



WINC 900A Wireless Modem

Owner's Manual

TELETRONICS INTERNATIONAL, INC.
Rockville, Maryland, USA, 20850-3155

Serial Number: _____

Remote Unites

| Serial Number | Remarks |
|---------------|---------|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Copyright ©1999
by
Teletronics International, Inc.

All Rights Reserved. No part or parts of this document may be reproduced, translated, stored in any electronic retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright holder.

LIMITED WARRANTY

The WINC 900A is warranted to the original purchaser to be free from defects in materials and workmanship under normal installation, use, and service for a period of one (1) year from the date of purchase.

Under this warranty, Teletronics International, Inc. shall repair or replace (at its option), during the warranty period, any part that proves to be defective in material of workmanship under normal installation, use and service, provided the product is returned to Teletronics International, Inc., or to one of its distributors with transportation charges prepaid. Returned products must include a copy of the purchase receipt. In the absence of a purchase receipt, the warranty period shall be one (1) year from the date of manufacture.

This warranty shall be voided if the product is damaged as a result of defacement, misuse, abuse, neglect, accident, destruction or alteration of the serial number, improper electrical voltages or currents, repair, alteration or maintenance by any person or party other than a Teletronics International, Inc. employee or authorized service facility, or any use in violation of instructions furnished by Teletronics International, Inc.

This warranty is also rendered invalid if this product is removed from the country in which it was purchased, if it is used in a country in which it is not registered for use, or if it is used in a country for which it was not designed. Due to variations in communications laws, this product may be illegal for use in some countries. Teletronics International, Inc. assumes no responsibility for damages or penalties incurred resulting from the use of this product in a manner or location other than that for which it is intended.

IN NO EVENT SHALL TELETRONICS INTERNATIONAL, INC. BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF THIS OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, WHATSOEVER.

Some states do not allow the exclusion or limitation of special, incidental or consequential damages, so the above exclusion or limitation may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Table Of Contents

| | Page # |
|---------------------------------------------------------------------------------|-----------|
| 1.0 OVERVIEW | 6 |
| 2.0 TECHNICAL INFORMATION | 6 |
| 3.0 EQUIPMENT CHECK LIST | 6 |
| 4.0 INSTALLATION AND COMMUNICATING WITH THE WINC 900A | 8 |
| 4.1 HARDWARE CONNECTION | 8 |
| 4.2 COMMUNICATION SOFTWARE SETTINGS | 9 |
| 4.3 COMMUNICATING WITH THE WINC 900A | 11 |
| 5.0 AVAILABLE OPERATION MODES IN WINC 900A & APPLICABLE APPLICATIONS | 13 |
| 5.1 SUMMARY OF VARIOUS OPERATION MODES, APPLICABLE APPLICATIONS, AND FAQ | 14 |
| 5.1.1.1 POINT-TO-POINT DIAL-UP CONNECTION OPERATION MODE | 14 |
| 5.1.1.2 APPLICABLE APPLICATIONS | |
| 5.1.2.1 POINT-TO-POINT AUTO CONNECTION OPERATION MODE | 15 |
| 5.1.2.2 APPLICABLE APPLICATIONS | |
| 5.1.3.1 MULTIPLE-TO-ONE DYNAMIC DATA REPORTING & MONITORING MODE | 16 |
| 5.1.3.2 APPLICABLE APPLICATIONS | |
| 5.1.4.1 MULTIPLE-TO-MULTIPLE TRANSPARENT OPERATION MODE | 19 |
| 5.1.4.2 APPLICABLE APPLICATIONS | |
| 5.2 FAQ AND SYSTEM ADJUSTMENT | 20 |
| 6.0 WINC 900A INTERFACE STATUS | 22 |
| 7.0 AT COMMAND SET | 24 |
| 7.1 AT COMMAND SYNTAX | 24 |
| 7.2 BASIC AT COMMANDS | 25 |
| 7.3 EXTENDED AT COMMAND SET | 30 |
| 7.4 S REGISTERS | 33 |
| 7.5 COMMONLY USED AT COMMANDS WITH THE WINC 900A | 33 |
| APPENDIX A - AT COMMANDS FOR THE WINC 900A | 36 |
| APPENDIX B - S REGISTER SUMMARY | 39 |
| APPENDIX C - WINC 900A SPECIFICATION | 44 |
| ADDITIONAL SUPPORT | |

1.0 Overview

Teletronics' advanced WINC 900A¹ wireless modem facilitates the transfer of information among computers and peripherals without cables and expensive network operating systems. The device operates at very low power in the ISM frequency band between 902 and 928 MHz and requires no licensing by the FCC. Using state-of-the-art spread spectrum technology, the WINC 900A offers reliable point-to-point data communication even when computers and peripheral devices are separated by walls, floors, and ceilings or dispersed in mobile or temporary facilities.

The WINC 900A is Hayes-AT compatible, simple to operate, and supported by most commercially available communications software packages such as PROCOMM™, PC-ANYWHERE™, XTALK™, etc. Data rates are user-selectable and vary from 300 bps to 38400 bps.

2.0 Technical Information

The WINC 900A transfers data asynchronously between computers or peripherals at user defined data rates of 0.3, 0.6, 1.2, 2.4, 4.8, 9.6, 19.2 and 38.4 kbps and connects to the serial port of either a computer or peripheral via an RS-232 DB-25 connector. Data formats are selectable as follows: Data: 7 or 8 bits, Parity: even/odd/none, Stop bit: 1 or 2. Hardware and software flow control are supported via RTS/CTS and XON/XOFF, respectively. The WINC 900A operates full-duplex, using the standard Hayes-AT command set, and can be configured for point-to-point or networked operation. A complete listing of the available AT commands is included in Section 7.0.

The WINC 900A operates in the 902-928 MHz frequency band with a maximum power of 1 watt. Eight independent 3 MHz wide channels are available within this band. Outdoors, the operating range of the modem is approximately 1 kilometer. Depending on the material of walls and ceilings, indoor operation may be limited to approximately 100 meters.

The WINC 900A uses direct sequence spread spectrum signaling with a variable PN spreading rate. The device operates full-duplex using differentially encoded QPSK modulation. Sensitivity for this system is -85dBm (not including spreading gain). See Appendix C for a detailed technical specification of the device.

In general, the WINC 900A operates automatically with little need for user intervention. Both channel selection and power control are automatic and transparent to the user guarantying that communications occurs at the least power required to maintain the link on the selected channel.

3.0 Equipment Check List

The WINC 900A package contains the following items.

1. One (1) WINC 900A wireless modem
2. One (1) WINC 900A operation manual
3. One (1) warranty card
4. One (1) power cord
5. One (1) rubber omni antenna
6. Two (2) stands for vertical placement

¹ WINC is a trademark of Teletronics International, Inc. All other trademarks or references to other commonly used software or hardware are the property of their respective companies.

If anything is missing or damaged, please contact your supplier immediately.

Each WINC 900A is uniquely identified by an seven (7) digit address that is used when two units attempt to establish a communications link. The seven (7) digit address is found on the label affixed to the left side of the unit and is defined by the right-most seven (7) digits of the serial number. The device address can also be found by using the ATIO command discussed in section 7.2.

4.0 Installation and Communicating with the WINC 900A

The communication between the WINC 900A and your computer, terminal, or peripheral requires a simple connection using a straight through serial cable with proper connector at each ends. The following two sections will help you to walk through the hardware connection and the communication software test processes before you can communicate with WINC 900A directly.

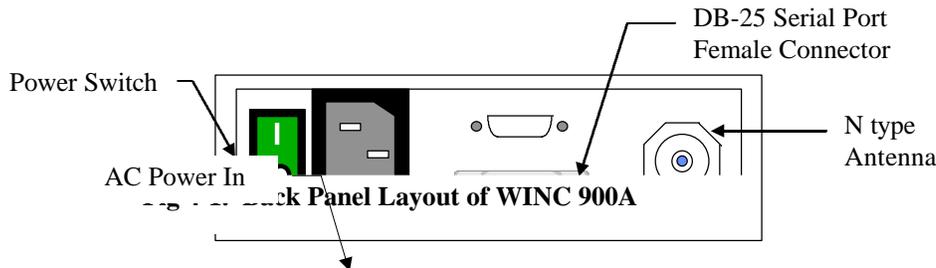
4.1 Hardware Connection

Step 1: Preparation before installation :

Required equipment:

- two (2) 386/486 IBM PCs with one DB-25 or DB-9 serial port each
- two (2) **straight through serial cables**, with a male DB-25 at one end for WINC 900A and a male/female DB-25/DB-9 at the other end for the serial port of your PC.

