

WiFi ESL Advanced Features

This document describes the advanced configuration features of the WiFi ESL. It covers:

1. WiFi ESL port modes
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 - Raw Server Mode
 - Raw Client Mode
 - RFC 2217 Mode
 - Data Connect Mode
 - Ethernet Modem Mode
 - Disabled Mode
2. WAN Port configuration
3. Passwords
4. Port access restrictions
5. Advanced serial port settings (buffer management)
6. Port reset
7. Device reboot
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1. WiFi ESL port modes

The WiFi ESL converts serial port data to and from TCP/IP packets over Ethernet. Each WiFi ESL port exchanges TCP/IP packets on its own unique TCP port (called the "Local Port" in the Properties dialog box). Each serial port on a WiFi ESL device can be configured independently to perform this conversion in one of the serial port modes discussed below:

Driver Mode (Default mode)

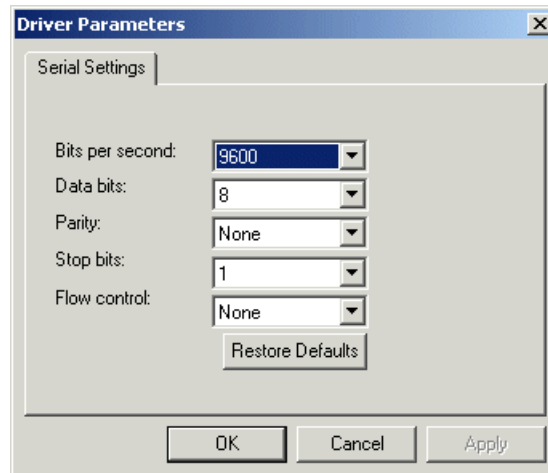
This mode enables the physical port of a WiFi ESL to communicate directly with the serial port API of a supported operating system as a local COM port. In this mode, authorized users can set bits per second, data bits, parity, stop bits, and flow control port-by-port, or the port will accept its serial port settings from the application/operating system that is accessing it. Driver mode is the factory default mode when a WiFi ESL is installed.

When installed on a LAN, a WiFi ESL in Driver Mode has all the functionality of an internally installed serial port. All data lines and control lines are active in Driver mode.

When installed on a WAN or the Internet, the serial port of a WiFi ESL gains enormous flexibility and power. To use a WiFi ESL port on a remote network:

1. configure the IP address and TCP port of the WAN connection in the *Ether-Link Manager*™ to match the gateway IP address of the remote network,
2. map the IP address and TCP port of the remote gateway to the IP address of the WiFi ESL, and
3. configure the WiFi ESL itself for Driver Mode.

Applications: General serial port access from applications running on a PC.



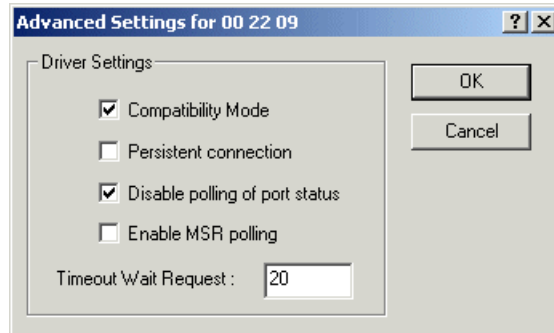
Driver Mode operation with Host PC security and firewalls:

When first installing *Ether-Link Manager*™ and driver onto the host PC, the security and firewall settings may have to be adjusted or turned off to allow the application and driver to use COM port and network resources in order to load the software.

The *Ether-Link Manager*™ (and firmware upgrade utilities) use UDP communications, which includes UDP broadcast packets. Note: some LAN routers may block some UDP packets. In such instances an Ethernet crossover cable can be used from the host PC to connect directly to the device that is to be configured.

Virtual port (driver) settings

The WiFi ESL virtual port allows a serial port on a WiFi ESL to be used in same manner as a local serial port when the port is configured in Driver Mode (described above). In this state, the driver for the virtual port converts local serial port accesses into TCP/IP packets to be exchanged with WiFi ESL ports.



Compatibility Mode. The WiFi ESL virtual port normally operates in high performance mode. Compatibility mode supports applications that require a more accurate simulation of a local serial port. The need for Compatibility mode is indicated when data being sent to the remote serial port is lost or sent repeatedly.

When this option is enabled, the WiFi ESL Windows driver sends a "write request" with the data packet to the WiFi ESL. The WiFi ESL signals the completion of the "write request" only after the last data character has been output to the UART. The "write request" is handled in the same way as a "write request" under Windows. This ensures that all the characters that were sent to the WiFi ESL serial port are in the UART and are output, before the next data character is sent by the driver from the host PC.

Persistent connection. This setting maintains a persistent connection when the client station's connection is broken to the unit, then re-established. This setting is accessed through Window's Device Manager | Ports (COM & LPT).

When this option is enabled the communication link from the physical serial port on the WiFi ESL to the COM port that is enumerated on the PC will be re-established automatically, in event that the power is cycled, the WiFi ESL is rebooted, or the port is reset.

To most effectively use this feature, match ALL the default serial operating parameters to the parameters that are used in the communications at the serial port and COM ports. Doing so will minimize delay in reconnection as the reconnection procedure uses default parameters first, then the settings that are actually in use.

Disable polling of port status. Polling of port status can be disabled. This is useful when a software application accessing the remote serial port repeatedly polls to check port status, slowing access to the remote port. This setting is accessed through Window's Device Manager | Ports (COM & LPT).

COM port applications may send multiple-repeated status polls to the COM port UART. Status polls are passed to the WiFi ESL serial port UART firmware. These status polls will show up as TCP/IP packets that are exchanged on the LAN between the Windows driver and the WiFi ESL. When the option to suppress the status polls is enabled, the Windows driver will reply to the application status polls using the last set of stored parameters in the driver. Status polls will not be sent to the WiFi ESL over the LAN. The COM port status changes that are made in the WiFi ESL are updated and stored in the driver memory, as and when they occur.

Enable MSR polling. Some applications repeatedly poll the Modem Status Register (MSR) of a device to see whether that register is set. This activity may significantly slow data transfer over a WAN and add traffic to a network. By default, the WiFi ESL will obtain the state of the remote MSR and present it to applications seeking this information, without repeatedly polling the MSR. When the MSR's state changes, this information will be conveyed by the WiFi ESL. Selecting to enable MSR polling will allow applications to directly poll the MSR on each polling request.

Timeout Wait Request. This setting, specified in seconds, allows a user to set the length of time the WiFi ESL will wait before dropping a connection if there is no response. This setting will therefore serve to limit the time a "persistent" connection is maintained.

Virtual port (driver) bindings

Background. Activating a WiFi ESL port in effect creates a "virtual" driver port that is associated with a particular physical serial port on a particular WiFi ESL. When a driver virtual port is opened, a connection must be established to the appropriate WiFi ESL. In normal operation, that connection is made to the IP address assigned to the WiFi ESL at the time the activation was created. However, on many Ethernet/IP networks, the IP address of individual devices may

change (for example, when a DHCP server assigns addresses). This address reassignment will cause virtual ports to fail or make unintended connections to unintended WiFi ESLs.

Therefore, WiFi ESLs are designed with the ability to "find" a WiFi ESL port based on a "binding". A port binding is a network identification of the target WiFi ESL that must match before a driver port will initiate a connection. Bindings may be made to the MAC address, Name, or IP address of the associated device.

Binding to MAC Address. MAC addresses are unique and permanent identifiers for Ethernet devices, and are assigned to devices when they are manufactured. Binding to a WiFi ESL's MAC address ensures that a virtual port always makes a connection to that same physical device, even if the device's IP address or Name have changed. Binding to MAC address provides security and reliability. Virtual ports will only connect to that single particular physical device.

Binding to Name. Device Name is a 15-character field assigned by the WiFi ESL system administrator. Binding a virtual port to a device's Name will ensure that a connection will be made to an actual port if a device can be found with the name specified in the "Bindings" dialog box. This port may be on a different physical device from the one with which the virtual port was initially communicating (that is, a device with a different MAC address), or it may be a port on the same physical device but with a changed IP address, or both. Binding to a device's Name provides reliability and dynamic connections. Virtual ports will connect to the device with a name that matches the binding. If a particular device is replaced with a new one with the same assigned Name, the virtual port will establish the connection. Also, Names can be reassigned at any time to cause client PCs to connect to new devices without being reconfigured.

Binding a virtual port to a Name allows that virtual port to be identified on the network with a more representative mnemonic than an IP address or MAC address. For example, a security system might name its virtual port targets "Camera1", "Camera2", "CardReader6", and so forth.

Binding to IP Address. The IP address of a network device is assigned by either the WiFi ESL system administrator or through a DHCP server. Binding a virtual port to an IP address will force that virtual port to attempt a connection to any device with that particular IP address only. Binding to IP address provides dynamic connections. Device IP addresses can be reassigned at any time to cause client PCs to form new connections without being reconfigured. Note: when no bindings have been stipulated, a virtual port is implicitly bound to an IP address because such an address is required to make a connection.

