half-open connection that can only be terminated with a reset.

The host can also terminate a TCP session by deactivating **DTR** (if **S211=0** or **&D2**) or issuing the **+++** escape sequence.

Note that DTR needs to be asserted (or **S211=1** or **&D0**) by the host before a TCP session can be started.

6.6 TCP Auto Answer

TCP auto answer (**S0=1|2**) also allows a TCP connection request to be “answered” when the modem is idle, not in a data session. Note that DTR needs to be asserted (or **S211=1** or **&D0**) by the host before a TCP session can be entered. The TCP connection request’s destination port has to match the modem’s device port.

Note that **UDP auto answer** may also be set simultaneously with **TCP auto answer**. Then, when in the idle state, the modem will accept either a **TCP** connection request or **UDP** incoming packet, and enter a **TCP** or **UDP** session as appropriate.

6.7 Hybrid Modes

Some previous hybrid modes (MD=5, 6) are no longer implemented as special, unique modes. Now that UDP auto answer (UDP Half-open, S82=2) can be enabled in conjunction with UDP PAD mode (MD3), effectively this is the same as MD5 and MD6 previously accomplished. Setting MD5 and MD6 are still supported, but not recommended, since all they do is set several settings as described below.

The settings to accomplish hybrid modes:

AT Setting	Hybrid (MD5)	Hybrid2 (MD6)
MD	3	3
S82	2	2
S0	1	1
*UDPLAST	0	1

6.8 SLIP Mode

SLIP mode is entered by using the “**AT\ASLIP**” command. As in PPP Mode, the IP address that the host assumes is affected by the setting of **S300**. SLIP does not negotiate the IP with the host, so before making a SLIP connection, the host SLIP driver must be configured to use the IP specified by querying **S110**.

The host can exit SLIP mode by deactivating DTR (if **S211=0** or **&D2**) or issuing the +++ AT escape sequence.

Note that DTR needs to be asserted (or **S211=1** or **&D0**) by the host before SLIP mode can be entered.

6.9 Modbus/BSAP Configuration [Raven Only Feature]

Modbus, BSAP, and Modbus variations are communications protocols that are widely used in telemetry. They were designed to be used in a radio environment where packets are broadcast to a group of remote units. Each Modbus packet contains an ID so that only the one remote unit, whose ID matches the ID in the packet, will respond to the host. The ID is used to address a specific remote.

When Ravens are used in place of radios, there is a Raven connected to the host computer and a Raven connected to each remote unit. Packets transmitted from the host need to contain the IP address of the specific remote unit whose ID matches the ID in the packet from the host computer.

The Modbus/BSAP feature adds the capability for a list of IP addresses or names, and matching remote IDs to be entered into the host Raven. When the host computer sends a poll request, the ID is matched to the corresponding IP address and a UDP packet is assembled using this IP address. The complete packet from the host is then encapsulated in this UDP packet and transmitted to the remote unit. The remote units operate in normal UDP mode and their data is sent to the host.

6.9.1 Configuring the Polling Host Application Raven

Set the **S53** Port to match whatever port number is being used on all the remote modems. For example, if the remote Ravens' **S110** port number being used is "12345", then the Modbus host Raven's **S53** port should be set to “12345”.

ATMD13	for Modbus ASCII
ATMD23	for Modbus RTU (Binary)
ATMD33	for BSAP
ATMD63	Variable Modbus [where you set up the individual parameters]

Enter the list of ID/Local addresses and their associated remote IP addresses or names as follows:

The ID/Local address and IP or name is entered using the **ATMLIST** or **ATMLISTX** commands. **ATMLIST** allows the ID to be entered in decimal, while **ATMLISTX** allows the ID to be entered in hex.

For example, if a remote's IP address is **123.456.133.45** or name is **remote1**, and its ID/Local address is **27**, you can enter:

ATMLIST27=123.456.133.45

If you want to enter the ID is hex:

ATMLISTX1B=123.456.133.45

Continue until all the remotes are entered. There can be a total of 20 remote ID/Local addresses entered into a Raven. Note a special build Raven Modbus Host version is available that allows up to 100 entries in the list.

Remember to save the entries with **AT&W**.

If Using Dynamic IPs

The host Raven should be configured to report its current IP to a DDNS server so the remote Ravens can use DDNS to obtain the host Raven's IP. The remote Ravens can then send their current IPs to the host Raven which will update the Modbus IP list by matching the modem names.

Enter names into the IP list as follows:

ATMLIST27=remote1

or **ATMLISTX1B=remote1**

Continue until all the remotes are entered. There can be a total of 20 remote ID/Local addresses entered into a Raven. Note a special build Raven Modbus Host version is available that allows up to 100 entries in the list.

Remember to save the entries with **AT&W**.

6.9.2 Configuring the Remote Ravens

The remote Ravens connected to the RTUs being polled, need to be set up for normal UDP operation.