Step 2: Cabling



1. Turn your computer off before starting.
2. Connect the DB-25 serial port of the WINC 900A to the serial port of your computer **using a straight through serial cable with RS-232 DB-25 connectors at each end.** (please refer to Fig. 4-2) Although the WINC 900A is configured to accept a DB-25 connector directly, a DB-9 connector may be used with the proper adapter. (The cable with connector is not supplied with the WINC 900A, but is available from most computer retailers and electronics suppliers.)

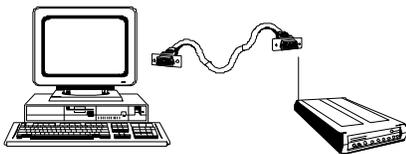


Fig 4-2. Serial Port to Serial Port Connection

3. Connect the power cord to the rear of the unit and plug it into the electrical jack nearest your equipment. (please refer to Fig. 4-1) The WINC 900A is equipped with a universal power supply for 110-220 volts and will internally adjust itself for either voltage.
4. Fasten the rubber omni antenna to the antenna connector of the WINC 900A or attach your Yagi antenna to the antenna connector of the WINC 900A using shielded low loss cable with TNC to N type connector.
5. Turn on the computer.

6. Turn on the WINC 900A modem. The WINC 900A performs a brief self-test via resident communications software. After the initialization of the communication software on the PC, the front panel LEDs² indicate the state of the WINC 900A. **If cabling is properly done, the DTR, DSR, CTS and RTS indicators should be green, whereas the RI, DCD, RxD, and TxD indicators are red after the WINC 900A is initially powered up .**

After the completion of the hardware connection between your PC and the WINC 900A , you must follow the same steps above working on the 2nd unit.

4.2 Communication Software Settings

Although the WINC 900A is a sophisticated wireless modem and integrated spread spectrum transceiver, it has been designed to be compatible with off-the-shelf communications software typically used with conventional land-line modems. Consequently, if you have not already done so, install the appropriate data communications software into your computer before proceeding further. Please note, due to the popularity of MS-Windows, the Terminal in the Accessories of MS Window 3.1 will be used in the following process as guidance. **But, the maximum baud rate of MS Terminal is 19.200Kbps only; therefore, it requires other communication software to reach 38.400Kbps.**

Step 1: Activate your communication software

1. Running MS-Windows, and then activate the Terminal in Accessories.
2. Click the “Settings” ,and then activate the “Communications” dialog box.

Step 2: Configure your communication software to meet default value of WINC 900A

1. Click on the available serial port from the “Connector” list,
2. Click on the 9600 from the “Baud Rate” list,
3. Click on “OK” return to the Terminal.

All selectable items in the communication dialog box will turn into active (high-lighted), if the selected serial port is available on your computer. Otherwise, stop here and consult with a computer expert knowledgeable about setting up serial port for you.

Step 3: Communicate with WINC 900A via AT command

1. Press the “Enter” key.
You should get an “ERROR” whenever you press the Enter key without AT commands.
2. Try type in “ATIO”
You should get response similar to the followings:
MODEM address: xxxxxxxx
Current channel: 0

(The MODEM address should match the right-most seven (7) digits of the serial number digit found on the label affixed to the left side of the unit.)

After the configuration setup process above, the communications software will go into the local-terminal or direct-connection mode. All AT commands for WINC 900A will be sent to the serial port directly, accepted and executed by WINC 900A.

² See Section 7.0, WINC 900A Interface Status, for LED indicator definitions.

There is a possibility that you will get some funny characters or no response resulting from the different baud rate settings on the communications software and the WINC 900A. If this happens, please reset the WINC 900A back to the manufacturer's default setting -- 9600 bps as instructed below.

Whenever you need to clear the settings, you can issue AT command AT&F to reset the WINC 900A to the original factory default conditions. An alternative method for accomplishing this is to hold the reset button on the front panel and turn on the power of WINC 900A. (please refer to Fig. 4-3) A pencil, pen or other sharply pointed object is required to access the button through the hole on the front panel.

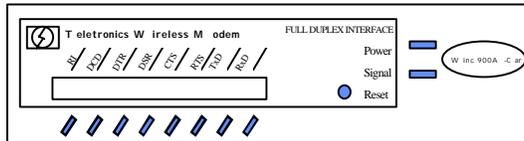


Fig 4-3. WINC 900A Front Panel

Step 4: Save the configuration settings

of your communications of software

If you already completed the steps above without problems, you may select the “Save” from the “File” option in the MS-Windows Terminal and save the configuration settings for the future before you leave Terminal.

If you still have problems communicating with the WINC 900A from your computer, please work on the followings step by step, and then start all over again from the beginning of this chapter or walk through our recommendation below.

1. Contact your computer hardware engineer, verify the availability of the serial port (com port) on your computer, and working on this until the serial port is available to you.
2. Connect your serial port with an external modem and work on the communication software setting until you get the dial tone, dialing out successfully.
3. Replace the external modem with WINC 900A. At this point, go through the factory default setting process above to make sure that 9600 is the default baud rate on WINC 900A.
4. Please work from the beginning of chapter 4.0 again.
5. If you still have problems communicating with the WINC 900A, please visit our **Web Customer Support page at www.teletronics.com** or fill out the technical support request form at the last page with all details and fax it to our “Technical Support Team” located in our US headquarters.

4.3 Communicating with the WINC 900A

Once the WINC 900A and the communications software have been installed, the device is ready to use. You can communicate directly with the WINC 900A using the AT command set, the communications software should allow you to put the ~~com~~ Default Reset Button Hole in al or direct-connection mode.

A connection between the local and remote WINC 900A is automatically established on the channel that provides the best performance. However, if you come across difficulty to operate WINC 900A on your learning curve. The AT command AT&F is used to reset the WINC 900A to the original factory default conditions. An alternative method for accomplishing this is to use the reset button on

the front panel of the device. A pencil, pen or other sharply pointed object is required to access the button through the hole on the front panel.

4.3.1 Establish Connection and Function Test

Step 1. Establish Communication with WINC 900A (execute followings at both PCs)

1. Execute MS-Windows
2. Activate the Terminal in the Accessories
3. Select the Settings, and then click on the “communications” option
4. Click on the available com port from the connectors list
5. Click on the 9600 from the baud rate list.
6. Click on the OK, which will bring you back to the Terminal and stay in the local terminal mode.
7. Press “Enter” key without AT command. You should get an “ERROR” as response.

Step 2. Establish connection with remote WINC 900A

1. Get the remote station’s address, the right-most seven (7) digits of the serial number digit found on the label affixed to the left side of the unit.
2. Type in AT connection command ATDT with seven (7) digit remote address as “ATDTxxxxxxx”.
3. You should get a “CONNECT” as response at both sides.
4. If you did get the “CONNECT” response, you will stay in direct connection mode until you type in the escape sequence “+++”.
5. If you did not get the “CONNECT” response and system halt. Please reboot the WINC 900A, verify the remote address, and try the AT connection command again.
6. In the connection mode, you may start to type some message on one of your computers. The typed in message will be displayed on the screen of the remote side.

Step 3. Function test on file transfer

1. Click on the “Transfers” from the menu bar of Terminal.
2. Click on the “Send Text File”
3. Select one of the text files from the file list, and then click on OK.
4. You should be able to see the content of the text file on the screen of the remote side. Also, the transferred file will be created on the remote side, if your friend can help you out on the remote side, select the “Receive Text File” option from the “Transfers”, and assign a file name for the in-coming file.

Step 4. Disconnect established link between two WINC 900As

The WINC 900A only responds to AT commands when in the *command* or *off-line* mode. Consequently, to terminate a connection, the unit must escape to this mode before it will respond. This is accomplished by issuing the escape sequence “+++”. Once in the command mode, the AT command ATH is issued to close the connection.

While the basic AT command set is generic and applies to most land-line modems, a number of AT commands unique to the WINC 900A are included in Section 7.3. These commands are used to control air-link specific parameters like the channel number and other operational characteristics.

For completeness, the basic and extended AT command set is described in Section 7.0. In addition, Appendix A contains the Standard AT Modem Commands and Appendix B contains the S Register Summary.

5.0 Available operation modes in WINC 900A and Applicable applications

Resulting from our long term commitments to our products and tight relationship with our customers, WINC 900A can be configured to various operation modes as followings:

1. Point-to-Point Dial-up connection mode
2. Point-to-Point Auto connection mode
3. Multiple-to-One Wireless Dynamic Data Reporting and Monitoring (WDDR) mode
4. Multiple-to-Multiple Transparent mode

The first two operation modes, the Point-to-Point Dial-up connection mode and the Point-to-Point Auto connection mode, were developed on the foundation of the traditional point-to-point asynchronous mechanism that comes with build-in protocol providing error free data transmission.