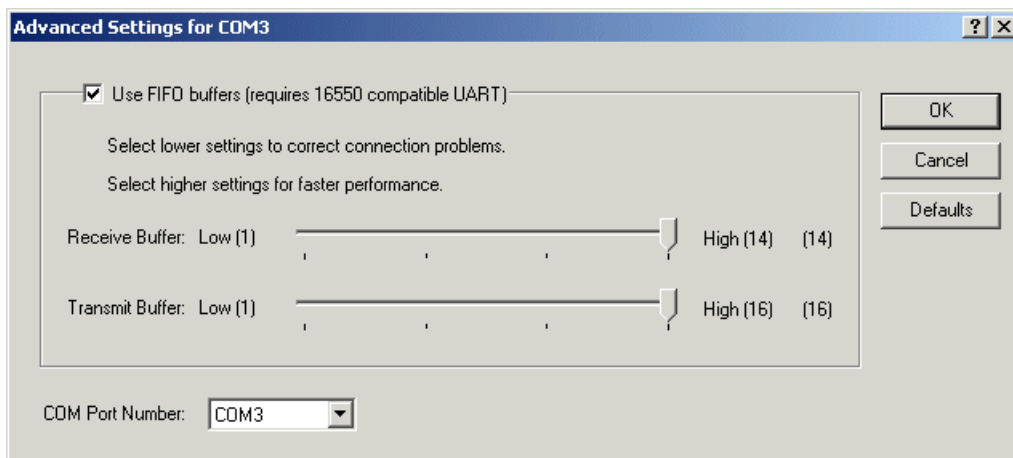
Binding to more than one parameter. Usually, only one degree of binding is sufficient for an individual virtual port to achieve the goals of robust communication and flexibility. It is however also possible to bind a virtual port to more than one parameter. Doing so requires careful consideration of the implications of maintaining connectivity. If multiple bindings are selected for one port, *all* individual binding parameters must match for a connection to be made. For example, enabling both IP address and MAC address bindings for a virtual port would cause that virtual port to find a particular physical device by MAC address, but make a connection only if the device's IP address also matched the binding setting.

Resetting registry information in Windows

Under Windows you may need to use the line command "arp -d *" to clear the OS registry of the previous IP and MAC relationship. This may become apparent when first using and setting up a device with the factory default IP settings.

Virtual port COM number assignment

By default, a WiFi ESL virtual serial port is assigned to the next available COM number when it is activated. This COM number assignment can be reassigned to any unused COM number from 1 to 256.



Transmit FIFO buffer configuration

Each serial port of a WiFi ESL has a first-in first-out (FIFO) buffer for transmitting data and a FIFO buffer for receiving data.

Transmit FIFO buffers are configurable and can buffer from 1 to 16 characters in the UART, for output to the serial port. Receive FIFO buffer levels are fixed at 8 characters.

Some serial devices, when they are not able to accept data from the serial port, will send an XOFF character to that port. Upon receipt of the XOFF character, the WiFi ESL will output the remaining characters in the port's transmit FIFO buffer. The WiFi ESL will then only accept more characters from the PC driver after an XON has been issued by the serial device.

If the nature of a serial device is such that it cannot accept buffered characters after sending an XOFF character, the user of a WiFi ESL can set the transmit buffer level to some low value such as 1 or 2 characters, to overcome the situation where data is sent to a device that is unable to accept it. This may be necessary for POS printers and some CNC devices or PLCs, for example.

The transmit FIFO buffer level can be set using either the *Ether-Link Manager*[™] (Port Settings |Advanced), or the Telnet configuration interface.

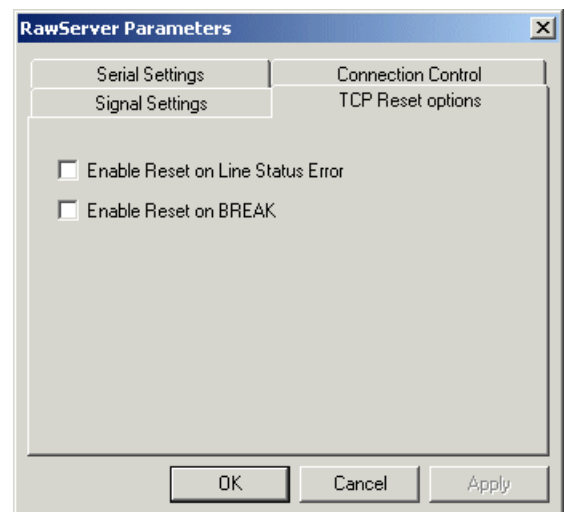
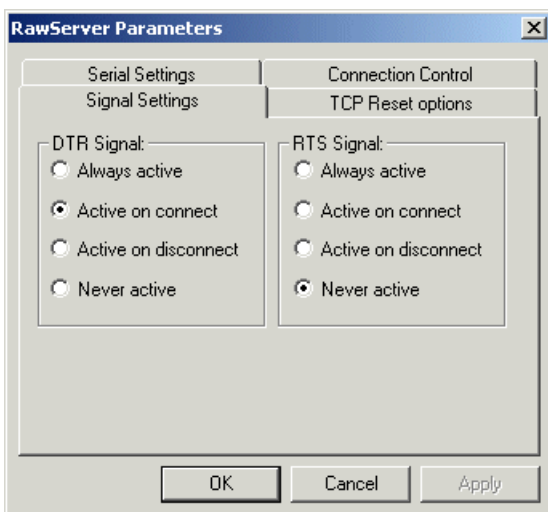
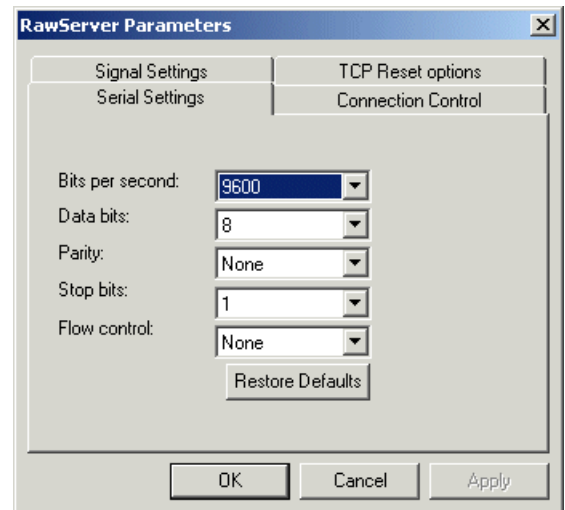
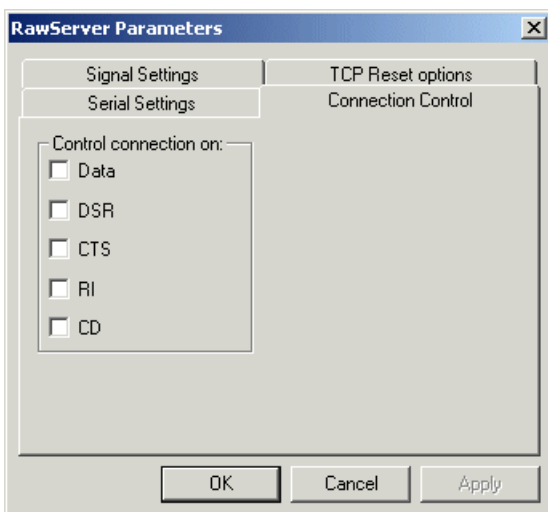
Raw Server Mode

This mode is used to establish a raw TCP connection to a WiFi ESL port. The physical port on the WiFi ESL is made available as a network resource with a specified IP address and port number. In this mode, authorized users can set bits per second, data bits, parity, stop bits, and flow control port-by-port, to match the requirements of the Data Terminal Equipment (DTE) connected to the physical WiFi ESL port.

In Raw Server mode only transmit (Tx) and receive (Rx) lines are active. However, control lines can be triggered by the TCP connection being established. Under the "Signal Settings" tab shown below, the user can set how the control lines are to react when a TCP connection is established.

The TCP connection can be set to close on two conditions: a status error at the serial port (such as a parity error, buffer overrun, cable disconnection, etc.), or when a BREAK is sent to the serial port. By default these conditions are disabled.

Applications: Remote monitoring, security systems.



Message Status Settings (web browser interface only):

In Raw Server mode the device can be configured to provide status messages in response to either or both of two conditions: connection and port permissions not matched.

The "TCP Connection STATUS" message can be used to provide a welcome or greeting message when a client connects to the WiFi ESL.

The "Permission NOT MATCHED" message can be used to provide a message about the status of the device attached to the serial port, in the event that conditions for connection to that device are not met. These conditions are specified in the Raw Server Mode Serial Port Settings dialog, "PERMIT CONNECTION ON:" options. For example, if a printer is attached but not online when the application attempts to print, a "Printer offline" message could be sent.