ATMD3 for Normal UDP operation**For Static IPs**

Set **ATS53= IP address/port number** of the Raven connected to the Polling Host. If the polling host Raven's IP and port are **123.456.133.11** and **12345**, set as follows:

ATS53=123.456.133.11/12345**ATS53=home1/12345****If Using Dynamic IPs**

Set **ATS53= name/port number** of the host Raven. If the polling host Raven's ***MODEMNAME** and **Device Port** are **home1** and **12345**, set as follows:

ATS53=home1/12345

The remote Ravens need to be configured to update the host Raven with their current IPs. Set up ***IPMANAGER[1 | 2]** to point to the host Raven:

***IPMANAGER[1 | 2]=home1**

where **home1** = ***MODEMNAME** in the host Raven.

***DOMAIN** should match the domain of the host Raven. For example, if the DDNS being used is **eairlink.com**, then ***DOMAIN=eairlink.com**. And the fully qualified domain name the remote Raven would query is **home1.eairlink.com**.

A new IP update will be sent anytime the remote Raven detects that its IP has changed. A periodic update is a redundant process that guarantees the host Raven will be updated in the event the host Raven loses its IP list for any reason or the remote Raven's IP is changed or dropped without notification to the remote Raven. Configure the frequency the IP update will be occur.

AT*IPMGRUPDATE[1 | 2]=n

where n = minutes [0-255]

Other parameters may need to be changed, but this is dependent on the RTU type being used.

Remember to save your configuration with **AT&W**.

7. Using AT Commands

Use a terminal emulation program to connect up to the modem either locally (via the serial port of a computer) or remotely (over an existing internet connection on a PC to the modem at a remote location). Set up to connect to the modem by either method described in Section 2.

Sample AT Commands

Here is an example of entering AT commands, changing some settings, saving and resetting the modem. (Note that any command you are unsure of is explained in *The AT Commands* section.)

Type **AT** and press the Enter key. **AT<enter>**

You should get a response of "**0**" or "**OK**".

To turn on echo and verbose modes, type the following:

ATE1V1<enter>

You should see an "**OK**" response if Verbose Mode was properly activated (**V1**)

If you should see a "**0**" response, your modem is in Terse Mode and the **V1** command did not adhere.

Try **ATV1** again by itself if that happens. You should see an "**OK**" response now.

To set the baud rate, (like 115200), type the following:

ATS23=115200,8N1<enter>

You should get an "**OK**" (if in Verbose Mode)

Note: Command settings take effect immediately unless otherwise noted in the description.

Note: HyperTerm needs to be disconnected and reconnected after each baud rate change to have it take effect.

7.1 GPRS Specific AT Commands

These AT commands are specific to the GPRS devices and networks.

Command	Description
+CGDCONT=cid, PDP_type, APN [?]	Define the PDP context. Must be defined before a connection can be made to the GRPS network. Needs to be configured only once, the parameters are saved and used each time a connection is made to the GPRS network. cid = PDP Context Identifier: numeric parameter that specifies a PDP context definition. PDP_type = Packet Data Protocol type = "IP" APN = Access Point Name a logical name that is used to select the GGSN or the external packet data network. Can only be what's on the SIM AT+CGDCONT = 1,"IP","proxy" AT+CGDCONT = 1,"IP","public"
+COPS?	Returns the currently selected network operator. AT+COPS? AT&T Wireless OK
+ICCID?	Returns the 20 digit SIM ID AT+ICCID? 89310380101024729959 OK

Command	Description
+RCIQ?	Returns the current cell information. AT+RCIQ? Serving Cell Info: BSIC: 5 TCH: 563 RSSI: -82dBm LAC: 6035 Cell ID: 4043 Dedicated Channel Info: TCH: 564 Channel Mode: 0 OK If there is not coverage, or unit has not yet registered: AT+RCIQ? +RCIQ: Not Registered with Network BSIC = Base Transceiver Station Identity Code TCH = Traffic Channel RSSI = Received Signal Strength Indicator LAC = Location Area Code

7.2 Raven and PinPoint AT Command Reference

Command	Description
+++	AT Escape sequence (not preceded by AT). If modem is in a data mode, this sequence causes the modem to re-enter AT command mode. There must be 1 second of idle time on the serial port before and after the sequence. Note that the “+” is ASCII character 0x2B. NOTE: The detection of this sequence is disabled if DAE=1
A/	Re-execute last command.
AIP=n [?]	n = 0: Allow only the IP specified in S53 to connect when UDP auto answer is enabled (S82=2). n = 1: Allow any incoming IP to connect when UDP auto answer is enabled (S82=2). Always subject to any Friends filters that may be defined