In the 3rd operation mode, the Multiple-to-One Wireless Dynamic Data Reporting and Monitoring operation mode, the build-in broadcasting function transmits the in-coming data from the connected external device to the air. All remote units operate/broadcast without build-in protocols for packet collision prevention and packet re-transmission; therefore, the transmitted packets from remote units might not be received by the information collection unit.

In the Multiple-to-Multiple transparent mode, each WINC 900A operates as a dumb transceiver fully controlled by industry oriented management systems in transmitting and receiving packet to/from the air. The correctness of the data is totally relay on the upper level management system. There is no involvement of build-in protocols from WINC 900A.

5.1 Summary of various operation modes, applicable applications, and FAQ

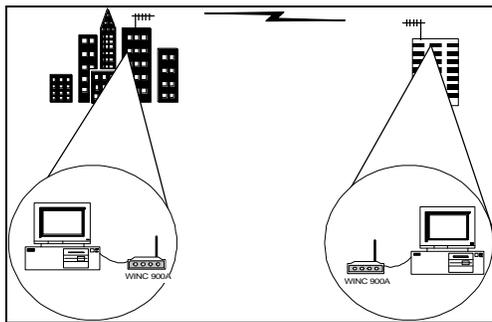
5.1.1.1 Point-to-Point Dial-up connection operation mode

The spirit of WINC 900A asynchronous modem development is to deliver a wireless asynchronous modem using traditional dial-up connection mechanism with error free protocol.

The dial-up connection process has been detailed in section 4.3.1. After the establishment of the point-to-point linkage connection, the user can perform the functionality provided by the communication software just like the connection established between two PC modems via telephone line.

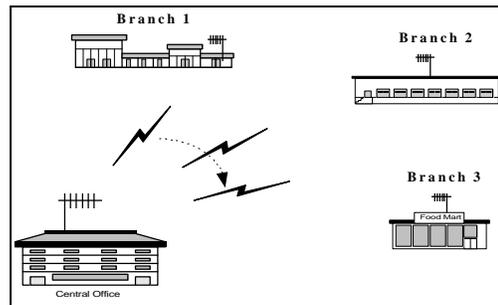
5.1.1.2 Applicable applications

- The traditional remote dial-up connection
- The one-to-multiple polling connection for data distribution or data collection process.



Traditional Dial-up Connection

The user issues the ATDT command or activate the connection function from the communication software to the remote unit and establish the point-to-point connection.



One-to-multiple Polling Connection

The user adopts the polling mechanism in their application program and initiates the dial-up function to establish wireless connection with each remote units by turns.

5.1.2.1 Point-to-Point Auto connection operation mode

Besides of the traditional dial-up connection above, a pair of WINC 900A can be operated in auto connection mode in order to establish a point-to-point permanent wireless linkage.

In the point-to-point auto connection operation, one of the two units will play a roll as Master unit, the user must issue the following AT commands to specify the address of the slave unit and to enable the auto connection operation at the Master unit.

AT commands issued at the Master unit to specify the address of the slave unit and to enable the auto connection function are :

AT~Axxxxxxx

(“xxxxxxx” above stands for the 7 digit address of the slave unit)

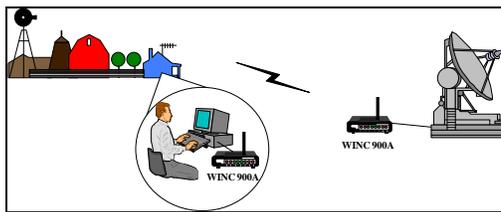
AT&!1

(to enable the auto connection function)

After initiating the auto connection operation, the Master unit will issue the connection request to the specified slave unit, establish connection, and go into connection mode. The Master unit will automatically recover the established wireless connection after the drop of linkage resulting from power outage or interference. Before issuing AT commands for configuration change or terminating the auto-connection function, users must issue the escape sequence, holding the “Shift” key and pressing “+” key 3 times, to return to the command mode.

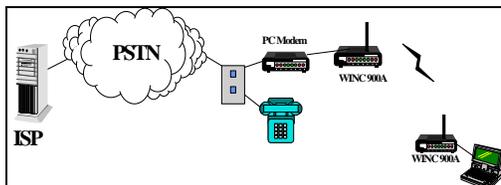
5.1.2.2 Applicable applications

- The extended cable connection for dial-up connection.
- The point-to-point perminal link connection
- The leasing line replacement
- The last mile connection

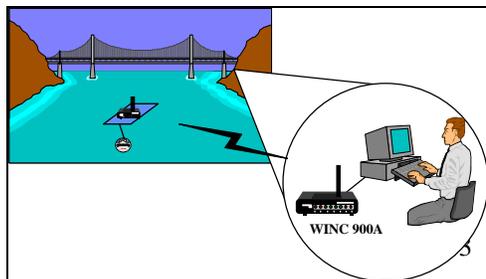


Last mile extension connection

The established wireless link can be used as wires between two locations for data transmission.

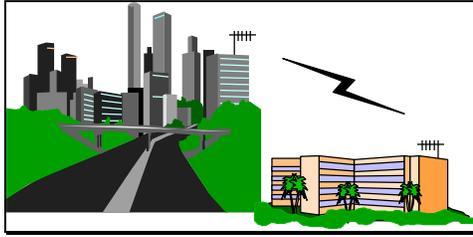


Extend
As ad
wireles
extend



Point to-Point Permanent Connection

WINC 900A is the ideal equipment to establish wireless link for data acquisition application. WINC 900A has a DC mode. User is capable to activate the connected external device at the remote site with required “BREAK” signal.



Leasing line replacement

Due to the build-in error free protocol and the connection auto-recovery capability, the wireless connection established by WINC 900A is the ideal to be used in replacing the costly leasing line.

5.1.3.1 Multiple-to-One Dynamic Data Reporting and Monitoring mode

In the Point-to-Point operation modes above, the build-in protocol ensures that all transmitted packets between two points will be delivered to the receiver promptly without error. But, in the Multiple-to-One wireless applications architecture, it is very difficult to specify the break point of satisfaction on performance with the same guarantee on error free.

For some **non-timing sensitive** Multiple-to-One applications, WINC 900A can be configured into three different broadcasting mode as followings :

| Operation Mode | AT command | General Description |
|--------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WINC-900A Regular Asyn. Mode | AT~P1 | refer to manual 5.1.1 section |
| WINC-900 Multiple Broadcast Mode | AT~P2 | Monitor unit stays in monitor mode and receives all data packet on the air. User can activate the broadcasting function of specific slave unit at remote site. |
| WINC-900 MultipleAuto Broadcast Mode | AT~P5 | Monitor unit stays in monitor mode and receives all data packet on the air. The broadcasting function of the slave unit is activated automatically after power on. |
| WINC-900 Multiple Transceiver Mode | AT~P6 | Both monitor and remote units are staying in monitor mode and receive all data packet on the air. Monitor and remote units will switch into broadcasting mode by incoming data from the connected external device and transmit received data from connected external device to the air. |

Due to the nature of the broadcasting mechanism and the inter-change between transmission and receiving, the transmitted data packets from all slave units might not be received fully by the monitor unit.

We are going to walk through configuration steps for AT~P5 operation mode and related AT command sets briefly in the following : (Please download WDDR user manual from our Web site, if you do further technical information)

Step 1 :

Operation mode setting and review using AT command sets.

AT~P5 to switch from Point-to-Point operation mode to Multiple-to-One operation mode. User can switch back to Point-to-Point operation mode using AT~P1 command.

AT&!Y The system current configuration setting dump.
 "station xxxxxxx, channel x, active_flag xx, pkt recvd xx, rxAlarm T"
 This stands for "Remote station xxxxxxx is on channel"x", is activated or de-activated, and the number of packets from REMOTE STATION is received by MONITOR. "rxAlarm" indicates if MONITOR unit has received any thing from that remote unit in the past 30 seconds.

Step 2 :

Monitor Station operation setting and related AT Command sets are :

AT~M to switch WINC 900A into MONITOR STATION mode

AT~Rxxxxxxx,n to register all eight units running under channel n. "xxxxxxx" is the 7 digit address of slave units. "n" is the channel that REMOTE STATION uses for broadcast.

AT~Z clears all registered REMOTE STATIONS from MONITOR STATION's memory.

