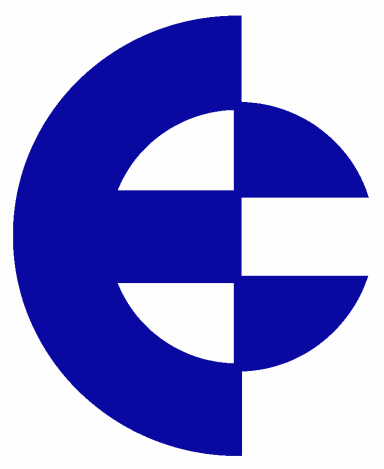


User Manual

905U-E Wireless Ethernet Bridge

ELPRO Technologies Pty Ltd, 9/12 Billabong Street, Stafford Q 4053, Australia.

Tel: +61 7 33524533 Fax: +61 7 33524577 Email: sales@elprotech.com

Web: www.elprotech.com

Thank you for your selection of the 905U-E Wireless Ethernet Bridge. We trust it will give you many years of valuable service.

ATTENTION!

Incorrect termination of supply wires may

cause internal damage and will void warranty.

To ensure your 905U-E enjoys a long life,

double check ALL your connections with

the user's manual

before turning the power on.

Caution!

For continued protection against risk of fire, replace the internal module fuse only with the same type and rating.

CAUTION:

To comply with FCC RF Exposure requirements in section 1.1310 of the FCC Rules, antennas used with this device must be installed to provide a separation distance of at least 20 cm from all persons to satisfy RF exposure compliance.

DO NOT:

operate the transmitter when someone is within 20 cm of the antenna

operate the transmitter unless all RF connectors are secure and any open connectors are properly terminated.

operate the equipment near electrical blasting caps or in an explosive atmosphere

All equipment must be properly grounded for safe operations. All equipment should be serviced only by a qualified technician.

FCC Notice:

This user's manual is for the ELPRO 905U-E Wireless Ethernet bridge. This device complies with Part 15.247 of the FCC Rules.

Operation is subject to the following two conditions:

This device may not cause harmful interference and

This device must accept any interference received, including interference that may cause undesired operation.

This device must be operated as supplied by ELPRO Technologies Pty Ltd. Any changes or modifications made to the device without the written consent of ELPRO Technologies Pty. Ltd. May void the user's authority to operate the device.

This device may only be used with ELPRO antenna / cable combinations as specified below.

ELPRO Antenna Part #	Antenna Gain	Cable Options		
		No Cable	CC10/900	CC20/900
WH900	-2dBi	OK	N/A	N/A
DG900	-2dBi	OK	N/A	N/A
CFD890EL	0dBi	OK	N/A	N/A
SG900EL	+5dBi	N/A	OK	OK
SG900-6	+8dBi	N/A	OK	OK
YU6/900	+10dBi	N/A	**NOT Permitted**	OK

End user products that have this device embedded must be supplied with non-standard antenna connectors, and antennas available from vendors specified by ELPRO Technologies. Please contact ELPRO Technologies for end user antenna and connector recommendations.

Notices: Safety

Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment as a result of its actions in Docket 93-62 and OET Bulletin 65 Edition 97-01.

Limited Warranty, Disclaimer and Limitation of Remedies

ELPRO products are warranted to be free from manufacturing defects for a period of 24 months from

the effective date of purchase by the end user. The effective date of purchase is decided solely by ELPRO Technologies.

This warranty does not extend to:

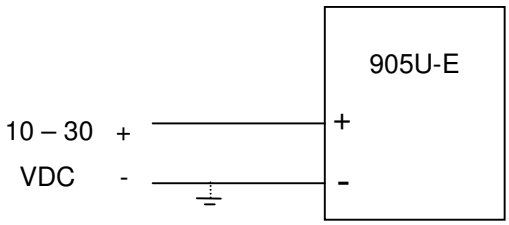
- failures caused by the operation of the equipment outside the particular product's specification, or
- use of the module not in accordance with this User Manual, or
- abuse, misuse, neglect or damage by external causes, or
- repairs, alterations, or modifications undertaken other than by an authorized Service Agent.