Command	Description
D[method][d.d.d.d]/[ppppp] or D[method][[@]name]/[ppppp]	Dial a connection to a remote IP and Port using either UDP, TCP, or Telnet. <i>method</i> = P – Establish a UDP connection T – Establish a TCP connection N – Establish a Telnet connection <i>d.d.d.d</i> = IP address to establish connection to <i>name</i> = domain name to establish connection to <i>ppppp</i> = IP port to establish connection to Examples: ATD – Dial (establish) default connection per S53 ATDPnnn.nnn.nnn.nnn/[ppppp] - Dial (establish) UDP session to the specified IP address/port. If the method, IP address, or port is omitted, the values from S53 are used. If a telnet connection is requested (N) and the port is not supplied, port 23 will be used instead of the value from S53. Several special dialing numbers exist to make it easy to establish a PPP or SLIP connection with the modem. ATD#19788 or ATD#19788 will establish a PPP connection (see \APPP) and ATD#7547 will establish a SLIP connection (see \ASLIP). If a domain name is specified, the '@' symbol can be used to explicitly indicate the start of the name. For example, if “ATDPHONY” is issued, this will be interpreted as dial a UDP connection to “HONY”. To dial using the default method to host “PHONY”, one would issue “ATD@PHONY”. To end the connection, issue the +++ escape sequence or drop the DTR line (if Ignore DTR S211=0 or &D2) NOTE: The <i>source</i> port of the session is the Device Port (set by S110 or *DPORT)
DAE=n [?]	Disable AT Escape Sequence detection n = 0: Enable +++ AT escape sequence detection. n = 1: Disable +++ AT escape sequence detection.
En	Toggle AT command echo mode. n = 0: Echo Off n = 1: Echo On.
FM=n [?]	Friends Mode – Only allow specified IPs to access the modem n = 0: Disable Friends mode n = 1: Enable Friends mode – Only packets from <i>friends</i> will be accepted (see below); packets from other IP addresses are ignored.

Command	Description
F <i>n</i> = <i>d.d.d.d</i> [?]	Friends mode IP address <i>n</i> = Friends list index [1 – 10] <i>d.d.d.d</i> = IP address to be allowed to access the modem 255 = allow any number 0-255 Example: 166.129.2.255 allows access by all IPs in the range 166.129.2.0—166.129.2.255.
H	This command does nothing but does not cause an error either.
HOR = <i>n</i> [?]	Half-Open Response – In UDP auto answer (half-open) mode: <i>n</i> = 0: No response codes when UDP session is initiated <i>n</i> = 1: RING CONNECT response codes sent out serial link before the data from the first UDP packet. <u>Note:</u> Quiet Mode must be Off.
I [0]	Returns the product name.
I1	Returns AirLink modem's firmware version, hardware ID, and copyright.
I2	Returns the OEM Modem's firmware version and relevant hardware ID
I3	Returns the OEM Modem's unique ID
M	This command does nothing but does not cause an error either.
MD <i>hh</i> [?]	Set or query the modem's default power-up mode <i>hh</i> (hex byte) = When the modem is power-cycled, it may enter the mode specified by this command after 5 seconds. On startup, typing ATMD0 within 5 seconds changes the mode to normal. 00 – normal (AT command) mode 01 – SLIP mode 02 – PPP mode 03 – UDP mode (address/port is in S53) 04 – TCP mode (address/port is in S53) [Also see Modbus Modes for Ravens]
OPRG = <i>n</i> [?]	Enables/disables over-the-air firmware upgrading of the modem. <i>n</i> = 0: Disables over-the-air programming. <i>n</i> = 1: Enables over-the-air programming.
PING <i>d.d.d.d</i> [, <i>n</i>] PING <i>domain_name</i> [, <i>n</i>]	Ping the specified IP address. Sends a single ping, returns either OK or ERROR depending on result. Times out in 10 seconds. If <i>n</i> is provided, it specifies the amount of data to send with the ping. If <i>n</i> is not provided, the default, 50 bytes is used.

Command	Description
Qn [?]	Set or query the AT quiet-mode setting. If quiet mode is set, there will be no responses to AT commands except for data queried. n = 0: Off (Default) n = 1: Quiet-mode on.
S0=n [?]	This register determines how a modem responds to an incoming TCP connection request. The modem remains in AT Command mode until a connection request is received. DTR must be asserted or (or S211=1 or &D0) must be set for a successful TCP connection. The modem will send a “RING” string to the host. A “CONNECT” sent to the host indicates acknowledgement of the connection request and the TCP session is established. n = 0: Off (Default) n = 1: On n = 2: Use Telnet server mode on TCP connections
S7=n [?]	Specifies the number of seconds to wait for a TCP connection to be established when dialing out.
S23 =<speed>,<databits> <parity><stop bits> [?]	Query or set serial line parameters: <speed> = [1200 2400 4800 9600 19200 38400 57600 115200 230400] <databits> = [7 8] <parity> = [O=Odd E=Even N=None M=Mark] <stopbits> = [1 1.5 2] Example: ATS23=19200,8N1 (sets modem to 19200, etc.) The settings take affect after reset. NOTE: MUST be 8 data bits for PPP mode.
S50=n [?]	Set or query data forwarding idle timeout. n = tenths of seconds. (Used in UDP or TCP PAD mode)
S51=n [?]	Set or query PAD data forwarding character. n = 0: no forwarding character n = other: ASCII code of character that causes data to be forwarded. (Used in UDP or TCP PAD mode.)