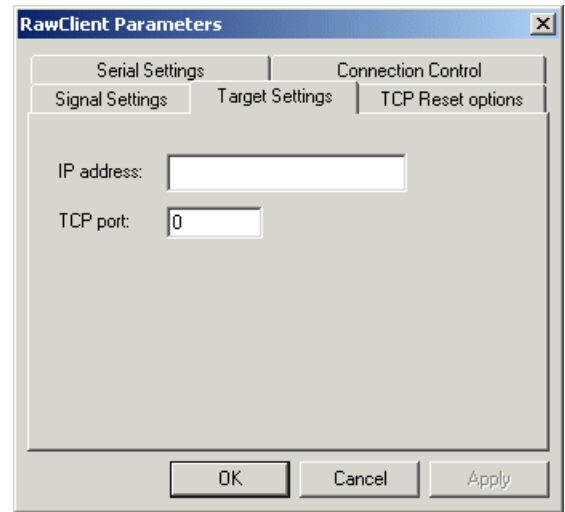
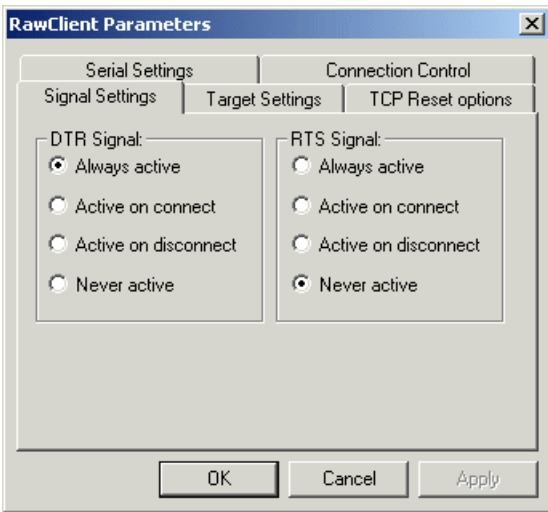
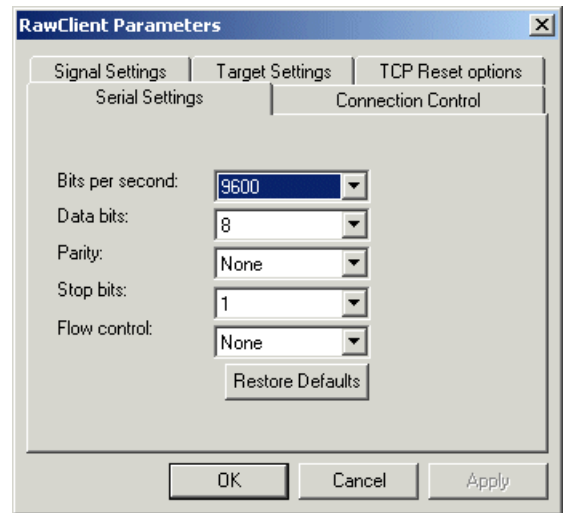
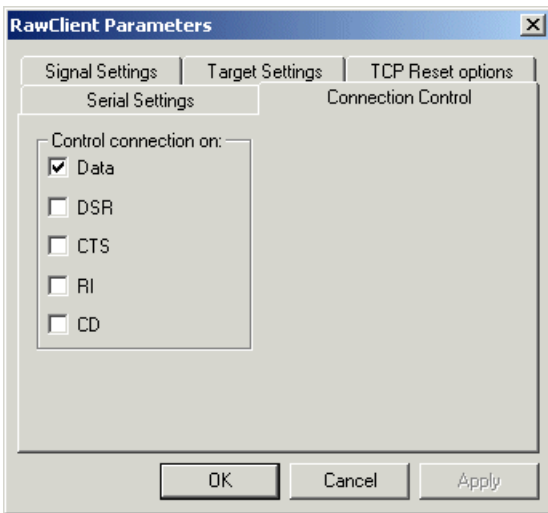
Raw Client Mode

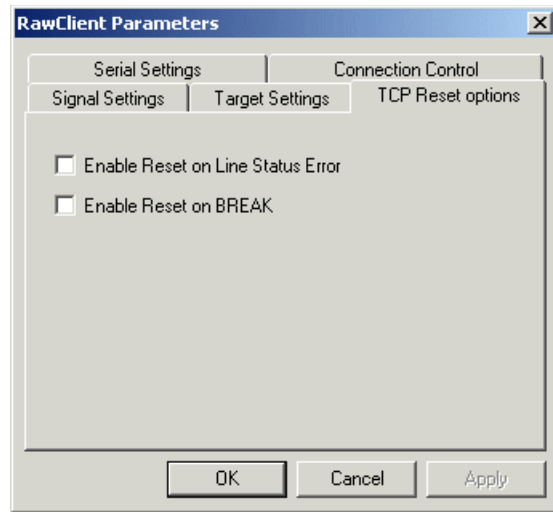
This mode is used to establish a raw connection to the WiFi ESL. The physical port on the WiFi ESL is configured to initiate a connection to a pre-defined IP address and port number, specified by an authorized user of that port in the "Target Settings" dialog box. In this mode, authorized users set bits per second, data bits, parity, stop bits, and flow control port-by-port, to match the requirements of the Data Terminal Equipment (DTE) connected to the physical WiFi ESL port.

In Raw Client mode only transmit (Tx) and receive (Rx) lines are active. However, operating as a client, the WiFi ESL can be configured to open a connection to the target IP address and port when it detects one or more of the following line conditions: data, DSR, CTS, RI, or CD. Users can configure which of these triggers will be in effect for any WiFi ESL port set in this mode in the "Connection Control" dialog box. "Signal Settings" are also settable by the user, as described in Raw Server mode.

The TCP connection can be set to close on two conditions: a status error at the serial port (such as a parity error, buffer overrun, cable disconnection, etc.), or when a BREAK is sent to the serial port. By default these conditions are disabled.

Application: Remote control.



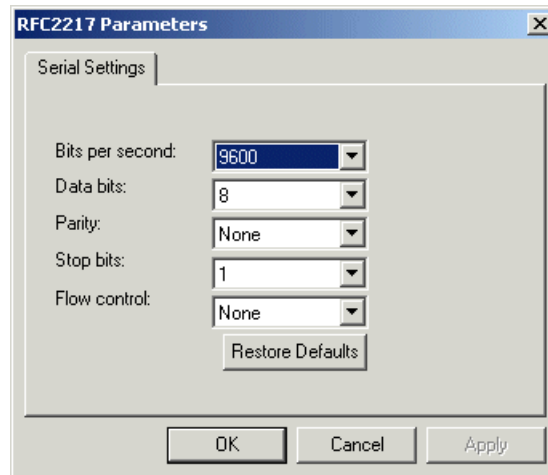


RFC2217 Mode

Users who want to communicate with a WiFi ESL across gateways or routers can configure a port on a WiFi ESL to operate in RFC 2217 mode, allowing serial port configuration commands and serial data to be sent to a WiFi ESL using the RFC 2217 framework for serial port control over Telnet. Data and control lines are transferred in RFC2217 mode. For those not familiar with RFC 2217 (the Telnet COM Port Control Option), the text of the actual RFC (Request For Comments) is available at www.faqs.org/rfcs/rfc2217.html or at any number of other sites.

This mode opens a WiFi ESL port when a TCP connection is established to the "local port". Port settings are embedded in data stream in accordance with RFC 2217.

Applications: UNIX systems and other platforms that have RFC 2217 Telnet capability can access and control the serial COM port of the WiFi ESL.



Data Connect Mode

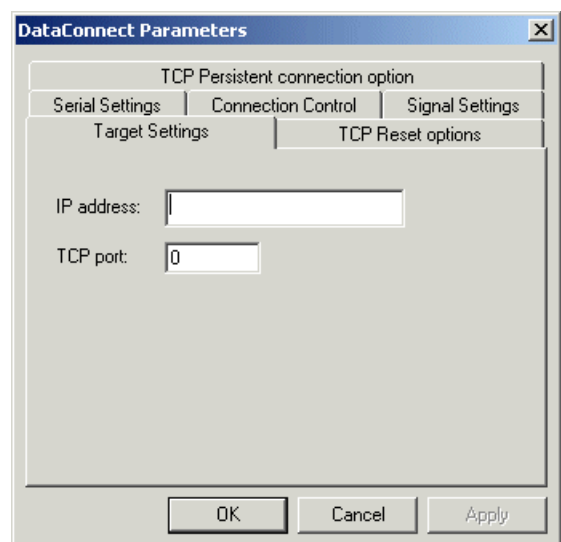
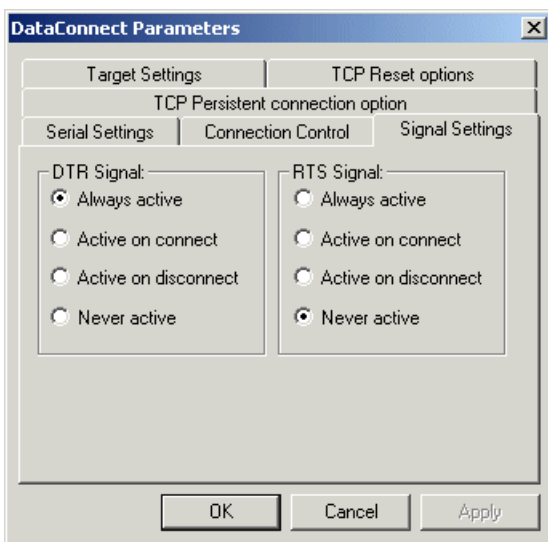
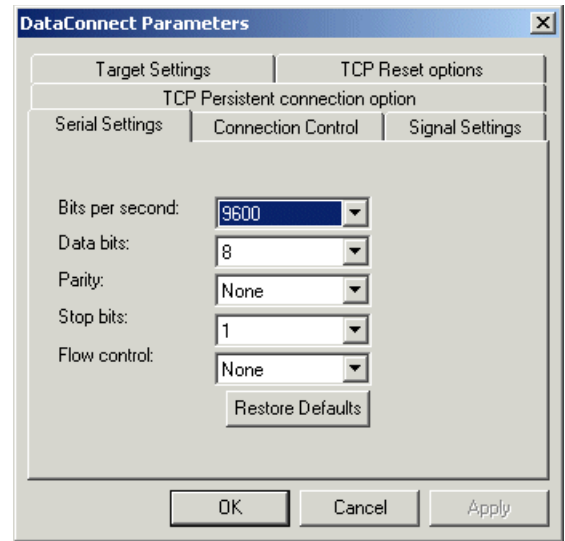
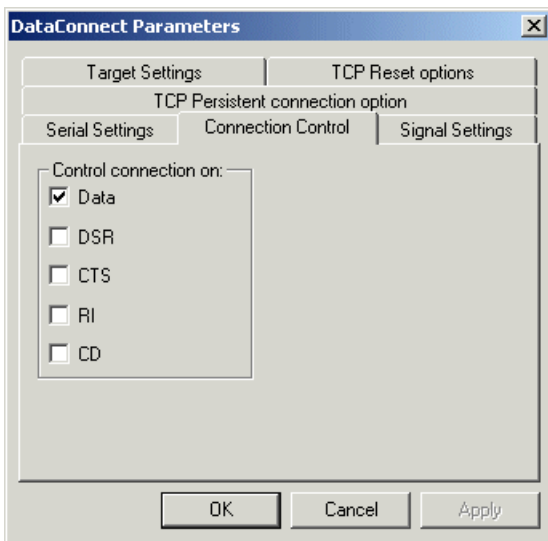
Data Connect mode combines Raw Client mode and Raw Server Mode. In this mode, the WiFi ESL will either initiate a TCP connection when activity is detected at the serial port, or it will receive TCP packetized serial data from the network port when an outside client connects to it.