ELPRO's liability under this warranty is limited to the replacement or repair of the product. This warranty is in lieu of and exclusive of all other warranties. This warranty does not indemnify the purchaser of products for any consequential claim for damages or loss of operations or profits and ELPRO is not liable for any consequential damages or loss of operations or profits resulting from the use of these products. ELPRO is not liable for damages, losses, costs, injury or harm incurred as a consequence of any representations, warranties or conditions made by ELPRO or its representatives or by any other party, except as expressed solely in this document.

CONTENTS

2.3 Power Supply

The 905U-E module is powered by a 10 - 30VDC supply. The power supply should be rated at 1 Amp and be CSA Certified Class 2.



The negative side of the supply is connected to "COM" and may be connected to “ground”. The supply negative is connected to the “GND” terminal internally. The positive side of the supply **must not be connected to earth.** The supply may be a floating supply or negatively grounded.

The power requirements of the 905U-E units is 700mA at 12VDC or 450mA at 24VDC.

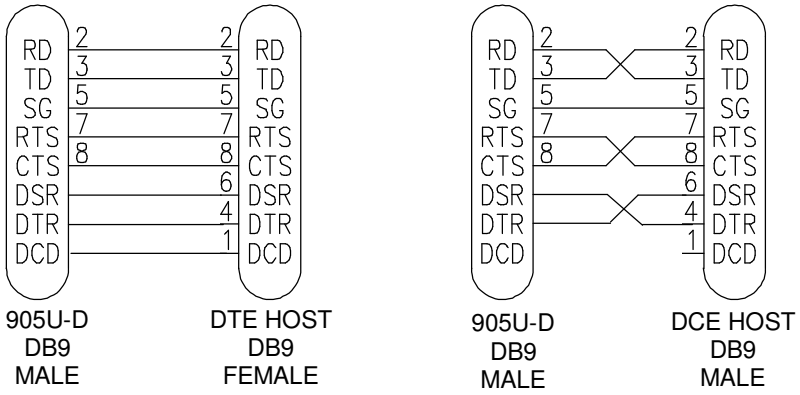
2.4 Ethernet Connections

HUB NIC

2.4 Serial Connections

2.4.1 RS232 Serial Port

The serial port is a 9 pin DB9 female and provides for connection to a host device. This port is independent of the RS485 port. Communication is via standard RS232 signals. The 905U-E is configured as DCE equipment with the pinout detailed below.



Hardware handshaking using the CTS/RTS lines is provided. The CTS/RTS lines may be used to reflect the status of the local unit's input buffer, or may be configured to reflect the status of CTS/RTS lines at the remote site. The 905U-D does not support XON/XOFF.

Example cable drawings for connection to a DTE host (a PC) or another DCE host (or modem) are detailed above.

DB9 Connector Pinout

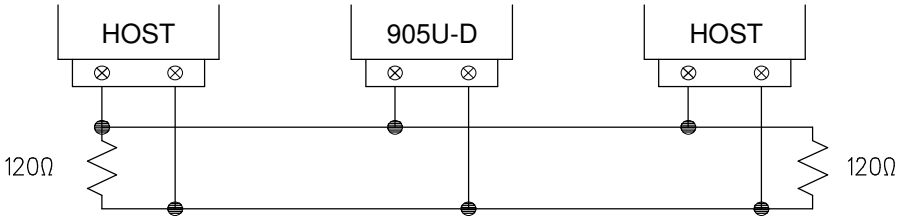
Pin	Name	Direction	Function
1	DCD	Out	**Data carrier detect** – - on when link is established in controlled mode - on always in transparent mode
2	RD	Out	**Transmit Data** – Serial Data Output
3	TD	In	**Receive Data** – Serial Data Input
4	DTR	In	**Data Terminal Ready** - DTR can be configured to initiate low power mode, or to force a link disconnection ("hang up" in controlled mode.
5	SG		**Signal Ground**
6	DSR	Out	**Data Set Ready** - always high when unit is powered on.
7	RTS	In	**Request to Send -** hardware flow control configurable
8	CTS	Out	**Clear to send -** hardware flow control configurable
9	RI		**Ring indicator** - indicates another module is attempting to connect in controlled mode.