Command	Description
S53= <i>[method]d.d.d.d[/ppppp] [?]</i>	Set or query Destination IP address, port, and method. These are used as defaults for the D (Dial) AT command. <i>method</i> = P – UDP T – TCP N – Telnet <i>d.d.d.d</i> = IP address <i>ppppp</i> = the port address ATS53=T192.168.100.23/12345 ATS53=192.168.100.23/12345 ATS53=/12345
S60=n [?]	Telnet Client Echo Mode n = 0: No Echo n = 1: Local Echo (Default) n = 2: Remote Echo
S82=n [?]	Enables UDP auto answer (half-open) mode. n = 0: Normal mode n = 2: Enable UDP auto answer mode.
S83=n [?]	Set or query UDP auto answer idle timeout. If no data is sent or received before the timeout occurs, the current UDP session will be terminated. While a session is active, packets from other IPs will be discarded (unless *UALL is set). n = 0: No idle timeout (Default). n = 1-255: Timeout in seconds.
S110=d.d.d.d[/ppppp] [?]	Used to query or set IP address and port for CDPD modems, or only sets the modem's Device Port for CDMA and GPRS modems. Since the IP address is determined from the CDMA and GPRS networks, any specified address will be ignored. If S300=0 you will get the network IP when you query this value. If S300=1 you will get the private IP address. <i>d.d.d.d</i> = IP address <i>ppppp</i> = port number NOTE: See also S300,*DPORT
S202?	Queries the current RSSI in dBm

Command	Description
S211 =n [?]	Ignore DTR. For applications or situations where hardware control of the DTR signal is not possible, the modem can be configured to ignore DTR. When Ignore DTR is enabled, the modem operates as if the DTR signal is always asserted. n=0 [default]: Use hardware DTR. [&D2] n=1: Ignore DTR. [&D0] n=3: Ignore DTR and assert DSR. This value is deprecated, and it is recommended to use &S to control the DSR instead. When this value is set to 3, &S will automatically be set to 0.
S221 =n [?]	Connect Delay [n = 0 - 255] n = number of seconds to delay the “ CONNECT ” response upon establishing a TCP connection OR n = number of tenths of seconds to delay before outputting ENQ on the serial port after the CONNECT when the ENQ feature is enabled [see *ENQ]
S300 =n [?]	Set or query whether a private or public (network) IP is to be used when the Host initiates a PPP connection to the modem. n = 0 [default]: Public (network) IP Mode: When the Host initiates a PPP connection, the host will be given the public IP that was obtained from the OEM Modem. If the network issues a new IP, the PPP connection will be closed (since the IP has changed) and has to be re-initiated. n = 1: Private IP Mode: When the Host initiates a PPP connection, the host will be given the IP address specified in S301 . The modem will then perform NAT-like address translation, which shields the Host from network IP changes.
S301 =d.d.d.d [?]	Set or query the private IP address that is to be negotiated by the PPP connection if S300=1 .
S302 =d.d.d.d [?]	Set or query the IP address that can be used to directly contact the modem once a PPP connection is established. If this value is not specified, 192.168.13.31 will be used. NOTE: This is not normally used nor needed by user applications.
TCPS =n [?]	TCP connection timeout (TCPT) units. n = 0: TCPT specifies minutes. n = 1: TCPT specifies seconds.
TCPT =n [?]	TCP connection timeout. Specifies a time interval upon which if there is no in or outbound traffic through a TCP connection, the connection will be terminated. This value only affects the TCP connection in TCP PAD mode. n = minutes (if TCPS=0) or seconds (if TCPS=1)
V n [?]	Set or query Command Response Mode. n = 0: Terse (numeric) command responses n = 1: Verbose command responses (Default).

Command	Description
Xn [?]	Extended Call Progress Result mode. n = 0: turn off extended result codes (Default) n = 1: turn on result codes. This adds the text 19200 to the CONNECT response.
Z	Reset the modem. NOTE: This command does nothing if *DATZ=1 .
&Cn [?]	Set DCD mode. n = 0: Always assert DCD n = 1: Assert DCD when in a data mode (UDP, TCP, PPP, or SLIP) (Default). n = 2: Assert DCD when the modem has network coverage.
&Dn [?]	Set DTR mode. n = 0: Ignore DTR, same effect as HW DTR always asserted (same as S211=1) n = 2: Use hardware DTR (same as S211=0)
&L <speed>,<databits> <parity><stop bits>	Set serial line parameters (see S23)
&Sn [?]	Set DSR mode. n = 0: Always assert DSR n = 1: Assert DSR when in a data mode (UDP, TCP, PPP, or SLIP) (Default). n = 2: Assert DSR when the modem has network coverage. Note: Although deprecated, S211 can also be used to request that DSR is always asserted. If S211 is set to 3 and &S is changed to a non-zero value, S211 will be changed to 1.
&V	View active profile (the contents of the registers)
&W	Writes all changed modem settings. If this command is not issued, any modified values will revert back to their previous values at modem reset.
&Z	This command does nothing but does not cause an error either.
\ACEPW=new123	Change the Ace password to a new value. Password is case sensitive. Default value is 12345 Example: AT\ACEPW=new123