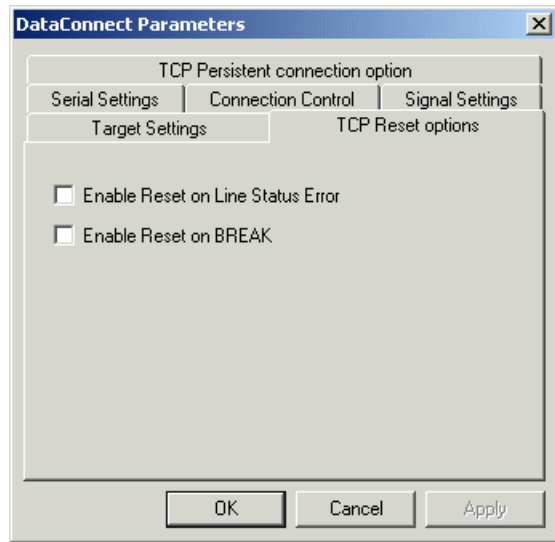
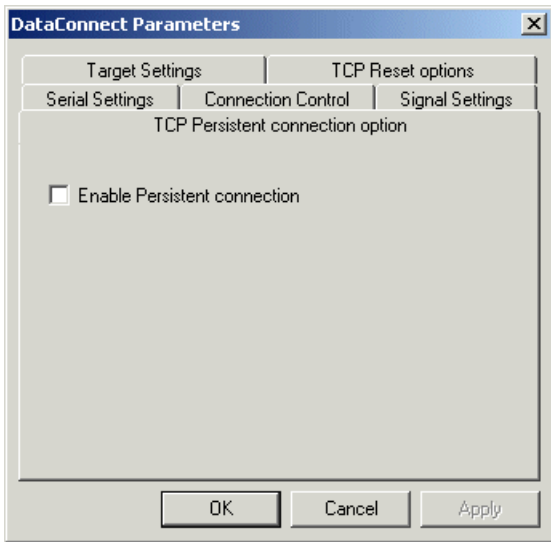
The configuration parameters for this mode combine all the parameters found in Raw Client and Raw Server modes (see above for details). In Data Connect mode only transmit (Tx) and receive (Rx) lines are active. However, control lines can be set using the "Connection Control" tab.

With two WiFi ESLs in this mode placed "back to back," the connection between them becomes in effect a cable extender over an Ethernet connection.

The TCP connection can be set to close on two conditions: a status error at the serial port (such as a parity error, buffer overrun, cable disconnection, etc.), or when a BREAK is sent to the serial port. By default these conditions are disabled.

Applications: Data connect mode provides a serial-to-serial communication link that would not be practicable to implement as a directly-wired link; it can replace serial cables with an Ethernet connection.





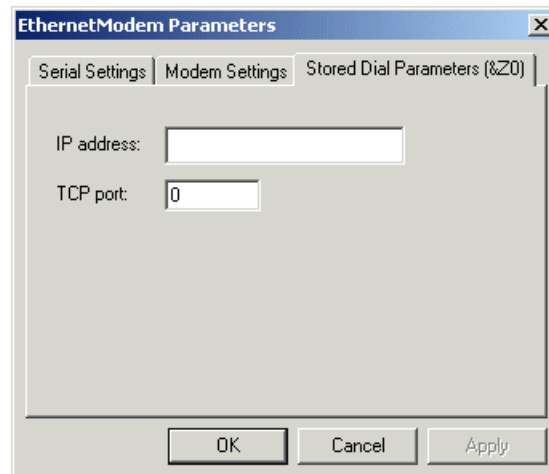
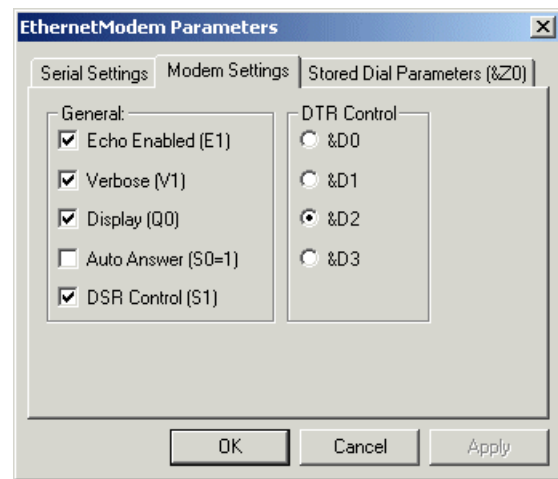
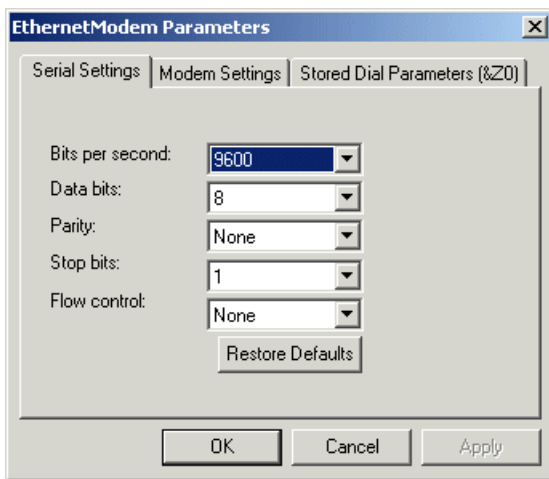
Ethernet Modem Mode

This mode allows Data Terminal Equipment (DTE) to control the WiFi ESL using the conventional modem "AT" command set. In this mode, a DTE user is able to "dial" an IP address and TCP port. Incoming TCP connections are handled under AT command set rules.

The standard serial port settings for bits per second, data bits, parity, stop bits, and flow control are available for configuration, and should be set to match the DTE.

Modem settings include ECHO Enabled (E1), Result Codes Format Verbose (V1), Result Codes Display Return (Q0), Auto answer (S0=1), DSR Control (&S1). Modem DTR control can be set to &D0, &D1, &D2, or &D3.

Applications: To provide the standard "AT" command interface to user applications that wish to communicate with devices in an Ethernet environment. Remote console management that looks for AT interfacing can use this application.



Ethernet Modem mode operation: WiFi ESL port as a modem

Procedure:

1. Place the serial COM port into Ethernet Modem mode (via Telnet IP:23, Web page IP:80, or in the *Ether-Link Manager*[™]). Note: the factory default IP for the WiFi ESL is 192.168.0.35.
2. The serial port behaves like a "universal" HAYES-type modem to the device connected at the serial port. The device receives the expected modem replies to the "AT commands" sent, when communicating with the serial (modem) port.

General “AT” Commands:

The “AT” commands direct a modem to dial, answer, hang up, and perform other communication tasks. The **commands** are preceded by **AT**, and followed by <cr> (ie. ATcmdCR). The only exception is for the +++ sequence, which is used to **place modem into command mode**.

The modem **must be in command mode to accept AT commands**. Any command sent to the modem while it is in the transmission (CONNECTed) mode **is passed as data**.

The following command set is supported by the serial (modem) port of the WiFi ESL:

Command	Description	Parameters
AT	The sequence AT followed by <CR>, returns OK, indicating that the serial port is in modem mode.	
ATA	Answer. After this command has been entered, the modem is placed into the answer mode : if an incoming RING is received, the modem will CONNECT with the incoming client. The ATA command is used to “answer” an incoming RING, which results in a CONNECT. If ATA is entered, and there is no incoming RING within 5 seconds, a timeout will occur, a NO CARRIER message will be displayed, and the modem will remain in command mode. NOTE: To place the modem into “ auto-answer ” mode, set the S0 register for a non-zero value (ie. AT&S0=1 and AT&W to save).	
ATDstring	Dial. Modem makes a connection to the IP address and port indicated by the string.	string = aaa.bbb.ccc.ddd:pppp
ATDS=n	Dial Stored. Modem makes a connection to the stored IP and port address. To store an IP:Port, use AT&Z0=“IP:Port” Note re ATD... commands: if the destination IP:Port does not accept the connection within 25-30 seconds, a NO CARRIER message will be displayed, and the modem will remain in command mode.	n = 0 remote location
ATEn	Echo. Host commands are echoed.	n = 0 disable echo n = 1 enable echo (default)
ATH or ATH0	(GO) on HOOK. Close the connection. Enter the COMMAND mode using “+++”, then enter ATH to close the connection.	n = 0 close the connection
ATIn	Inquiry. Displays information about the modem.	n = 0 device name n = 1 details of unit n = 2 more detailed + IP n = 3 all info plus profile
ATO	Go Online. Returns from command mode to an active connection (if one was previously established).	
ATQn	Display Result Codes. A “result” can be output after each command. Also see ATVn for format of result.	n = 0 display result n = 1 do not display result