2.4.2 RS485 Serial Port

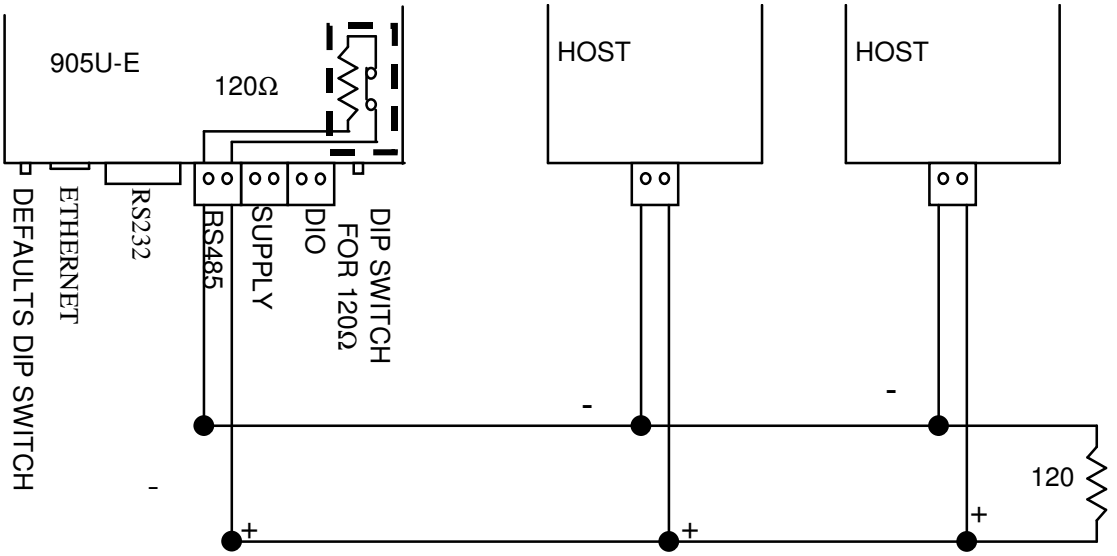
The RS485 port provides for communication between the 905U-E unit and its host device using a multi-drop cable. Up to 32 devices may be connected in each multi-drop network.

As the RS485 communication medium is shared, only one of the units on the RS485 cable may send data at any one time. Thus communication protocols based on the RS-485 standard require some type of arbitration.

RS485 is a balanced, differential standard but it is recommended that shielded, twisted pair cable be used to interconnect modules to reduce potential RFI. It is important to maintain the polarity of the two RS485 wires. An RS485 network should be wired as indicated in the diagram below and terminated at each end of the network with a 120 ohm resistor. On-board 120 ohm resistors are provided and may be engaged by operating the single DIP switch in the end plate next to the RS485 terminals. The DIP switch should be in the "1" or "on" position to connect the resistor. If the module is not at one end of the RS485 cable, the switch should be off.



RS485 CONNECTIONS



RS485 CONNECTION USING TERMINATING RESISTOR

2.4 Digital Input/Output

Chapter Three OPERATION

3.1 Power-up and Normal Operation

When power is initially connected to the 905U-E module, the module will perform internal diagnostics to check its functions. The following table details the status of the indicating LEDs on the front panel under **normal** operating conditions.

LED Indicator	Condition	Meaning
OK	On	Normal Operation
Radio RX	GREEN flash RED flash	Radio receiving data Weak radio signal
Radio TX	Flash	Radio Transmitting
Serial RX	GREEN flash RED flash	Serial Port Receiving CTS low
Serial TX	GREEN flash	Serial Port Transmitting
LINK	On	On when a radio communications link is established
LINK	Off	Communications failure or radio link not established

Other conditions indicating a fault are described in Chapter Six **Troubleshooting**.

3.2 Ethernet Data

3.2 Serial Data

The 905U-E module provides a full-duplex RS232 serial port and half-duplex RS485 serial port. The radio communications is half-duplex - this means that the 905U-E operates at half duplex. Many applications use full duplex RS232 communications but do not require full duplex - the

protocol used operates at half-duplex and will operate with the 905U-E without problems. If an application really requires full duplex communications, then the 905U-E should not be used.

3.2 Radio Data

3.3 Addressing

A 905U-E network comprises modules with the same "system" address. Only modules with the same system address will communicate with each other. This feature allows more than one system to operate in the same area on the same radio channel.