AT~Cxx Defines the channel scanning rule in the MONITOR. The "xx" value can be in the range specified as follows.

| | |
|-------------------------------------|-----------------------------------|
| 0 -- channel 0, 1, 2, 3, 4, 5, 6, 7 | 1 -- channel 0 only (925 MHz) |
| 2 -- channel 1 only (922 MHz) | 3 -- channel 2 only (919 MHz) |
| 4 -- channel 3 only (916 MHz) | 5 -- channel 4 only (913 MHz) |
| 6 -- channel 5 only (910 MHz) | 7 -- channel 6 only (907 MHz) |
| 8 -- channel 7 only (904 MHz) | 9 -- channel 0, 1, 2, 3 (non-GSM) |
| 10 -- channel 4, 5, 6, 7 | 11 -- channel 0, 2, 4, 6 |
| 12 -- channel 1, 3, 5, 7 | 13 -- channel 0, 2 |
| 14 -- channel 4, 6 | 15 -- channel 1, 3 |
| 16 -- channel 5, 7 | |

Step 3 :

Remote Station operation setting and related AT Command sets are :

AT~S Switch the WINC 900A from the MONITOR mode back to the REMOTE STATION mode

AT\Cn To define the channel used by this REMOTE STATION. If multiple REMOTE STATIONS are configured to use the same channel, collision avoidance is applied to achieve the best performance.

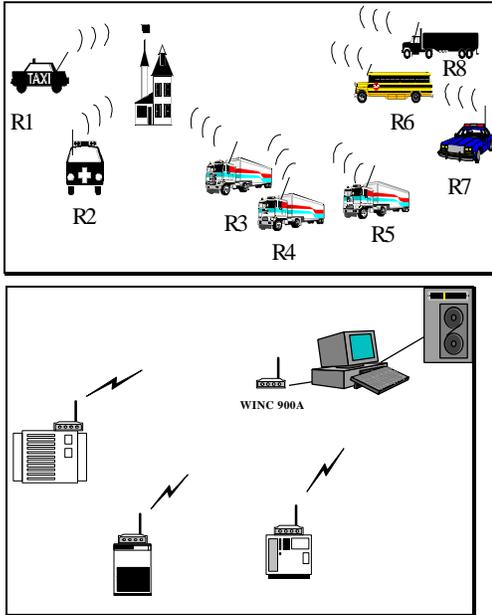
+++ one (1) second guard time is required between "+".
 The Escape Sequence switches the unit from on-line broadcast data mode to command mode such that AT commands can be issued.

AT&!O This switches the unit back to on-line broadcast mode.

5.1.3.2 Applicable application

- The fleet management system

- **The remote device monitoring system**



Mobile location and Fleet management system

WINC 900A can be configured into broadcast mode transmitting bus location or other information from each buses to the air and the designated monitoring unit will receive the transmitted packet in the air. The monitor unit will do its best to receive packets, but some packets might not be collected accordingly.

Remote sensor reporting system

For some of those non-timing sensitive operations, the build-in broadcast mode above is also applicable for data acquisition or monitoring applications.

5.1.4.1

Multiple-to-Multiple

Transparent operation mode

For some one-to-multiple, multiple-to-one or multiple-to-multiple applications, a fully controlled transmitting and receiving two way capability is required. To meet this requirement, our WINC 900A can be configured as dumb transceiver fully controlled by higher level application system.

The configuration steps and related AT command sets for setting are briefed in the following :

| | |
|-------|---------------------------------------------------------------------|
| AT&!E | to switch into transparent mode from point-to-point operation mode. |
| AT&!Q | to return to point-to-point operation mode from transparent mode. |
| AT\Cn | to specify the operation channel from 0 to 7. |

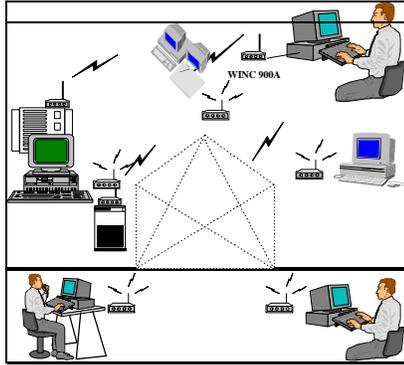
this operation channel must be specified before changing WINC 900A operation mode from the point-to-point to transparent. Otherwise, units can not receive packets.

Please note, the transparent mode can not be terminated by restoring manufacture default or hardware reset process. User must issue “AT&!Q” to exit the transparent mode.

5.1.4.2 Applicable application

- The multiple-to-one remote data acquisition application
- The one-to-multiple remote control application

- The multiple-to-multiple data exchange application



Multiple-to-multiple data exchange application
 Application characteristic of transparent mode provided by WINC 900A, the transmitted packets from one sender can be received by multiple (multiple WINC 900A) nodes on the same channel. With the support of upper level protocols, a wireless net can be formed among WINC 900As. communication protocol

5.2 FAQ and System Adjustment

The behaviors of WINC 900A are adjustable via the AT commands and the content of register in order to meet the requirement of you application. To speed up your learning curve, the following FAQ will play a roll as index for your reference. Please refer to the APPENDIX B - S Register Summary for details.

1. How to enable the auto-answering function of your modem ?
Please refer to the value of register 0.
2. How can I issue an AT command again after the dial-up connection has been completed, or in the auto connection mode, or in the transparent mode ?
Please refer to the Escape Character in the register 2 and 12.
3. Can I change the time-out length of connection request process ?
Please refer to register 7 for details.
4. How long this modem will take to declare lost link with its remote unit after linkage drop and ready for another connection request from remote unit ?
Please refer to register 10.
5. How long the in-coming data from the connected external device will stay in the data buffer before transmission ?
Please refer to register 50.
6. How can I reduce the waiting period and speed up the transmission process of the in-coming data from the connected external device ?
Please refer to register 51 and 52.
7. Where can I find the remote unit's address if the connection request was initiated from remote unit ?
Please refer to register 53.
8. How long the RF of WINC 900A will remain in burst mode after connection or data transmission ?
Please refer to register 60.
9. How can I disable the idle mode ?

Please refer to register 60.

10. How can I adjust the polling pace from the master unit in the idle mode ?
Please refer to register 61.
11. How can I adjust the length of the “BREAK” signal in order to activate the connected external PLC or SCADA device ?
Please refer to register 62.
12. How can I adjust the length of the carry detection function in the transparent mode ?
Please refer to register 63.

6.0 WINC 900A Interface Status

The WINC 900A interface status refers to the state of the RS-232 serial port between the local terminal or computer and the WINC 900A. The state, in turn, is determined by the signal levels on each of the signal lines that comprise the serial port. These status lines have been brought to the front panel in the form of a series of eight (8) light emitting diodes (LED). In addition, a reset button has been provided to the right of this series of LEDs.

To the right of the reset button are two additional indicators, one above the other and each rectangularly shaped. When the unit is powered on, the upper indicator turns red and stays red until the unit is powered down. The lower indicator provides a measure of the receive signal strength. When the indicator is green, the receive signal on the current channel is sufficiently strong to maintain a connection with the remote terminal. A weak signal will cause the indicator to turn off.

Each LED displays one of two different colors, green or red. Green indicates an active state or signal presence, whereas red indicates an inactive state or signal absence. The table below indicates the function of each signal beginning with RI, the left most indicator. The remaining indicators appear from left to right ending with RXD, the right most indicator.

| Panel L E D | Function |
|---------------------------|------------------------------------------------------------------------------------|
| Ring Indicator (RI) | Signals incoming connection request. |
| Data Carrier Detect (DCD) | Indicates "connection established" with remote. |
| Data Terminal Ready (DTR) | Signal from host to device. May indicate command mode escape or ignored by device. |
| Data Set Ready (DSR) | Signal from device to host. May indicate connection established or always on. |
| Clear To Send (CTS) | Indicates device ready to accept data from host. Used in H/W flow control. |
| Request To Send (RTS) | Indicates host ready to send data to device. Used in H/W flow control. |
| Receive Data (RXD) | Serial data input to host from device. |
| Transmit Data (TXD) | Serial data input to device from host. |

When the WINC 900A is initially powered up the CTS and DSR indicators should be green, whereas the RI and DCD indicators are red.

Once the connection is established, the DCD indicator turns green.

If the system is configured to use hardware flow control the CTS indicator will change to RED when the WINC's internal buffer becomes full. When data is removed from the buffer the CTS indicator will turn green again.

When a connection request from a remote terminal is received the RI turns green. It will turn red when the connection is established or the connection request has timed out.

The DTR, DSR, RTS, and CTS indicators follow the AT configuration commands as issued to the WINC 900A. For example, if the device has been configured for S/W flow control then the RTS and CTS indicators will be red.

Since the WINC 900A alternatively transmits and receives when on-line, the TXD and RXD indicators cycle between green and red at the configured data rate.