Command	Description	Parameters																																													
ATSr=n	<p>Set Register. Set value of register r to n. Note: only "S0" can be set for 0 or non zero. All others are fixed.</p> <table border="1"> <thead> <tr> <th>"S" Register</th> <th>"n" Value (default)</th> <th>Purpose</th> </tr> </thead> <tbody> <tr> <td>S0</td> <td>0</td> <td>auto-answer disabled = 0 auto-answer enabled = non-zero</td> </tr> <tr> <td>S1</td> <td>0</td> <td>not used</td> </tr> <tr> <td>S2</td> <td>43</td> <td>escape to command mode char "+"</td> </tr> <tr> <td>S3</td> <td>13</td> <td><CR> character. Fixed.</td> </tr> <tr> <td>S4</td> <td>10</td> <td><LF> character. Fixed.</td> </tr> <tr> <td>S5</td> <td>8</td> <td>backspace character defined</td> </tr> <tr> <td>S6</td> <td>3</td> <td>not used</td> </tr> <tr> <td>S7</td> <td>60</td> <td>not used</td> </tr> <tr> <td>S8</td> <td>2</td> <td>not used</td> </tr> <tr> <td>S9</td> <td>6</td> <td>not used</td> </tr> <tr> <td>S10</td> <td>7</td> <td>not used</td> </tr> <tr> <td>S11</td> <td>70</td> <td>not used</td> </tr> <tr> <td>S12</td> <td>50</td> <td>guard time in 20 ms increments</td> </tr> <tr> <td>S13</td> <td>0</td> <td>not used</td> </tr> </tbody> </table>	"S" Register	"n" Value (default)	Purpose	S0	0	auto-answer disabled = 0 auto-answer enabled = non-zero	S1	0	not used	S2	43	escape to command mode char "+"	S3	13	<CR> character. Fixed.	S4	10	<LF> character. Fixed.	S5	8	backspace character defined	S6	3	not used	S7	60	not used	S8	2	not used	S9	6	not used	S10	7	not used	S11	70	not used	S12	50	guard time in 20 ms increments	S13	0	not used	<p>r = register number [r < 14] n = value to assign</p>
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ATVn	<p>Format of Result Codes. Note: text output is: <CR><LF>text<CR><LF> Note: numeric output is: number<CR></p> <table border="1"> <thead> <tr> <th>Text Output</th> <th>Numeric</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>OK</td> <td>0</td> <td>command executed</td> </tr> <tr> <td>CONNECT</td> <td>1</td> <td>connection established</td> </tr> <tr> <td>RING</td> <td>2</td> <td>connection is being requested</td> </tr> <tr> <td>NO CARRIER</td> <td>3</td> <td>connection broken or not made</td> </tr> <tr> <td>ERROR</td> <td>4</td> <td>illegal command</td> </tr> </tbody> </table>	Text Output	Numeric	Meaning	OK	0	command executed	CONNECT	1	connection established	RING	2	connection is being requested	NO CARRIER	3	connection broken or not made	ERROR	4	illegal command	<p>n = 0 numeric form n = 1 text form</p>																											
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CONNECT	1	connection established																																													
RING	2	connection is being requested																																													
NO CARRIER	3	connection broken or not made																																													
ERROR	4	illegal command																																													
ATZ	<p>Reset. Close any open connections, and reset the S registers to the saved values.</p>																																														
AT&Cn	<p>DCD Control. [as Output].</p>	<p>n = 0 always active n = 1 follows connect status</p>																																													
AT&Dn	<p>DTR Control. [as Input].</p>	<p>n = 0 ignore n = 1 on-to-off: go to command mode & maintain the connection. n = 2 on-to-off: go to command mode & close the connection. n = 3 on-to-off: go to command mode, close connection & do Reset.</p>																																													

Command	Description	Parameters
AT&F	Load Factory Settings.	Default parameters for commands and parameters are set: Serial Port: 9600 8-data no parity 1-stop bit no flow control Address of remote host: 0.0.0.0 Auto-Answer is disabled: S0 register = 0 Command line echo is enabled. ATE1 Result codes are displayed as text. ATQ1, ATV1 DCD line follows connection status [active if connected]. AT&C1 DTR control: if on-to-off, then go to command mode and close connection. AT&D2 DSR line is always active. AT&S1
AT&Sn	DSR Control.	n = 0 set DSR always active n = 1 follows connection status.
AT&V	View Profile Settings. Displays the S-register values, stored IP:Port of remote host, serial port and control line settings.	
AT&Z?	Display Address Settings. Displays the stored IP:Port for the remote host.	
AT&Z0=s	Store Address Settings. Stores the IP:Port number for the remote host.	
+++	Escape from the active connection to the modem command line mode. Three consecutive "+" characters will place the modem into command mode. The first two "+" characters will be transmitted to the remote host on the link, third "+" character will place the modem into command mode – the third character is not transmitted to the remote host. The connection to the remote host is placed "on-hold" when the third "+" character is keyed in. No further data will be transmitted unless the transmission mode is re-enabled.	The follow-on options are: – use the ATO command to re-enable transmission to remote host – use the ATH command to terminate the connection – use the ATZ command to terminate the connection, and reset parameters to stored settings.

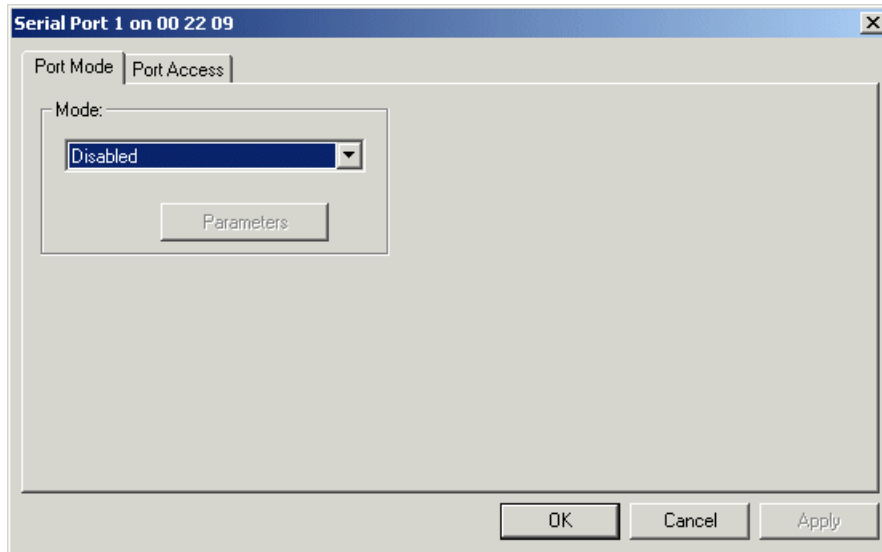
Phone to IP references and settings (web browser interface only):

The phone to IP references table enables a user to map a series of phone numbers to IP:port numbers. This table is particularly useful when an application addresses its data output to a conventional POTS modem using a telephone number, and that phone number input either cannot be used to hold an IP: port number address or the IP:port number address is too many characters for the software application to manage.

The phone to IP references configuration screen also provides settings for delays and retries that can be increased to give needed latencies to the modem or application to allow for robust connections over a WAN.

Disabled Mode

This mode simply disables a port; it has no configuration settings.



2. WAN Port configuration

Enter the IP address and TCP port number for WAN port configuration using this feature. Ensure that the IP address does not conflict with an IP address also in use on the local area network.

The WAN activation is normally used to enumerate a remote serial port as a local COM port on the PC, where the remote serial port is located on a separate network (i.e., different LAN, over the Internet).

To create a WAN COM port enumeration, the target COM port must not be on-line on the LAN during enumeration. After enumeration, the WiFi ESL can be placed on-line on the LAN. WAN-enumerated COM ports will communicate with the remote COM ports on the LAN.

3. Passwords/Notes on Security

By factory default, the WiFi ESL has passwords assigned (one for the administrator, and one for each of the physical serial ports). Passwords are case sensitive. The factory default administrator password is "admin". The factory default port passwords are "port1" for port one, "port2" for port 2, and so on. It is strongly recommended that new passwords be configured if the WiFi ESL is to be used in a multi-user situation, even in small offices.

Simple security can aid network users and administrators by preventing accidental changes that could prove detrimental to network performance.

Three basic levels of security exist:

1. "Administrator" level
2. "Port" level
3. "Access" level (discussed in the next section)

The WiFi ESL recognizes a single password for each device, plus an additional, unique password for each device's port. The administrator has complete access and control over the WiFi ESL. The administrator can assign access and limit control over ports to the other security levels.

The port user can change port settings (baud rate, driver mode, etc) as may be permitted by the administrator. Ports may be accessed, but not changed without a password. The port password can be entered using either an html browser interface, or the Manager program (Windows).

Using the browser interface, enter the password from the "home page" of the WiFi ESL. If you enter the correct administrator password, you will automatically be directed to the Administrator's Menu.

If you enter a correct port password, you will automatically be directed to the Port Configuration Menu.

Several ports may share the same password.