3.3 Bridge Mode

Joins sections of the same network.

Work at the MAC Layer.

Filter may be used to minimize traffic

Learns where to send data

Initially Broadcast, listen, then limit

3.3 Router Mode

Joins separate networks

Useful for minimizing traffic between networks

Work at the Internet Layer

Knows where to send data based on IP address and routing rules.

905U-E at present only implements only 1 routing rule – default gateway

3.3 Access Point

Access Points (AP)??.

Alternatively, Access Points may be used as a single hop repeater.

All radio traffic with the radio cell is controlled by the Access Point, and must pass through the Access Point. Ideally the Access Point is placed at the wired location where the majority of data traffic will flow. This will reduce quantity of data transmitted over the radio.

Access Points periodically sent out Beacon messages. These messages are used by Clients to synchronise their link with an individual AP.

3.3 Client

A Client is a How is a Connection Established

Client Scanning - RX LED flicker. Select best RSSI

Joining, Timer Synchronisation, Leadin short

Authentication Request

Encryption Requested -> Challenge and Response

Acceptance

Association LINK LED on

Monitor RSSI and Fade Margin

Short vs Long Beacon Interval

How is a Connection Lost

Retry 3 times, allow other data through, backoff, then disassociation

Client hears misses several beacons

Client periodically reassociates

Access Point doesn't hear any reassociating or data from a Client

All related to Beacon Interval configured.

3.3 Filter

need to add other bridges mac addresses when in bridge mode?

3.3 Radio Rates

The 905U-E is capable of using several radio transmission rates. A reduction in speed will increase the range.

3.8 Radio Interference

The 905U-E operates on the 902-928MHz license-free radio band (restricted to 915 – 928 MHz in Australia and 921 – 928MHz in New Zealand). Devices on this radio band must use a spread spectrum technique to allow multiple users to share the band with minimal interference.

The 905U-E uses a frequency-hopping spread spectrum technique. The 905U-E will not interfere, or be interfered by, radio devices on other bands, such as two way radios or wireless telephones. There can be interference from other devices on the same band. As the "hopping sequence" used by the 905U-E is different to other devices on this band, the probability of two devices using the same channel is small, and if this does occur, the probability of sharing the same channel on a re-transmission is even smaller.

In countries which allow the full 902-928MHz band (such as USA and Canada), there are eight hopping sequences, and the first four do not use the same frequency channels as the last four - this can give isolation between two systems. That is, a system with hopping sequence 1 will hear messages from another system using hopping sequence 3, but will not if the other system used hopping sequence 5. The hopping sequence may be configured under the Radio Settings Configuration menu. In countries which only allow half the band (such as Australia and New Zealand), it is not possible to separate systems in this way because the band is smaller and all hopping sequences use all channels available.

Chapter Four CONFIGURATION

4.1 Before Configuring

Configuration comprises selecting parameter values for the operation of the 905U-E unit. Before you start configuration, parameter settings must be decided. The main parameters are:-

- Addressing – System address, IP address, Network mask, Gateway IP address.
- Device Mode – Bridge or Router
- Operating Mode – Access Point or Client.
- Encryption

The other configuration parameters do not need to be selected, and are provided as a means of "fine tuning" the operation of the 905U-E units.

Configuration may be achieved using only Windows Internet Explorer ®.

4.2 Addressing

A 905U-E network comprises modules with the same "system" address. The system address is text string 1 to 31 characters in length. Only modules with the same system address will communicate with each other. If you are adding another module to an existing system, use the same value as the existing modules. If you are starting a new system, select random values and use the same value for each module.

The Device Mode must also be selected. If you wish to link a single network together, then set Device Mode to Bridge. If two separate networks are to be joined then Device Mode should be set to Router.

IP addresses and netmasks must be set to reflect the Device Mode configured. If the unit is configured as a Router, then the 905U-E requires an IP address and netmask to be set for within each of the networks it is joining. When configured as a Bridge, the 905U-E requires only one IP address.

4.3 Default Configuration

The default configuration of the 905U-E is a Bridge, Client, IP address 192.168.123.123, netmask 255.255.255.0, gateway IP address 192.168.123.1. Default username is "*user*" and the default password is "*user*" for configuration.