When the default reset button is pressed, the WINC 900A either defaults to the factory preset configuration of 9600 bps, 8 bits per character, no parity, 1 stop bit, hardware flow control, and auto answer or resets to the previously configured state. To ensure that the device resets to the default conditions, first power down the unit and then power it on while depressing the reset button.

To the right of the serial line LEDs are two small rectangular LED indicators. The upper red indicator lights when the power is on, while the lower green LED indicates the receive signal level. Solid ON indicates sufficient signal strength, while solid OFF indicates either no received signal or a signal too weak to sustain communications. A blinking signal indicates a marginal signal level.

If you experience difficulty in making connections between a local and remote WINC 900A, first reset both units to the factory default conditions and retry before calling for technical assistance.

7.0 AT Command Set

At any given time the WINC 900A is in either one of two modes, the *command* mode or the *on-line* mode. When in the command mode, the device accepts commands from the host computer. These commands are sent to the WINC 900A as character strings composed of printable ASCII characters. Using the same character set, the WINC 900A responds to the host computer's command by sending back a result code string indicating whether the WINC 900A was able to accomplish the requested command.

The command language is based on the Hayes compatible and *de facto* industry standard AT command set. In addition to the basic AT commands, certain command extensions accommodate specific WINC 900A configuration requirements.

7.1 AT Command Syntax

A command line is a string of characters sent from the host computer or peripheral - Data Terminal Equipment (DTE), to the WINC 900A - Data Communications Equipment (DCE). (The command line is interpreted by the DCE only when in the command state.) All command lines have a prefix, a body, and a terminator. The prefix consists of the characters "AT" and the body is a command string restricted to the printable ASCII characters. The default terminator is the <CR> character and is required for all commands except the A/ command. The WINC 900A accepts command strings that adhere to the following rules:

- (a) Commands begin with the two character sequence **AT** or **A/**. Any preceding characters are ignored. The command line is terminated by the ASCII defined carriage return character resident in register **S3**.
- (b) Commands are accepted in upper and lower case.
- (c) Multiple commands may be concatenated on the same command line, although blanks (space character) may be inserted for readability and are ignored. Certain restrictions in command sequencing on the same command line, as indicated below, must be followed.
- (d) Unsupported commands or parameters return an ERROR result code to the host computer. Any following commands on the same command line are ignored.
- (e) Missing parameters default to the value 0 where expected.
- (f) The command line may be edited prior to entering the command terminator with the backspace character (register **S5**) or deleted entirely using the line cancel character (ASCII CAN - Control X).
- (g) The **A/** command repeats the most recent command and requires no carriage return terminator.

7.2 Basic AT Commands

The WINC 900A is designed to respond to the following Hayes compatible AT commands.

A - Answer On-line

The command ATA causes the WINC 900A to cease accepting commands and to wait for an incoming connection request for up to register **S7** seconds. If a pending connection request is present, the device accepts the connection and enters the on-line state. Any following commands on the same command line are ignored. If input is detected prior to entering the on-line mode, the command is aborted.

Format:

| | |
|-----|-----------------|
| ATA | Answer on-line. |
|-----|-----------------|

Result codes:

| | |
|------------|-------------------------------------------------------------------|
| CONNECT | Connection is established. |
| NO CARRIER | Connection not established due to S7 time-out or command aborted. |
| ERROR | Connection already established. |

D - Dial

The ATD command begins a transaction to establish a connection with a remote party. The WINC 900A transmits a connection setup request containing the destination address given on the command line and waits for up to register **S7** seconds for a response. If the connection is accepted, the device enters the on-line state. Any following commands on the same command line are ignored. If input is detected prior to entering the on-line mode, the command is aborted.

The destination address may be explicitly given on the command line or retrieved from the configuration file's S register containing the stored address string.

Format:

| | |
|------|------------------------------------------------------------------------------------------------------------------|
| ATDs | s=destination address string, plus optional dial modifiers. Default dial string is the last destination address. |
|------|------------------------------------------------------------------------------------------------------------------|

Dial Modifiers:

| |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dial modifiers specify additional information or actions during the connection origination process and include T, P, W, @, Sn, and “;”. These modifiers are included for Hayes compatibility and are ignored. Invalid characters are ignored as well. The Sn dial modifier substitutes one of the stored destination addresses. The stored address list is defined with the &Z command. |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Result Codes:

| | |
|------------|--------------------------------------------------------------------------------------------------------------------------------------|
| CONNECT | Connection is established. |
| NO CARRIER | Connection is not established or command aborted. |
| BUSY | Connection is refused and extended result codes are selected (otherwise NO CARRIER). |
| NO ANSWER | No response is received from the destination within S7 seconds and extended result codes are selected (otherwise NO CARRIER). |
| OK | Valid argument. |
| ERROR | Connection already exists. |

When an air-link connection is unable to be completed, an extended reason code is written to register **S56**.

E - Command Mode Echo

The ATE command controls the echoing of characters in the command mode.

Format:

| | |
|------|-------------------------------------------|
| ATE0 | Do not echo AT commands to host computer. |
| ATE1 | Echo AT commands to host computer. |

Result Codes:

| | |
|-------|-------------------|
| OK | Valid argument. |
| ERROR | Invalid argument. |

H - Hang-up (close connection)

The ATH command closes the current connection. The command may be interrupted by the input from the host computer allowing the close connection process to be upgraded from H0 to H1 if required.

Format:

| | |
|------|---------------------------------------------------------------------------|
| ATH0 | Transmit pending data, then close connection. |
| ATH1 | Return result code OK. |
| ATH2 | Discard pending data and close connection immediately. |
| ATH3 | Discard pending data, close connection immediately and leave the network. |

Result codes:

| | |
|-------|-------------------|
| OK | Valid argument. |
| ERROR | Invalid argument. |

I - Identify

The ATI command returns information about the WINC 900A or equivalent DCE device.

Format:

| | |
|------|------------------------------------------------|
| ATI0 | Identifies modem's address. |
| ATI1 | Identifies software (firmware) release number. |
| ATI2 | Identifies manufacturer. |
| ATI3 | Identifies equipment model number. |
| ATI4 | Identifies crystal type. |

O - Enter On-line Mode

The ATO command instructs the device to return to the on-line state. Commands following on the same line are ignored. This command line is used following an *escape to command mode* command.

Format:

| | |
|-----|--------------------------------|
| ATO | Return to <i>on-line</i> mode. |
|-----|--------------------------------|

Result Codes:

| | |
|---------|------------------------------------|
| ERROR | Connection does not exist. |
| CONNECT | Successful return to on-line mode. |

Q - Quiet Mode

The ATQ command controls whether result codes are sent to the host computer. If this command is selected, the V and X commands may further modify the result codes.

Format:

| | |
|------|-----------------------------------------|
| ATQ0 | Modem sends responses to host computer. |
| ATQ1 | Modem does not send responses to host. |

Result codes:

| | |
|-----------|----------------------|
| OK | If ATQ0 is selected. |
| <nothing> | If ATQ1 is selected. |
| ERROR | Invalid argument. |

S - Select Register

The ATS command selects a register for interrogation or modification in the current active profile. Additional reads or writes to the register are accomplished with the ? or = commands, respectively. The register remains selected until the next S command is given. The complete set of S register commands is provided in Appendix B.

Format:

| | |
|------|----------------------|
| ATSn | Select register <n>. |
|------|----------------------|

Result Codes:

| | |
|-------|--------------------------|
| OK | Valid register selected. |
| ERROR | Unsupported register. |

? - Read Selected Register

The ATS? command returns the value of the selected register specified by the S command.

Format:

| | |
|-------|---------------------------------------|
| ATSn? | Read value of register <n>. |
| AT? | Read value of last selected register. |
| ATS? | Read value of register 0. |

Result codes:

| |
|----------------------------------------------------------------|
| Depends on S register contents. Numbers are in decimal format. |
|----------------------------------------------------------------|

= - Write Selected Register

This command alters the value in the currently selected S register. The format of the parameter is numeric or text, depending on the register being modified. Numeric values are specified in decimal. If the S register is a text register, this command must be last on the command line.

Format:

| | |
|--------|------------------------|
| ATS0=n | Set register 0 to <n>. |
|--------|------------------------|

Result codes:

| | |
|-------|--------------------------------------|
| OK | Valid parameter. |
| ERROR | Invalid value for selected register. |

V - Verbal Result Codes

The ATV command determines whether the device sends a numeric digit (terse mode) or an informative text string (verbose mode).