An empty password field means the password is NULL. If a port level password has been set, but no administrator password has been set, the correct administrator password must be entered (that is, NULL) to log on with administrator rights, i.e. leave password empty and click the CONFIGURE button. **Note: If an administrator password has not been set, port level passwords (should they exist) will not restrict users from changing port settings.**

***THIS HOLDS TRUE EVEN IF PASSWORDS HAVE BEEN SET FOR PORT ACCESS,
BUT NOT ADMINISTRATOR ACCESS***

Using the Manager application, enter the password by right-clicking" on the Serial Device Server you wish to manage. Administrator passwords apply to WiFi ESL "boxes" (shown in the left-hand pane of the Manager). Port passwords apply to WiFi ESL port(s) (shown in the right-hand pane of the Manager).

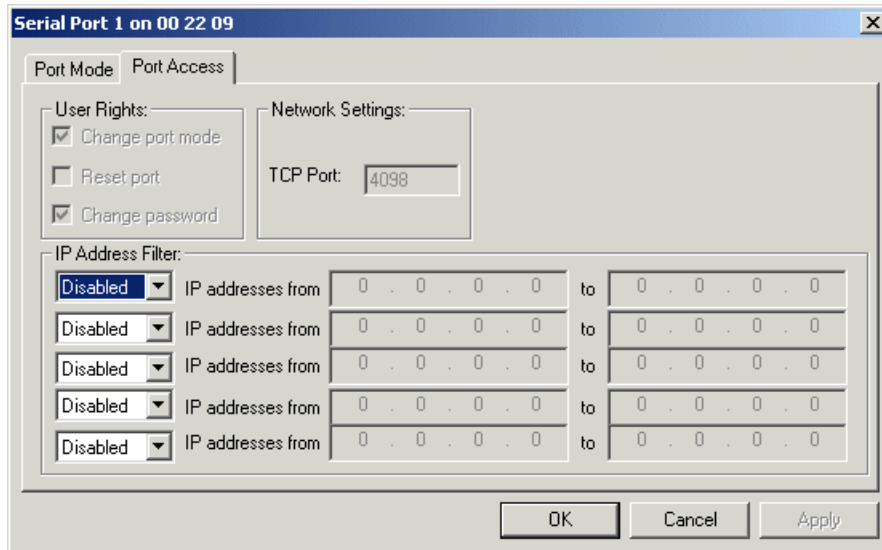
Password icons indicating locked or unlocked status appear to the left of the particular device. If the icon is a lock, it means that the device is locked and you must enter the correct password to access the device. An icon representing a key indicates an unlocked port or device.

To enter the correct password, right-click on the device, choose "unlock," and enter the correct password in the popup window.

An Administrator may grant or restrict access to individual ports by IP address, or IP range.

4. Port access restrictions

An administrator can set port access on any port by specifying ranges of IP addresses to either allow or disallow access to a given serial port. Additionally, this screen indicates the state of user rights such as whether a user can change a port's mode, reset a port, or change a port's password.



5. Advanced serial port settings

The web browser configuration provides additional serial port settings to enable the user to purge or not purge serial and TCP buffers in the UART. Generally, these can be left to purge (the default); for applications where it is essential that data not be lost by buffer purging, this option can be enabled.

6. Port reset

To reset a serial port, when in the *Ether-Link Manager*[™], right-click on the serial port and select RESET from drop down menu.

Each serial port can be reset without disturbing the other serial ports on the WiFi ESL. The set/stored operating settings for the serial port are not lost/changed after a reset. A serial port reset will also occur if operating parameter settings are changed. This is the case if after entering or viewing the settings the OK or Submit function is used. If the serial port is in use, the communications at that port will be interrupted; therefore, the user should keep this in mind when resetting the port. Options to restrict port resetting are provided.

7. Device reboot

To reboot the WiFi ESL, when in the *Ether-Link Manager™*, right-click on the device and select Advanced|Reboot.

This function will fully reboot the WiFi ESL, including a reset of all serial ports. The set/stored operating settings for the network and serial ports are not lost/changed after a reboot. A reboot will occur if the network parameter settings are changed. This is the case if, after entering or viewing the settings, the OK or Submit function is used. If serial ports are in use, the communications at those ports will be interrupted; therefore, the user should keep this in mind when rebooting the device.

8. Reset to factory defaults

Devices can be easily reset to factory defaults using the following methods:

Software reset to factory defaults

Using the *Manager* application, provided the administrative password to the device is known. Resetting the device to factory defaults will remove all user-configured settings, including port and network settings, access restrictions, and passwords. The device will be restored with factory default passwords in effect.

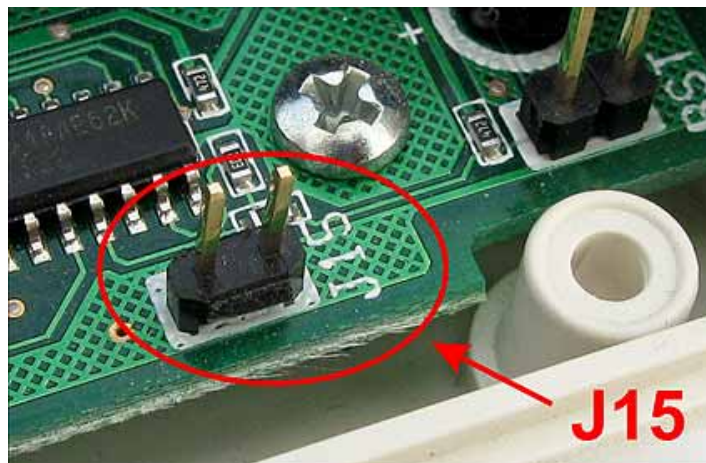
To reset to factory defaults using the *Manager*, right-click on the device icon in the left side of the *Manager*, and from the pop-up menu that appears, choose "Reset device".

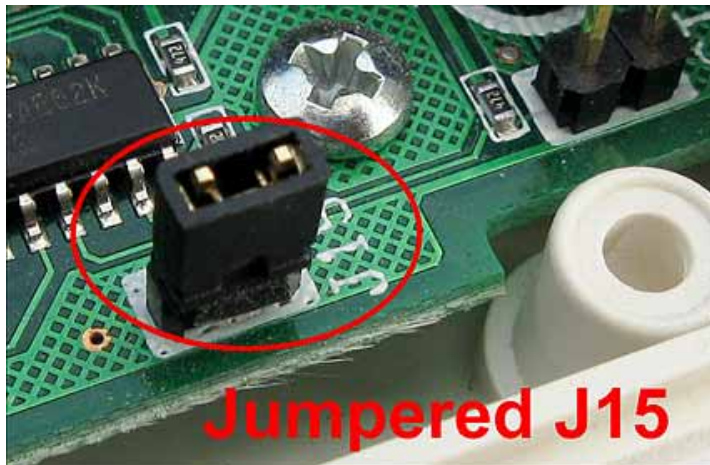
Hardware reset to factory defaults

The hardware reset does the same thing as the software reset. It is useful when the password to the device is not known or the device is locked up and cannot be successfully restarted by cycling its power. As with the software method of factory reset, resetting the device to factory defaults using a hardware reset will remove all user-configured settings, including port and network settings, access restrictions, and passwords. The device will be restored with factory default passwords in effect.

To reset using a hardware reset:

1. Disconnect power from the device.
2. Turn the device upside down and remove the four black screws that hold the enclosure shut.
3. Remove the lid of the enclosure.
4. On the main board of the device, locate the jumper marked "J15". The location of this jumper might not be precisely as pictured below, depending on the particular device. **Note:** Do not use the jumper pair identified as "RST".
5. Short the two pins of jumper pair J15 with either a jumper, a screwdriver, or other metallic conductor.
6. Leaving the pins shorted, power up the device. Allow 20 seconds for a full power-up cycle.
7. Disconnect power from the device.
8. Remove the jumper short.
9. Replace the enclosure lid and reinsert the four screws.
10. Power up the device. It will now be reset to factory defaults.





9. Subnet configuration with the WiFi ESL

If the WiFi ESL is on a different subnet from a client station that is attempting to access it, the WiFi ESL will be visible in an instance of the *Ether-Link Manager*™ running on the the client station, and its ports can be activated on that client station, but applications running on the client station will not be able to open a serial port on the WiFi ESL.

For example, if the IP address of the WiFi ESL is 192.168.0.35 and the IP address of the client station is 192.168.1.1, the two devices are on different subnets (as indicated by the difference between the "0" and the "1" in the third portion of the two IP addresses).

Two solutions exist:

1. change the subnet of the either the WiFi ESL or the client station so that they are both on the same subnet or,
2. change the subnet mask of the WiFi ESL to encompass both subnets. By default, the WiFi ESL has its subnet mask set to 255.255.255.0. This setting excludes all but the fourth portion of the IP address when assessing IP addresses. In the example above, a subnet mask of 255.255.0.0 will include the WiFi ESL in both subnets.

10. Re-establishing a TCP connection with the WiFi ESL

The nature of TCP socket connections means that a TCP socket established with a host will hold that TCP socket "open" even when active communication has been broken. This situation might occur, for example, when a WiFi ESL serial port is connected in Raw Server mode with a host PC that is rebooted without the TCP connection to the WiFi ESL being properly closed. While the TCP connection continues to be held open, further TCP connections cannot be established. This "lockout" is normal TCP behaviour designed to allow communications to be smoothly re-established between a TCP client and server.

In the circumstance where connection to a WiFi ESL is broken, it may be desirable to allow another client to access the WiFi ESL port. To prevent a "lock-out" from persisting, the WiFi ESL monitors the TCP port for an active and valid connection every time that a TCP connection request is attempted.