Command	Description
\APASSTHRU	Set modem operation to pass through mode. This will pass any characters received on the serial port directly to the internal OEM Modem and output any characters from the internal OEM Modem out the serial port. This allows direct access/configuration of the OEM Modem. Once this mode is entered, the unit must be physically reset to return to normal operation. NOTE: It may take up to 30 seconds for the OEM Modem to respond after CONNECT is output. NOTE: This mode is not available through the remote AT telnet server.
\APPP	Set modem operation to PPP mode. The modem expects the Host to start PPP negotiation. DTR must be asserted or (&D0 or S211=1)
\ASLIP	Set modem operation to SLIP mode. DTR must be asserted or (&D0 or S211=1)
\Qn [?]	Set or query the serial port flow control setting. n = 0: No flow control is being used n = 2: RTS/CTS hardware flow control is being used n = 4: Transparent software flow control. Uses escaped XON and XOFF for flow control. XON and XOFF characters in data stream are escaped with the @ character (0x40). @ in data is sent as @@.
*CTSE=n [?]	Clear To Send Enable This feature asserts CTS when there is no network connection. Note: Flow control (AT\Q) will override this indication, so if you want to use CTS to indicate no network coverage, flow control has to be off (AT\Q0). RS232 voltage levels: Positive = Network coverage, Negative = no coverage. n = 0: Disabled (Default). n = 1: Enable assertion of CTS for network coverage.
*DATE =[mm/dd/yyyy],[hh:mm:ss] [?]	Sets and queries the clock in the unit. Either the date and time can be specified, or simply one of the two can be specified in which case the unspecified value will remain unchanged. The date and time are always specified in UTC (Universally Coordinated Time) and, as such, the hours are specified in 24-hours format. Note that if the product has a GPS (i.e. PinPoints), the GPS will be used to set the time, in which case any date/time specified will be ignored.
*DATZ=n [?]	Enables or disables reset on ATZ n = 0: Normal Reset (Default). n = 1: Disable Reset on ATZ.
*DEVICEID=n [?]	Sets or queries the 64-bit Device ID that is used by the modem to identify itself to the server. The default is a value that depends on the underlying communications technology being used.

Command	Description
*DEVICEIDX=n [?]	Same as *DEVICEID except entry of the 64-bit Device ID is in hexadecimal.
*DNSn=d.d.d.d	Sets the DNS addresses to be returned during PPP negotiation. If the underlying communications network provides DNS addresses, they replace those specified by this command. *DNS1 and *DNS2 are valid.
*DOMAIN=[name] [?] (was *DOMAINSUFFIX)	Domain (or domain zone) which the modem is in. This value is used during name resolutions if a fully qualified name is not provided and also for DNS updates. This value can be up to 20 characters long. If *DOMAIN=eairlink.com , then when ATDT@remote1 is entered, the fully qualified name remote1.eairlink.com will be used to perform a DNS query to resolve the name to an IP address. Note: Only letters, numbers, hyphen '-', and periods can be used in a domain name.
*DPORT=n [?]	Sets or queries the modem's Device Port. Valid values are 1-65535. [See S110]
*DU=n [?]	Dial UDP Always The dial command always uses UDP, even when using ATDT n = 0: dial using the means specified [default] n = 1: dial UDP always, even when using ATDT NOTE: When this parameter is set you <i>cannot</i> establish a TCP PAD connection.
*ENQ=n [?]	Outputs an ENQ [0x05] after the TCP CONNECT delayed by the Delay Connect Response time [S221]. n = 0: Disabled (Default). n = 1: Enables ENQ on CONNECT .
*MODEMNAME=[name] [?] (was *DOMAINNAME)	Name of the modem (up to 20 characters long) to use when performing IP change notifications to IPManager. This name should not be a fully qualified domain name, but simply the first portion. The value in *DOMAIN provides the domain zone to add to this name. For example if *MODEMNAME=mymodem and *DOMAIN=eairlink.com , then the modem's fully qualified domain name is mymodem.eairlink.com . NOTE: Only letters, numbers, hyphen '-', and periods can be used in domain name.
*NETCHAN?	Returns the current active channel number.
*NETIP?	Query the current public (network) IP address of the modem. This is the IP address that was obtained from the embedded OEM Modem, and is the address to which packets can be sent in order to contact the modem from the Internet. NOTE: This could be 0.0.0.0 if there is no current network IP

Command	Description
*NETOK	Checks wireless network connection Responds OK if connected Responds ERROR if not connected
*NETPHONE?	Query the device's phone number, if applicable or obtainable.
*NETPW=pw [?]	The password that is used to login to the wireless network, when required.
*NETRSSI?	Returns the current RSSI [Receive Signal Strength Indicator] of the modem as a negative dBm value.
*NETSTATE?	Query the current network state. Will get one of the following strings: Connecting To Network The modem is in the process of trying to connect to the network; Network Authentication Fail Authentication to the network has failed. Either *NETUID and *NETPW need to be updated, or the PDP Context [GPRS network] needs to be specified, or for some reason the network refuses to allow the modem to connect; Network Negotiation Fail Network connection negotiation failed. This is usually temporary and often clears up during a subsequent attempt; Network Ready Modem is connected to the network and ready to send data; Network Dormant Modem is connected to the network, but the link is dormant [CDMA network]. It will be woken up when data is sent or received; No Service There is no network service (e.g., no CDPD, no GPRS, or no CDMA service detected); Hardware Reset The OEM modem is being reset. This is a temporary state.
*NETUID=uid [?]	The login that is used to login to the wireless network, when required.
*TPORT=ppppp [?]	Sets or queries the port used for the AT Telnet server. Valid values are 0-65535. If 0 is specified, the AT Telnet server will be disabled. The default value is 2332.
*UALL=n [?]	Accepts UDP packets from any IP address when a UDP session is active. If there is no UDP session active, an incoming UDP packet will be treated according to the UDP auto answer and AIP settings. n = 0: No effect (Default). n = 1: Accept UDP data from all IP addresses when in a UDP session.