The module may be forced to factory default setting by using the default configuration dipswitch or via the *System Tools* menu via Internet Explorer.

4.4 Factory Default Switch

When powered up with the Factory Default switch on, the 905U-E will start with temporary settings of ethernet IP address 192.168.123.123, subnet mask 255.255.255.0, gateway IP 192.168.123.1, username and password "user" and the radio disabled. This allows easy access to configuration when configuration detail has been forgotten. The existing configuration is not modified, unless the user makes changes.

Do not forget to set the switch back to the OFF position and cycle power at the conclusion of configuration for resumption of normal operation.

4.4 Configuration Program

The 905U-E has a built-in webserver, containing webpages for analysis and modification of configuration. The configuration must be accessed using Microsoft® Internet Explorer. This program is shipped with Microsoft Windows or may be obtained freely via the Microsoft® website on the internet.

Serial configuration for IP address, gateway address and subnet mask may be accessed via the RS-232 serial port.

Accessing Configuration inside a module for the first time

There are two methods for accessing the configuration inside a 905U-E. The first method requires changing your computer settings so that the configuring PC is on the same network as the 905U-E with factory default settings.The second method requires setting an IP address so the 905U-E is accessable on your network.

You will need a straight through ethernet cable between the PC ethernet card and the 905U-E. The factory default ethernet address for the 905U-E is 192.168.123.123.

Consult your network administrator for an IP address on your network, the gateway IP address, and network mask.

Adjust PC or 905U-E network settings so that both are on the same network. This may achieved two ways as outlined below.

Option 1 – Set PC to same network as 905U-E

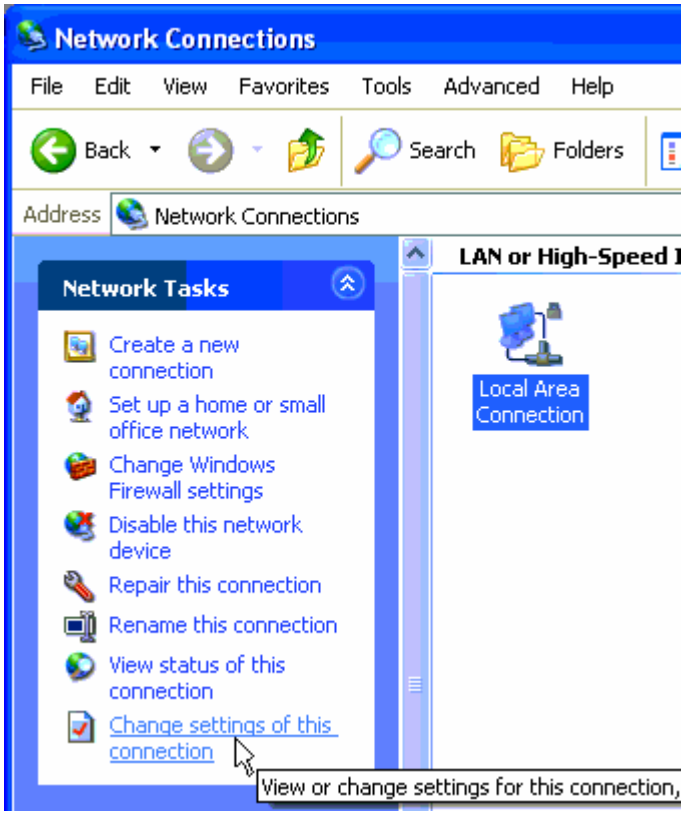
Connect ethernet cable between unit and the PC configuring the module.

Set the Factory Default Switch to the ON (SETUP) position. This will always start the 905U-E with ethernet IP address 192.168.123.123, subnet mask 255.255.255.0, gateway IP 192.168.123.1 and the radio disabled. Do not forget to set the switch back to the OFF position and cycle power at the conclusion of configuration for resumption of normal operation.