If the connection between the WiFi ESL and a client has been "broken," then the next client attempting to connect to the serial port will need to make **two** attempts to connect. The first attempt will cause the WiFi ESL firmware to check for the validity of the previously-established TCP connection. If the connection is determined to be "broken," then the WiFi ESL will "properly" close the TCP socket. At that point a second connection attempt can be accepted and set up as a new TCP socket. The time interval between connection attempts should be in the order of about 10 seconds.

Note for application programmers: When writing connection code, make the attempt to connect several times, in the event that the previous TCP connection with the WiFi ESL serial port was not closed properly under TCP rules.

11. Configuring the WiFi ESL using Telnet

1. Open a Telnet session with local echo on and carriage return/line feed on.

Windows example

1. Go to Start|Run, type "telnet", and click on "OK".
2. A Telnet console opens. At the Telnet prompt, set local echo on by typing "set local_echo" and pressing <Enter>. Set carriage return and line feed on by typing "set crlf" and pressing <Enter>. NOTE: These commands may differ slightly depending on the Telnet client you are using.
3. Open a Telnet session to the WiFi ESL. At the Telnet prompt, type ""open [IP address]" and press <Enter>, where [IP address] is the address of the WiFi ESL with which you wish to communicate. The Telnet configuration screen will open.

Note: The Telnet interface does not provide a configuration interface for wireless settings, such as SSID, encryption method, or selection of Ad Hoc/Infrastructure modes. Additionally, the factory reset option in the Telnet interface does not reset WiFi settings.

2. Configure the WiFi ESL.

The following network and port settings can be configured in a Telnet session:

Device settings (for the WiFi ESL device):

- IP address
- Net mask
- Gateway
- NetBios name (Device Name)
- DHCP mode
- Device password

Port settings (for each WiFi ESL port individually):

- Port mode (see ADVANCED readme file for description of the various port modes)
- TCP port number
- Port mode settings (see ADVANCED readme file for details on port mode settings)
- Port access
- Port passwords
- Port reset
- Port status

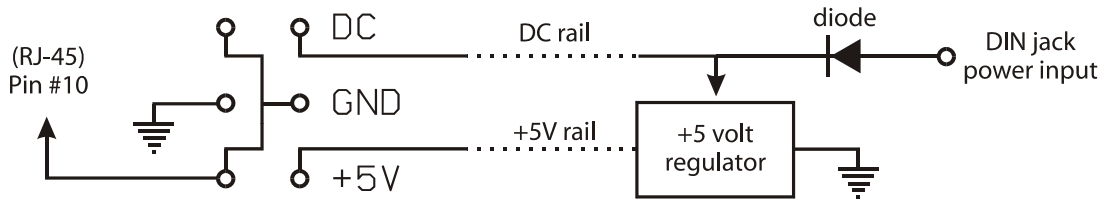
After changing device settings, the WiFi ESL will be reset. Changes to port settings are implemented without resetting the WiFi ESL.

12. Jumpering Pin #10 on the RJ-45 serial port connector

General:

Devices with an RJ-45 10-pin connector have a jumper-selectable power input/output option at Pin #10. A jumper is located on the interface board (I/F board), to the right of the RJ-45 10-pin connector, to configure this pin.

Jumper pin connections (viewed looking onto the component side)



Pin #10 can be used to supply power to serial devices attached to the RJ-45 serial port, or to supply power to the unit through the serial port.

Pin #10 is separately jumpered for each RJ-45 connector. Consequently, each port can be configured independently of the others.

Jumper settings:

Four jumpering options are possible:

[no jumper]



This is the factory default jumper setting. When the connector is unjumpered, Pin #10 is unconnected.

[DC]



When the jumper is in this position, Pin #10 is connected to the power input pcb trace. Three scenarios for configuring Pin #10 for DC power exist:

1. Power can be supplied to the unit via the DIN connector. In this case, the input voltage (after the diode) is present at Pin #10. Voltage can be drawn from Pin #10 to power some external equipment that is connected to the RJ-45 10-pin connector. When drawing power from a multi-port unit, consider the total possible power draw of the external equipment being connected and powered.

Note: The DIN power input has a protective input diode connected in series with the center pin of its connector (as diagrammed above). The cathode of the diode is connected to the power input pcb trace.

2. Power can be supplied to the unit via Pin #10 of the RJ-45 connector. If no voltage is supplied to the DIN connector, power can be supplied via Pin #10 to the unit. **Careful consideration must be given to the implications of**

supplying power to the system in this manner. Consult Technical Support before attempting this configuration.

Note: Pin #10 *does not* have a protective input diode connected to its connector.

- Power can be supplied to the unit via both Pin #10 of the RJ-45 connector and the DIN connector at the same time. If voltage is supplied both at the DIN connector and at Pin #10 (i.e.: battery back-up), current to power the unit (150-200ma) will be drawn from the higher-voltage source. **Careful consideration must be given to the implications of supplying power to the system in this manner. Consult Technical Support before attempting this configuration.**

Note: Pin #10 *does not* have a protective input diode connected to its connector.

[GND]



When the jumper is in this position, Pin #10 is connected to the unit's common ground.

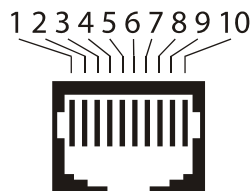
[+5V]



When the jumper is in this position, Pin #10 is connected to the output of the +5 volt internal power regulator circuit. Voltage of +5 VDC can be accessed by an external device (current limited to ____ ma. max.)

If the internal power regulator circuit is not installed, then a +5 regulated voltage can be supplied to the unit at Pin #10.

RJ-45 Pinout



- #1 Ring Indicator (RI)
- #2 Data Carrier Detect (DCD)
- #3 Request to Send (RTS)
- #4 DCE Ready/Data Set Ready (DSR)
- #5 Transmit Data (TD)
- #6 Receive Data (RD)
- #7 Signal Ground/Common (GND)
- #8 Clear to Send (CTS)
- #9 DTE Ready/Data Terminal Ready (DTR)
- #10 DC Power I/O (jumper select)

13. Checking for a free IP address for the computer to connect to the WiFi ESL in Ad Hoc mode

Choose an IP address you are considering for use for the computer you will use to connect to the WiFi ESL. This address will need to be:

1. on the same Local Area Network (LAN) as that used by the WiFi ESL
2. not already in use on that LAN

The following instructions on checking for a free IP address are specific to Windows 7; however, the instructions for other versions of Windows are similar.

Click on the Windows "Start" button, then in the search box (where the text "Search programs and files" appears, Type "cmd" and hit <Enter>.

A text-based command window will appear. Test the IP address you are considering using by attempting to ping it from the command line, by typing "ping xxx.xxx.xxx.xxx", where "xxx.xxx.xxx.xxx" is the IP address you intend to set as a static IP address for your computer.

If your ping receives a response, the IP address you are considering is already in use. Try addresses until one receives no pingback, and ensure that the address is in the same local area network as that of the WiFi ESL. This means the first "xxx.xxx.xxx" of the IP address matches the first portion of the WiFi ESL's IP address, which by default is 192.168.0.35.

You can exit the command window by typing "exit" at the command line prompt.

14. Setting your computer's IP address to a static IP address in Windows 7

The following instructions on setting a static IP address are intended to facilitate setting up an Ad Hoc mode connection between a WiFi ESL and a computer. The instructions are specific to Windows 7; however, instructions for other versions of Windows are similar.

1. Go to Control Panel | Network and Internet | Network and Sharing Center.
2. Choose "Manage Adapter Settings".
3. Right-click on "Wireless Network Connection".
4. Choose "Properties".
5. Under "This connection uses the following items:" highlight "Internet Protocol Version 4 (TCP/IPv4)" then click on "Properties".
6. Under the "General" tab click on the radio button "Use the following IP address".
7. Under "IP address:" enter an unused IP address in the range used by the WiFi ESL. By factory default the WiFi ESL has an IP address of 192.168.0.35, so an appropriate IP address would be in the form 192.168.0.xxx, where "xxx" is a number between 0 and 255 that is not already used on the LAN. Let's say it's 192.168.0.131.
8. Under "Subnet mask:" enter the value 255.255.255.0. This value might be completed by default.
9. Under "Default gateway:" enter nothing.
10. Hit <OK>, then <Close>.

You have now set your computer with a static IP address and are ready to connect in Ad Hoc mode to the WiFi ESL.

15. WiFi ESL serial port command line configuration

The WiFi ESL has a rudimentary configuration interface, accessible on its serial port #1. This is a command line interface that accepts commands sent to the serial port using terminal emulator software, and it provides a means of configuring the WiFi ESL for operation on a network.

An initial connection to a WiFi ESL can be made without a wireless interface, by connecting an RS-232 serial port from a computer to serial port 1 on the WiFi ESL. This connection will allow you to configure the WiFi ESL directly, on a cabled connection.

1. Use a null modem female-to-female serial cable for this connection.
2. Disconnect power from the WiFi ESL.
3. Connect the serial cable to the computer and the WiFi ESL's serial port 1.
4. Using a terminal application like Hyperterm (included with versions of Windows 95-XP inclusive), PuTTY, or Tera-Term, connect the serial port of your PC to serial port 1 on the WiFi ESL. A list of terminal emulator applications for a variety of operating systems can be found here:

http://en.wikipedia.org/wiki/List_of_terminal_emulators

You might want to turn your terminal application's "local echo" setting on, so that what you type will be visible.