Command	Description
*UDPLAST =n [?]	If enabled, sets S53 to the last accepted IP address through UDP auto answer. This can be used in conjunction with MD3 so that when there is no UDP session, new serial host data will cause a connection to be restored to the last IP accepted through UDP auto answer. n = 0: Does not change S53 setting. (Default). n = 1: Set S53 to the last accepted IP. NOTE: This does not change the S53 setting in NVRAM. If the modem is reset, the original S53 setting will be restored from NVRAM.
*USD =n [?]	Inserts a delay between received UDP packets by a specified interval before sending them out to the serial port. n = 0: No UDP packet delay (Default). n = 1-255: Delay in 100ms units, from 100 ms to 25.5 sec.

8. Raven Installation

This section describes what is necessary to mount the Raven, connect the antenna and connect the power.

8.1 Mounting the Raven

The Raven should be mounted in a position that allows easy routing and access for the cables. There should be no binding or sharp corners in the cable routes. The Raven should be mounted so that the LEDs on the front panel can be easily seen for ease of operational verification.

The snap-in mounting bracket (part number 100-170-1006) is installed using #8 or #10 screws. Press the Raven down firmly into the bracket and note that both sides have locked into the groove on the Raven case.



Figure 1 - Raven Mounted in Mounting Bracket

Note: The tie-wrap is if the modem needs to be really secure, as in a vehicle or in shipping. In stationary applications, as in a box that sits out in a pasture with a solar cell, etc., the tie-wrap is not necessary.

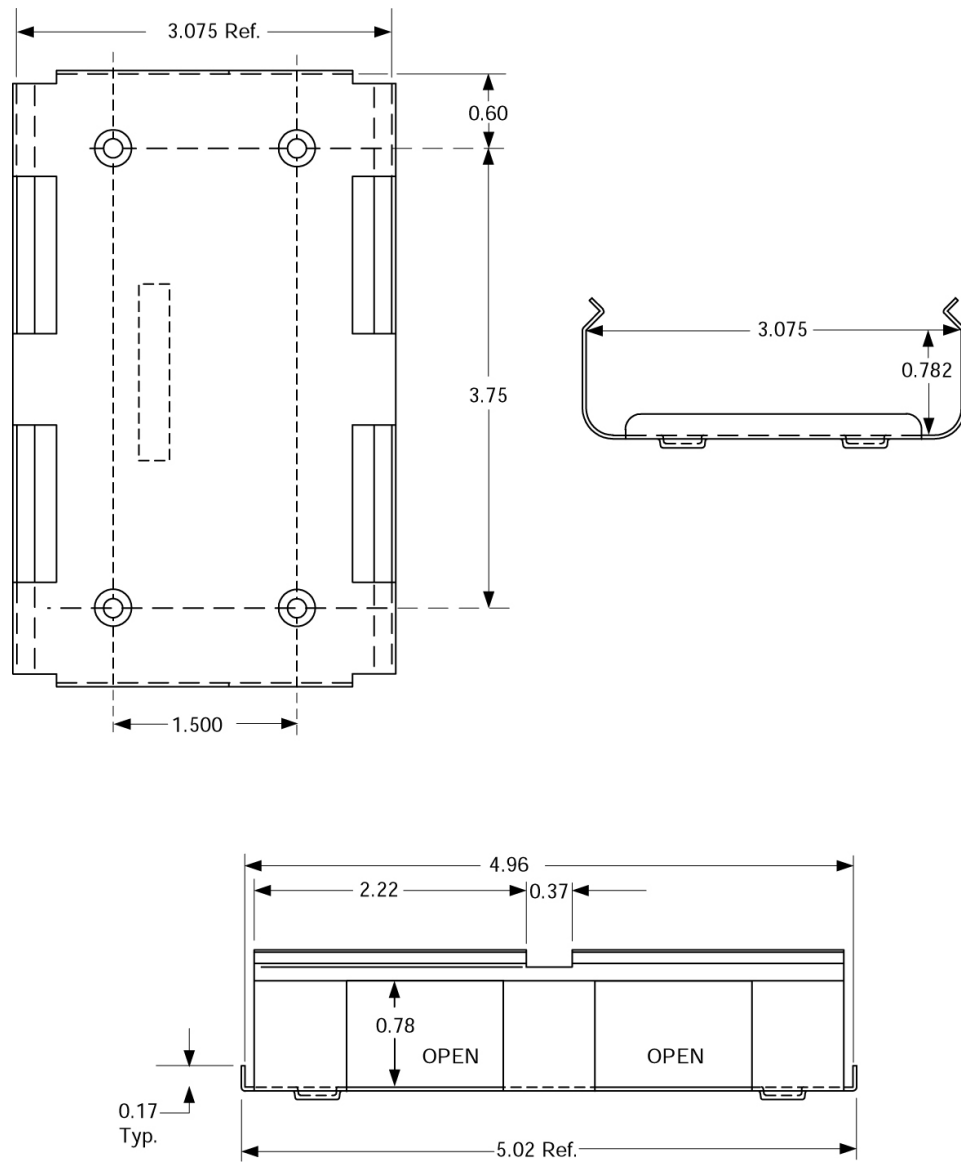


Figure 2- Snap-in Mounting Bracket

8.2 Connecting the antenna

Install an appropriate external cellular antenna. Connect the antenna to the external jack of the bulkhead jack adapter with an appropriate RF cable. Connect the Raven antenna jack to the interior bulkhead jack with an appropriate RF cable.