Format:

| | |
|------|-------------------------------|
| ATV0 | Use numeric result codes. |
| ATV1 | Use text string result codes. |

Result codes:

| | |
|-------|-------------------|
| OK | Valid argument. |
| ERROR | Invalid argument. |

Below is a listing of numeric and text string result codes:

| Numeric Code | Text String Response |
|--------------|----------------------|
| 0 | OK |
| 1 | CONNECT |
| 2 | RING |
| 3 | NO CARRIER |
| 4 | ERROR |
| 6 | NO DIAL TONE |
| 7 | BUSY |
| 8 | NO ANSWER |

X - Extended Result Codes

The ATX command determines whether the device enables extended result codes. All extended result codes are enabled in the default settings.

Format:

| | |
|------|-------------------------------------------------------------------------------|
| ATX0 | Enable only codes 0...4. Extended results are mapped as appropriate to 0...4. |
| ATX2 | Enable all extended result codes (default). |

Z - Soft Reset

The ATZ command resets all parameters to the saved profile, aborting any active connection. If no profile was saved, the device is reset to the default condition.

Format:

| | |
|-----|---------------------|
| ATZ | Perform soft reset. |
|-----|---------------------|

Result code:

| | |
|----|-------------------|
| OK | Command complete. |
|----|-------------------|

&C - Set DCD Operation

For serial ports, the AT&C command defines the operation of the data carrier detect signal (DCD) at the modem interface.

Format:

| | |
|-------|------------------------------------------------------------------------------------|
| AT&C0 | DCD always active. |
| AT&C1 | DCD follows the state of "Connection Established" condition, which is the default. |
| AT&C2 | DCD always on, except momentarily at connection disconnect. |
| AT&C3 | DCD follows the state of the "RF in Range" condition. |

&D - Set DTR Operation

For serial ports, the AT&D command defines the device's response to the state of the data terminal ready (DTR) signal at its interface with the host computer.

Format:

| | |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT&D0 | DTR is ignored (default). |
| AT&D1 | Enter command state upon detecting active-to-inactive transition of DTR. |
| A T&D2 | Closes the connection upon detecting active-to-inactive transition of DTR. Equivalent to executing ATH2 command. Auto-answer is disabled while DTR is inactive. |

&F - Restore Factory Defaults

The AT&F command resets the modem to factory default settings.

Format:

| | |
|------|---------------------------|
| AT&F | Restore factory defaults. |
|------|---------------------------|

&S - Set DSR Operation

For serial ports, the AT&S command defines the operation of the data set ready (DSR) signal at the modem interface.

Format:

| | |
|-------|------------------------------------------------------------------|
| AT&S0 | DSR is always active. |
| AT&S1 | DSR follows the state of the "Connection Established" condition. |
| AT&S2 | DSR follows the state of the "Battery OK" condition. |

&V - View Active Profile

The AT&V command displays the active configuration state of all registers.

Format:

| | |
|------|----------------------|
| AT&V | View active profile. |
|------|----------------------|

&W - Save Active Profile

The AT&W command saves the current configuration state of all registers in non-volatile memory. At power up, the device is set with the active profile status.

Format:

| | |
|------|----------------------|
| AT&W | Save active profile. |
|------|----------------------|

7.3 Extended AT Command Set

The following commands, which comprise the extended AT command set, provide control of the data transfer packet assembly and disassembly characteristics performed in the WINC900A, as well as air-link specific configuration parameters.

&L - Set Modem Line Speed and Format

For serial ports, the AT&L command allows the host processor to set the line speed and format between it and the modem. All subsequent communication with the host will be at the new speed and format if the command completes successfully.

Format:

| |
|------------------------------------------|
| AT&L<speed>,<databits><parity><stopbits> |
|------------------------------------------|

AT\C - Select Communications Channel

Although the WINC 900A automatically selects the best channel over which to communicate, the communications channel may be changed using the AT\C command.

Format:

| | |
|-------|--------------------|
| AT\C0 | Channel 0, 925 MHZ |
| AT\C1 | Channel 1, 922 MHZ |
| AT\C2 | Channel 2, 919 MHZ |
| AT\C3 | Channel 3, 916 MHZ |
| AT\C4 | Channel 4, 913 MHZ |
| AT\C5 | Channel 5, 910 MHz |
| AT\C6 | Channel 6, 907 MHZ |
| AT\C7 | Channel 7, 904 MHZ |

&P - Set RF Power Level

The AT&P command sets the RF output (transmit) power level of the WINC 900A.

Format:

| | |
|-------|--------------------------------------|
| AT&P0 | Auto Power Control Mode |
| AT&P1 | Set output power to 1 milliwatt. |
| AT&P2 | Set output power to 10 milliwatts. |
| AT&P3 | Set output power to 100 milliwatts. |
| AT&P4 | Set output power to 1000 milliwatts. |

&! - Set Wireless Specific Parameters

The AT&! command, followed by the parameter identifier, defines specific wireless parameters that may affect system performance.

Format:

| | |
|-------|------------------------------------|
| AT&!S | Activate the short spreading code. |
| AT&!L | Activate the long spreading code. |

&!n - Automatic Re-connection Control

The AT&!n command determines whether the automatic re-connection feature is enabled. If enabled, this command must be preceded by the command AT~A<address>, where <address>=remote terminal address or identifier.

Format:

| | |
|-------|--------------------------------------------|
| AT&!0 | Disable automatic re-connection. (default) |
| AT&!1 | Enable automatic re-connection. |

\F - Set Data Forward Operation

The AT\F command determines whether the data forwarding characters specified in registers **S51** and **S52** are included in the packet transmitted to the remote terminal. For the data forwarding characters to be recognized, the manual transmit mode (\M command) must be enabled.

Format:

| | |
|-------|------------------------------------------------------------------------------------------------------------------|
| AT\F0 | Data forwarding characters are excluded from the packet (not transmitted). |
| AT\F1 | Data forwarding character specified by S51 is included, but S52 is excluded. |
| AT\F2 | Data forwarding character specified by S52 is included, but S51 is excluded. |
| AT\F3 | Both data forwarding characters S51 and S52 are included in packets to the remote modem (default). |

If only a single data forwarding character is required, registers **S51** and **S52** should be set to the same value and **AT\F0** or **AT\F3** selected as appropriate.

\M - Manual Transmit Control

The AT\M command controls the recognition of data forwarding characters in the packet assembler while the device is in on-line mode. If enabled, the modem recognizes the reception of one of the two forwarding characters from the host computer as a condition to transmit any pending data. The \F command determines whether the forwarding characters themselves are included in the packet. If manual transmit control is disabled, the forwarding characters are included in the packet regardless of their disposition defined by the \F command.

Format:

| | |
|-------|---------------------------------------------------------|
| AT\M0 | Disable recognition of data forwarding characters. |
| AT\M1 | Enable data forwarding character recognition (default). |

\Q - Set Flow Control Operation

The AT\Q command determines the data flow control technique to be applied between the host computer and modem.

Format:

| | |
|-------|--------------------------------------------|
| AT\Q0 | No flow control. |
| AT\Q1 | Bidirectional XON/XOFF flow control (S/W). |
| AT\Q2 | Hardware flow control (default). |

| | |
|-------|------------------------------------------|
| AT\Q3 | Both hardware and software flow control. |
|-------|------------------------------------------|

\T - Automatic Transmit Control

The AT\T command enables the inter-character time-out forwarding operation in the packet assembler in the on-line mode. The inter-character timer determines the amount of time allowed between characters received from the host. The time-out value is specified in register **S50** in 0.1 second increments.

Format:

| | |
|-------|------------------------------------------------------------------------|
| AT\T0 | Disable automatic timed transmission (default). |
| AT\T1 | Enable automatic timed transmission according to register S50 . |

7.4 S Registers

The configuration of the WINC 900A is accessible to the host computer as a set of parameters stored in a set of S registers. Some registers may be updated directly with **AT** commands and others are read-only. The contents of the set of registers determine the configuration profile. At least three different profiles are present in the device: Appendix B contains a summary of the complete S Register set.

- (a) Active Profile: The active profile is the set of register values actually used as the current operational parameters of the equipment. They are queried or modified using the **Sr?** and **Sr=n** commands, respectively.
- (b) Saved Profile: The saved profile is a subset of the registers of the active profile. The saved profile is used at power up to establish the power-on configuration state. The saved profile is preserved across cold boots or power down. A saved profile is created by writing the profile desired with the **&W** command, which copies the contents of the subset of the active profile registers into the saved profile. The saved profile may be recopied over the active profile at any time with the soft reset **Z** command.
- (c) Factory Profile: The WINC900A has an embedded permanent profile that is a factory default setting and can not be modified. The factory profile may be copied into the active profile with the loadable defaults **&F** command, or by depressing the default reset button on the front panel.