5. Configure the computer's serial port to the following settings:
 - Baud rate: 115200 bps
 - Data bits: 8 bit
 - Parity: none
 - Stop bits: 1 bit
 - Flow control: none
6. Power up the WiFi ESL.
7. After 3 seconds and within 15 seconds of applying power to the WiFi ESL, send the string "+++++" to the COM port connected to the WiFi ESL. Note: Be sure that these are "plus" signs: use the "+" key on the main keyboard, as the "+" key on the numeric keyboard may give an incorrect character. The WiFi ESL will respond with a command prompt:

```
WiFi Setup
```

```
WSL>
```

8. At this point you are connected to the serial port configuration interface of the WiFi ESL. This connection will time out and the device will reset after an interval of 60 seconds without terminal input. A list of valid commands can be obtained by typing "?" <Enter> or "help" <Enter> into the terminal application.

Note: The commands requiring a parameter to be supplied (such as "ssid") are entered in two steps: first, the command is entered, such as "ssid", then the <Enter> key is pressed. Some minimal information about the parameter options or requirements may be presented.

Once you enter the appropriate parameter or selection, hit <Enter> again.

Finally, once all changes are made, enter "saveconfig" to write the changes to the WiFi ESL, then reset the system.

Valid serial port command line interface commands are:

Command	Description
help or ?	Displays a list of valid commands.
list	Shows the current WiFi ESL settings.
ssid	Sets the SSID for the WiFi ESL. This is a string of 1 to 32 characters. This SSID is one of either: 1) the SSID associated with the WiFi ESL unit when in Ad Hoc mode, or, 2) the SSID of an access point or router to which the WiFi ESL will be connecting in Infrastructure mode.

Command	Description
mode	<p>Sets the operating mode for the WiFi ESL. This mode can be Ad Hoc (the default) or Infrastructure.</p> <p>When choosing Infrastructure mode, operation can be “Mixed”, “802.11b+g”, or 802.11a. “Mixed” mode offers both 802.11b+g and 802.11a. The 802.11a-only setting is for connections to devices with legacy WiFi capabilities.</p> <p>Note: When changing the WiFi ESL’s operation from Ad Hoc to Infrastructure mode, ensure that all the relevant parameters have been set before rebooting the device, or the WiFi ESL will reboot searching for a network to which it cannot attach. Should this happen, cycle power to the device and re-enter the serial port command line interface, or open the enclosure and perform a hard reset as described in “8. Reset to factory defaults” on page 24.</p>
channel	<p>Sets the channel on which the WiFi ESL operates. “Channel” can be automatically chosen, or can be configured to an absolute value from 1 to 11. The factory default channel is 1. Ad Hoc mode is available on channels 1 to 11, but not on auto channel selection.</p>
security	<p>Sets the encryption method used by the WiFi ESL. This encryption method is one of either: 1) the encryption method associated with the WiFi ESL unit in Ad Hoc mode, or, 2) the encryption method used by an access point or router to which the WiFi ESL will be connecting in Infrastructure mode. Options are:</p> <p>None: The WiFi ESL uses no encryption. WEP (64 bit): The least-secure encryption option. WEP (128 bit): The second-weakest encryption option. WPA (TKIP): A stronger encryption method. WPA2 (AES): The strongest encryption method.</p> <p>Note: In Ad Hoc mode, the only valid encryption options are WEP (64-bit), WEP (128-bit), or none. By factory default, the WiFi ESL uses WEP (64-bit) to ensure connection and operation with devices not capable of higher-level security methods. We recommend changing the WiFi ESL to the most secure encryption method supported by your access point or router when switching from Ad Hoc to Infrastructure mode.</p>

Command	Description
key	<p>Sets the key (sometimes known as a password or passphrase) used by the WiFi ESL. The parameters of the key are determined by the encryption method used, as follows:</p> <p>None: The WiFi ESL uses no key. WEP (64 bit): The key is either 5 ASCII or 10 hexadecimal characters. WEP (128 bit): The key is either 13 ASCII or 26 hexadecimal characters. WPA (TKIP): The key is a string of from 8 to 63 characters. WPA2 (AES): The key is a string of from 8 to 63 characters.</p> <p>Note: As the parameters of the key are a function of the encryption method used, please set the encryption method BEFORE attempting to input a key. Note: With WEP 64 or WEP 128 encryption, keys can be entered as ASCII or hexadecimal. However, when the “list” command shows WiFi ESL settings, the WEP keys will always display in hexadecimal format.</p>
name	Sets the device name used by the WiFi ESL (as distinguished from the SSID).
ip	Sets the IP address used by the WiFi ESL when DHCP is disabled (see below, “dhcp”). The factory default is 192.168.0.135.
mask	Sets the network mask of the WiFi ESL. The factory default is 255.255.255.0.
gateway	Sets the IP address of a gateway device on the LAN being used by the WiFi ESL.
dns	Sets the IP address of a DNS server should the WiFi ESL connect through a DNS server.
dhcp	<p>Enables or disables DHCP operation by the WiFi ESL. When DHCP is disabled, the WiFi ESL uses a static IP address. By factory default DHCP is disabled and the WiFi ESL’s IP address is set to 192.168.0.35. When DHCP is enabled, the WiFi ESL will obtain its IP address from a DHCP server, should it be able to locate and connect to one.</p> <p>Note: DHCP operation should be disabled in Ad Hoc mode. In Infrastructure mode, DHCP can be enabled or disabled.</p>
saveconfig	<p>Saves any configuration changes made during the current terminal configuration session. These changes can be reviewed (using the “list” command above) and modified.</p> <p>Note: Any changes made, whether the “saveconfig” command has been entered or not, are not implemented until a reset.</p>
reset	<p>Resets the system, implementing changes made and subsequently saved with the “saveconfig” command.</p> <p>Note: Changes made and not confirmed with the “saveconfig” command are not implemented and not retained on a reset.</p>

Command	Description
defaults	Resets the system, restoring all factory defaults. This command is the equivalent of a hard reset as described in "8. Reset to factory defaults" on page 24.

16. Changing to WiFi Infrastructure Mode

To use the WiFi ESL as a network device on a LAN, it must be operating in Infrastructure mode and be connected to a wireless access point or wireless router. This configuration can be done either using a web browser or using a direct serial port connection, as described below.

USING A WEB BROWSER

These instructions describe setting the WiFi ESL into Infrastructure mode using a web browser, so that it will connect to a wireless access point, such as a wireless router. You will need to know the name of the access point (its SSID), the method of encryption it uses, and its security key.

1. Once you have connected to the WiFi ESL in Ad Hoc mode, open a web browser to the IP address used by the WiFi ESL. After entering the device's password (by default "admin", enter the Network and WiFi Settings page of the WiFi ESL's configuration screens.
2. In the Network Settings, check the "DHCP enabled:" checkbox.
3. In the WiFi Settings, enter the following:
 - i) In the "SSID:" box, enter the name of the access point you to which you will be connecting the WiFi ESL.
 - ii) In the "WiFi mode:" box, choose "Auto".
 - iii) In the "WiFi security:" box, choose the encryption method used by the access point.
 - iv) In the "Enter Key" box, enter the security key of the access point.
4. Click on the "Submit and reboot" button. At this point you will lose connection to the WiFi ESL as it drops its Ad Hoc connection and connects using Infrastructure mode to the access point you have chosen.
5. If you are going to access the WiFi ESL from the computer you have been using to set it up, you will now also need to connect that computer to the same LAN.

Note: If your Infrastructure mode settings are not correct, the WiFi ESL will not be able to connect to the new wireless network, nor will it be available to the previous Ad Hoc network. In this situation you will need to reconnect using a direct serial port connection (described in "15. WiFi ESL serial port command line configuration" on page 33), or hard reset the WiFi ESL to its factory default settings to proceed (described in "8. Reset to factory defaults" on page 24).

USING DIRECT SERIAL PORT CONNECTION

These instructions describe setting the WiFi ESL into Infrastructure mode using direct serial port connection, so that it will connect to a wireless access point, such as a wireless router. You will need to know the name of the access point (its SSID), the method of encryption it uses, and its security key.

1. Once you have established a terminal connection to serial port 1 of the WiFi ESL, verify its settings using the "list" command.

```
list <enter>
```
2. Configure the Service Set Identifier (SSID) to the SSID of the router or access point to which you will be connecting. Remember that SSIDs are case sensitive:

```
ssid <enter>
[supply new SSID] <enter>
```
3. Configure the mode of operation used by the wireless network to which you will be connecting. Usually changing from the factory default (Ad Hoc) to the "mixed" Infrastructure mode is best:

```
mode <enter>
1 <enter>
```
4. Enter the key used by the wireless network to which you will be attaching:

```
key <enter>
[supply new key] <enter>
```
5. Enable the WiFi ESL to obtain its IP address from the network's router or access point using DHCP:

```
dhcp <enter>
2 <enter>
```
6. At this point it is a good idea to verify the settings you have entered:

```
list <enter>
```

7. When you are satisfied with the settings, save them to the WiFi ESL. They must be saved before rebooting or they will not be implemented:

```
saveconfig <enter>
```

8. Now reboot the WiFi ESL using the reset command:

```
reset <enter>
```

The message "Reset Started" will appear in the terminal screen, and the connection with the WiFi ESL on the serial port will be broken. The WiFi ESL will now connect to the wireless network access point for which it has been configured.

Note: If your Infrastructure mode settings are not correct, the WiFi ESL will not be able to connect to the new wireless network, nor will it be available to the previous Ad Hoc network. In this situation you will need to reconnect using a direct serial port connection (described in "15. WiFi ESL serial port command line configuration" on page 33), or hard reset the WiFi ESL to its factory default settings to proceed (described in "8. Reset to factory defaults" on page 24).