Note if the antenna is mounted outdoors where there is a possibility of lightning or static build up due to thunder storms passing by, then a lightning protection device should be installed between the modem and the external antenna.

8.3 Connecting the serial cable

Connect the RTU/PLC meter serial port to the Raven serial port with a DB-9 male connector.

8.4 Grounding the Raven Case

The exterior Raven case should be connected to the enclosure ground which should be connected to the battery or power source negative terminal. This is best accomplished with a grounding strap under one of the mounting bracket screws to the enclosure grounding bar.

8.5 Connecting the power cable

The power cable positive lead should be connected to the battery or power source positive terminal. The power cable negative lead should be connected to the battery or power source negative terminal. The Raven has an internal polysilicon circuit breaker that opens at 0.5 to 1.0 amps of current.

Insert the power connector into the Raven power receptacle.



Figure 3 - Raven Back Panel

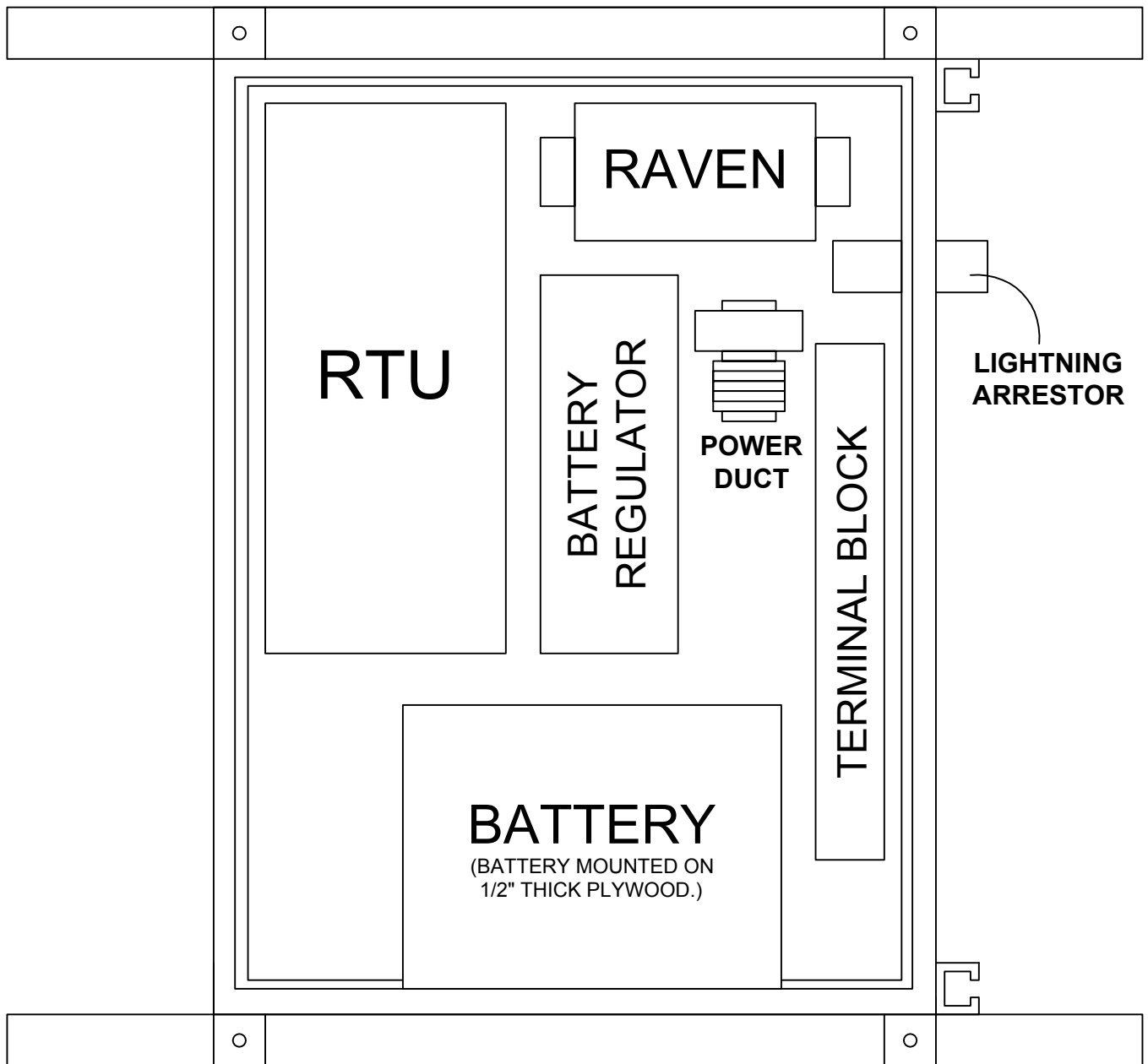
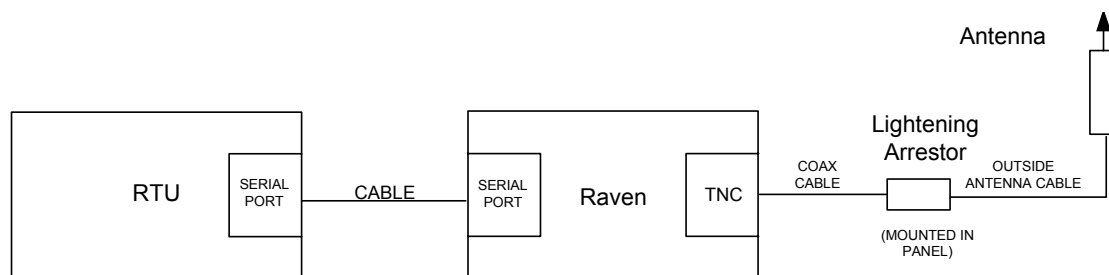
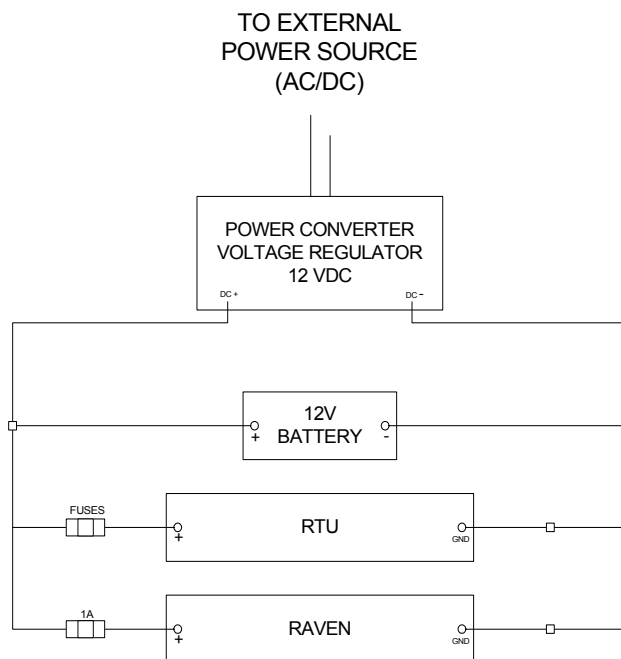