7.5 Commonly used AT Commands with the WINC 900A

Although the AT command set is a *de facto* industry standard for typical land-line modems, for ease of operation and simplicity the WINC 900A has been designed to accept many of these same commands. These commands control the interface between the device and the host processor and configure the device itself.

Connecting to a Remote Station

Unlike a telephone modem, the WINC 900A can establish connections to remote terminals on any one of eight channels. Although the WINC 900A automatically selects the best channel over which to communicate when a *call* is initiated, this feature may be negated by first selecting a particular channel over which to communicate. This is done by using the AT\Cn command prior to using the

ATDT command, where Cn refers to Channel n. For example, the command AT\C5 followed by the command ATDT100001 will establish a connection on Channel 5 with the remote modem whose address is 100001.

Standard communication software packages, especially those running in the Windows environment, generally do not provide the capability to identify a channel number. In this case, the augmented AT\C command should be used in the direct mode.

Changing Line Speed and Format

The serial interface between the device and the host processor can be configured with a variety of line speeds and data formats using the AT&L command, as follows: AT&L<line speed>, <databits><parity><stopbits>. For example, the command AT&L9600,8N1 will configure the interface at 9600 bps, 8 data bits per character, no parity, and 1 stop bit. Although this happens to be the default configuration, many other combinations of line speed and data formats are supported by the WINC 900A. Please see the product specification details in Appendix C.

Saving the Current Active Profile

The AT&W command saves the current configuration settings in non-volatile memory to protect against a power outage or other event that may modify the current settings. When powered on again, the device will be set to this profile.

Viewing the Current Profile

The current configuration, or active profile, of the WINC 900A can be viewed at any time by using the AT&V command. In response to this command, the configuration state of all registers will be displayed.

Changing the Communications Channel

Unlike a telephone modem, the WINC 900A establishes connections and facilitates communications over an air-link in the ISM band between 902 and 928 MHz. Within this band, the WINC 900A provides eight (8) user selectable channels over which the local and remote terminals communicate. Although the communications channel is automatically selected, any of the eight channels may be selected by the user. To do this, use the AT\C command prior to issuing the ATDT<address> command. Here AT\C0 refers to channel 0, AT\C1 refers to channel 1, etc. This command establishes connections on C0 through C7.

Changing the RF Power Level

Depending on specific operating conditions, the user may wish to change the output power level of the transmitter. The AT&P command accomplishes this by specifying one of four (4) possible power levels; 1, 10, 100, and 1000 milliwatts.

Changing the Spreading Code

The performance of the system depends on a number of selectable parameters. One of these is the length of the spreading code. A short code provides higher transmission rates at slightly decreased robustness, whereas a long code provides more robustness at the expense of transmission rate. The length of the spreading code is selected by the AT&!<x> command, where <x> represents the spreading code descriptor; L for the long code and S for the short code.

Verifying the Local Address

Each WINC 900A has been identified at the factory with a unique address (identical to the serial number listed on the label on the left-hand side of the unit)³. For a remote terminal, this represents the destination address. The local address can be verified using the ATI command, where ATIO refers to the equipment identification number or local address. See Section 8.2 for additional information concerning the ATI command.

³ See Section 3.0

APPENDIX A - AT Commands for the WINC 900A

The following table lists those AT commands used by the WINC 900A. While most of these commands are supported by ordinary land-line modems, some are WINC 900A specific. Each command, except for A/, must be preceded by the string "AT" and terminated with the <CR> character. For further information about the AT Command Set, refer to Section 8.0.

| COMMAND | EXPLANATION |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A | Manually answer incoming connection requests or calls. |
| A/ | Repeat the last command line executed. No carriage return required. |
| AT | Appears at the beginning of each command line, except for the A/ command. |
| Dn | Initiate connection with the destination WINC 900A, identified by address n. Although dial modifiers typically used for ordinary telephones are accepted by the WINC, they are unnecessary and are ignored by the system. |
| E | E0 Do not echo AT commands to host. E1 Echo AT commands to host. |
| H | Terminate Connection ATH0 Transmit pending data, then close connection. ATH1 Return result code OK. ATH2 Discard pending data & close connection immediately. ATH3 Same as ATH2 plus depart network. |
| I | Local Device Information ATI0 Identify modem ID address. ATI1 Identify firmware version number ATI2 Identify manufacturer. ATI3 Identify equipment model number. ATI4 Identify crystal type. |
| O | Enter On-line Mode. ATO Return on-line. |
| Q | Quiet Mode ATQ0 Disable quiet mode. Results sent to host. ATQ1 Enable quiet mode. Results not sent to host. |
| S | Select Register (See Appendix B.) |
| ? | Returns value of selected register specified by S command. ATSn? Read value of register <n>. AT? Read value of last selected register. ATS? Read value of register 0 |
| = | Write Selected Register. ATS0=n Set register 0 to <n>. ATSxx=string Set register xx to "string". |
| V | Verbal Result Codes ATV0 Use numeric codes. ATV1 Use text string codes. |
| X | Extended Result Codes ATX0 Enable only codes 0...4. ATX2 Enable all extended result codes. |
| Z | Soft Reset |

| | |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | ATZ Perform soft reset & abort active connection. |
| +++ | Escape to command mode from on-line mode and maintain connection to remote device. |
| &C | Set Data Carrier Detect (DCD) Operation. AT&C0 DCD always active. AT&C1 DCD follows the state of "Connection Established". AT&C2 DCD always on, except momentarily at hang-up. AT&C3 DCD follows state of "RF in range". |
| &D | Set Data Terminal Ready (DTR) Operation. AT&D0 DTR is ignored. AT&D1 Enter command state after detecting DTR transition. AT&D2 Closes the connection upon detecting DTR transition. |
| &F | Restore factory defaults. AT&F Restore factory defaults. |
| &L | Set Modem Line Speed & Format AT&L<speed>,<databits><parity><stopbits> |
| &P | Set transmitter output power level. &P0 Auto &P1 1 milliwatt &P2 10 milliwatts &P3 100 milliwatts &P4 1000 milliwatts |
| &S | Set Data Set Ready (DSR) Operation AT&S0 DSR always active. AT&S1 DSR follows state of "Connection Established" condition. AT&S2 DSR follows state of "Battery OK" condition. |
| &V | View Active Profile AT&V View active profile. |
| &W | Save Active Profile AT&W Save Active Profile |
| &!<n> | Automatic link re-connection <n>=0; Automatic re-connection disabled. <n>=1; Automatic re-connection enabled. (These commands must be preceded by the command AT~A<address>, where <address>= remote node identifier.) |
| &!<x> | <x>=S; Select short spreading code. <x>=L; Select long spreading code. |
| \C | Select communications channel. C0 925 MHZ C1 922 MHZ C2 919 MHZ C3 916 MHZ C4 913 MHZ C5 910 MHZ C6 907 MHZ C7 904 MHZ |
| \F | Set Data Forward Operation AT\F0 Data forwarding characters are excluded from packet. AT\F1 Data character for S51 included, S52 excluded. AT\F2 Data character for S52 included, S51 excluded. |

| | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------|
| | AT\F3 Both characters for S51 and S52 included. |
| \M | Manual Transmit Control AT\M0 Disable recognition of data forwarding characters. AT\M1 Enable data forwarding character recognition. |
| \Q | Set Flow Control AT\Q0 No flow control AT\Q1 Bidirectional XON/XOFF flow control AT\Q2 Hardware flow control. AT\Q3 Both. |
| \T | Automatic Transmit Control AT\T0 Disable automatic timed transmission. AT\T1 Enable automatic timed transmission according to register S50. |

APPENDIX B - S Register Summary

| Register | Function | Range | Units | Default |
|----------|-------------------------------------------------|-------------|---------|-----------|
| S0 | Rings to Auto-Answer | 0-1 | rings | 1 |
| S2 | Escape Character | 0-255 | ASCII | 43<+> |
| S3 | Carriage Return Character | 0-127 | ASCII | 13<CR> |
| S4 | Line Feed Character | 0-127 | ASCII | 10<LF> |
| S5 | Backspace Character | 0-127 | ASCII | 8<BS> |
| S7 | Wait Time for Carrier | 0-255 | second | 60 |
| S10 | Carrier Loss Disconnect Time | 0-255 | second | 50 |
| S12 | Escape Prompt Delay | 0-255 | 0.02sec | 50 |
| S14 | Command Status Bitmap (read only) | | | |
| S21 | Equipment Status Bitmap (read only) | | | |
| S22 | Equipment Status Bitmap (read only) | | | |
| S23 | Equipment Status Bitmap (read only) | | | |
| S50 | Data forwarding idle time-out | 0-255 | 0.1sec | 2 |
| S51 | Primary Data forwarding character | 0-255 | ASCII | 13<CR> |
| S52 | Secondary Data forwarding character | 0-255 | ASCII | 26<ctl-Z> |
| S53 | Remote Party Address | Char.String | | 0303030 |
| S60 | Idle Mode | 0-1 | | 0 |
| S61 | Idle Guard Time | 1-5 | 0.1sec | 5 |
| S62 | PLC Break Control Signal Length | 0-255 | 10msec | 30 |
| S63 | Enable the detection function or Listening time | 0-10 | 0.01sec | 3 |

S-REGISTER DEFINITIONS :

The behaviors of WINC 900A can be adjusted via the AT commands and the content of register to meet application's requirement.

S0 Rings to Auto-Answer

Whether this unit will be able to answer the request for connection from the remote caller automatically or manually is decided by the content of the register 0.

S2 Escape Character

The value in register 2 maps to an ASCII code, a designated Escape Character on the keyboard, which allows user to switch the operation mode of the communication software back to command mode from connection mode by holding the "Shift" key and press this key three (3) times.

S3 Carriage Return Character

S4 Line Feed Character

S5 Backspace Character

S7 Wait Time for Carrier

The ATD command begins a transaction for establishing a connection with a remote party. The WINC 900A transmits a connection setup request containing the destination address given on the command line and waits for up to register **S7** seconds for a response. If the connection request is not accepted, the device returns to the command state.

S10 Carrier loss disconnect time

After the establishment of the linkage between two units, the build-in protocol of WINC 900A will verify the existing of connection. If the connection can not be verified within the designated time frame in register 7, this WINC 900A will declare disconnection and prepare himself for connection request.

S12 Escape Prompt Delay (EPD)

The value in register 12 defines the maximum period allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE. If any characters are detected over this time, the OK will not be sent.

S14 Command Status Bitmap

This is a read-only bit-mapped register defined as follows:

| | |
|------------|-----------------------------------|
| Bit 0 | Unused. |
| Bit 1 | Command mode echo; see E command. |
| Bit 2 | Quiet mode; see Q command. |
| Bit 3 | Verbose mode; see V command. |
| Bits 4,5,6 | Unused. |
| Bit 7 | Unused. |

S21 Equipment Signal Status Bitmap

For serial ports, this is a read-only bit-mapped register defined as follows:

| | |
|----------|--------------------------------|
| Bit 0 | Unused. |
| Bits 1,2 | DSR operation; see &S command. |
| Bits 3,4 | DTR operation; see &D command. |
| Bits 5,6 | DCD operation; see &C command. |
| Bit 7 | Unused. |

S22 Equipment Status Bitmap

This is a read-only bit mapped register defined as follows:

| | |
|------------|---------------------------------------|
| Bits 0,1 | Unused |
| Bit 2 | Unused |
| Bit 3 | Unused |
| Bits 4,5,6 | Extended result codes; see X command. |
| Bit 7 | Unused |

S23 Equipment Serial Port Status Bitmap

This is a read-only bit mapped register defined as follows:

| | |
|------------|------------------------------------------------------------------------------------|
| Bit 0 | Unused |
| Bits 1,2,3 | (value, data rate): (0, 1.2), (1, 2.4), (2, 4.8), (3, 9.6), (4, 19.2),(5, 38.4) |
| Bits 4,5 | Unused |
| Bits 6,7 | (value, parity): (0, even), (1, none), (2, odd), (3, mark) |

S50 Data forwarding idle time-out

The data from the connected external device will stay in a system buffer and packetized for transmission process. Before receiving the designated characters, reaching the ceiling of this buffer, or ending of waiting cycle (data forwarding idle time-out), the received data will remain in the designated system buffer. The value of register 50 specifies the amount of time allowed between characters received from the connected external device.

Range : 0-255 (1/10 second)

Default : 2 (0.2 second)

S51 Primary Data forwarding character

The data from the connected external device will stay in a system buffer and packetized for transmission process. Before receiving the designated character (Primary Data Forwarding Character and Secondary Data Forwarding Character), reaching the ceiling of this buffer, or ending of waiting cycle (data forwarding idle time-out), the received data will remain in the designated system buffer. The content of register 51 maps to the ASCII code which designates the Primary Data Forwarding Character. The modem recognizes the reception of the forwarding character from the host computer as a condition to transmit any pending data.

Range : 0-255 (ASCII)

Default : 13 <CR>

S52 Secondary Data forwarding character

The data from the connected external device will stay in a system buffer and packetized for transmission process. Before receiving the designated character (Primary Data Forwarding Character and Secondary Data Forwarding Character), reaching the ceiling of this buffer, or ending of waiting cycle (data forwarding idle time-out), the received data will remain in the designated system buffer. The content of register 52 maps to the ASCII code which designates the Secondary Data Forwarding Character. The modem recognizes the reception of the forwarding character from the host computer as a condition to transmit any pending data.

Range : 0-255 (ASCII)

Default : 26 <Ctrl-Z>

S53 Remote Party Address

After the establishment of wireless connection between two WINC 900As, the address of the remote unit will be logged in register 53.

Range : Character String

Default : 0303030

S60 Idle Mode

During the data transmission process, the RF of WINC 900As will stay in burst mode; therefore, the signal strength indicator on the front panel will be in “Green”. The RF of WINC 900A will remain in burst mode for another 30 seconds after the establishment of connection or the termination of data transmission process. To reduce the noise, the build-in protocol of WINC 900A will switch into idle mode and exchange packets to maintain the established link. The in-coming data from the physical connected will be detected and the WINC 900A will return to the burst mode. But, there is a delay during the wake-up process. This idle mode can be disabled via the register 60. If you disable the idle mode, then modem would never go to Idle mode state, even if, there is no incoming data.

Range : 0, 1. Idle mode enable = 0, Idle mode disable = 1.

Default : 0

S61 Idle guard time

To maintain the connection between two units in the idle mode, one of the two units will act as the master unit and start to poll the remote unit in a fixed interval defined by register 61. Your setting will be accepted if register S60 = 0.

Range : 1-5 (1/10 second)

Default : 5 (0.5 second)

S62 PLC Break Control Signal Length

Most of field devices, such as PLC or sensors, must to be activated by a fixed length signal initiated from manufacture’s application system. To ensure the delivery of the “BREAK” signal with required length, the length of the break signal can be defined in register 62 at the device side.

Range : 0-255 (10 msec)

Default : 30 (300 msec)

S63 Enable the detect function or Listening time.

To avoid the packet collision situation in the transparent mode, each unit will listen/monitor the traffic on the air. The data transmission process will be executed if there is no traffic on the air for a defined period time. Otherwise the transmission process will be on hold and the monitoring function will re-instated after a random time. The required clear air time can be defined in register 63. You can use this register only for transparent mode.

Disable = 0

Range : 0-10 (1/100 second)

Default : 3 (0.03 second)

APPENDIX C - WINC 900A Specification

Serial Interface

| | |
|--------------------------|--------------------------------------------------------------|
| Asynchronous data rates | 1.2, 2.4, 4.8, 9.6, 14.4, 19.2, 28.8, 38.4 Kbps |
| Asynchronous data format | Data: 7 or 8 bits, Parity: even/odd/none Stop bit: 1 or 2 |
| Flow Control | XON/XOFF, RTS/CTS |
| Connector | RS-232, DB-25 female |
| Operation | Full-Duplex |
| Compatibility | Hayes AT Command Set |

Radio

| | |
|----------------------|------------------------------------------|
| Power Output | 1, 10, 100, 1000 milliwatts (selectable) |
| Frequency Band | 902-928 MHZ |
| Independent Channels | 8 |
| Range | 1 kilometer outdoors; 100 meters indoors |
| Antenna | Omnidirectional "rubber ducky" |

Communication

| | |
|-----------------------|---------------------------------------|
| Modulation | DQPSK |
| Spread Spectrum | Direct-Sequence |
| Bandwidth per Channel | 3 MHZ |
| Sensitivity | -85dbm (not including spreading gain) |

Power

| | |
|-----------------------|--------------------------------------------------|
| Primary Power | 100-250 V AC @50/60 Hz, 0.3-0.7A, auto-switching |
| Internal Power Supply | 28 Watts, AC |

Additional Support

Teletronics International, Inc. is pleased to provide software and integration support to customers desiring to develop special WINC 900A applications. Teletronics' personnel will assist you in developing functional and technical requirements for your specific application and will work with you in implementing cost effective solutions. Please contact Teletronics directly to discuss your particular needs.

Printed in the USA
9A032098.DOC

Teletronics International Inc.
1803 Research Blvd, Suite 404
Rockville, MD 20850-3155 USA