Figure 4 Raven mounted in an enclosure with RTU

**Figure 5 - RTU to Raven setup****Figure 6 - Power Connections**

9. Raven GPRS Technical Specifications

9.1 Physical Characteristics

Weight: < 1 lb.
Size: 3.3" wide x 2" high x 6.8" long
RF Antenna Connector: 50 Ohm TNC
Serial Interface: RS232 DB-9F
Rugged aluminum case

9.2 Power Specifications

Input Voltage: 10 VDC to 28 VDC
Idle Input Current: 40 mA at 12V
Typical Transmit/Receive: 130ma at 12VDC
Max Input Current 250 ma at 12 VDC

9.3 Environmental

Operating ranges: -30°C to +70°C*
(<10%duty cycle limit above 60 °C)
Humidity: 5%-95%Non-condensing

9.4 RF Features

Network: 1900/850 MHz GSM/GPRS
Transmit frequency: 1850-1910 MHz and 824-849 MHz
Receiver frequency: 1930-1990 MHz and 869-894 MHz
Transmit power range at antenna port: 1.0 W for 1900 MHz and
0.8W for 850 MHz
Transmitter can reduce output power when near a base station as per GSM
specifications
Receiver sensitivity: typical -107 dBm (2.2439% bit error rate)
Multislot Class 8
FCC certified (FCC Identifier GGL-R1902G)
Industry Canada certified (certification #4481A-R1902G)

9.5 Status LED Display

Channel [Chan] LED

Flashing = Searching for a channel

On = Found a channel

Link LED

Off = No GPRS service

On = GPRS service is available on this channel

Winking off = Roaming

Winking on = GSM only signal, no GPRS.

Registration (REG) LED:

Off = No PPP link on GPRS network

On = PPP link is established on GPRS network and have an IP address.

RSSI LED

– Indicates signal strength. Signal strength is denoted as follows:

- < -100: RSSI LED off
- -99 to -90: Blink every 1200ms
- -89 to -80: Blink every 600ms
- -79 to -70: Blink every 300ms
- >= -69: RSSI LED on solid

Transmit Receive (Tx/Rx) LED:

Off = Idle

On = Transmitting/Receiving (on RF)

ERR LED

Currently unused

Power (PWR):

Off = Power off

On = Power on

9.6 Application Interface Features

RS232, 1200 bps to 115.2 kbps

AT Commands, PPP, SLIP, UDP, TCP