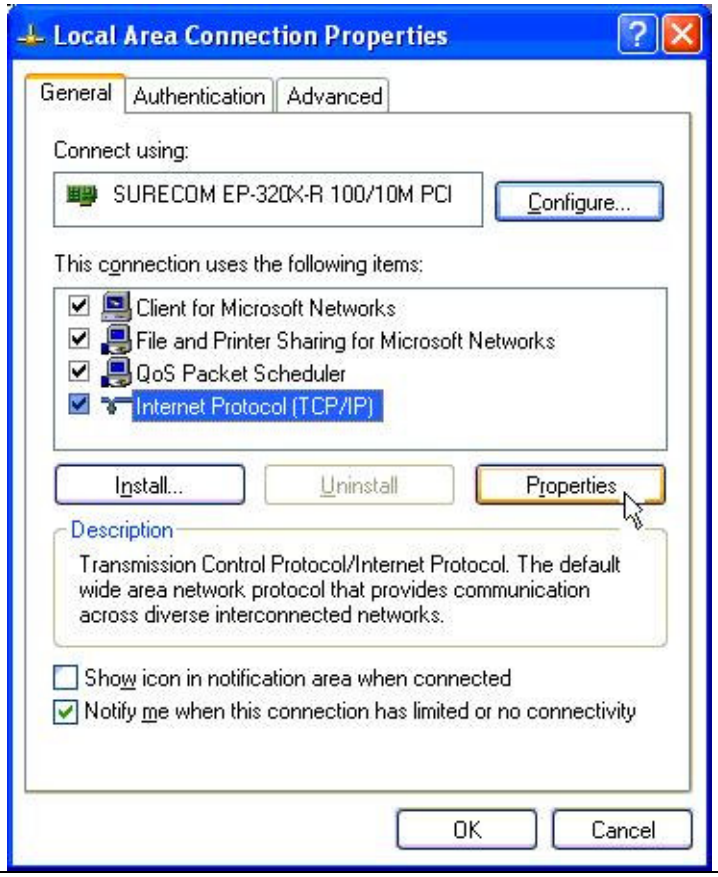
Power up module.

Open Network Settings on PC under Control Panel.

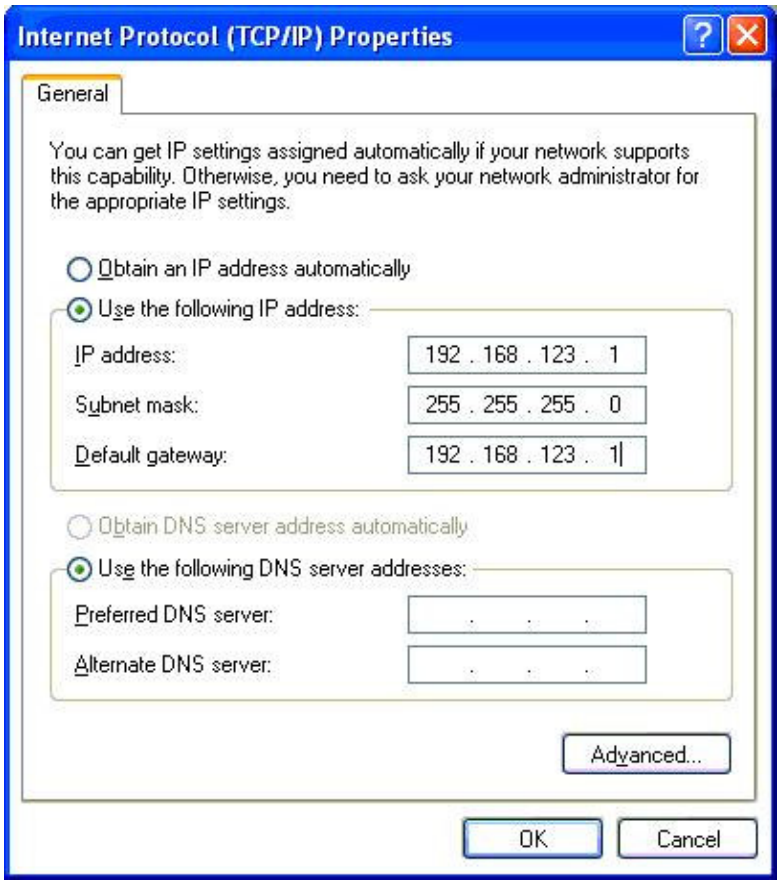
Open Properties of Local Area Connection.



Select Internet Protocol (TCP/IP) and click on Properties.

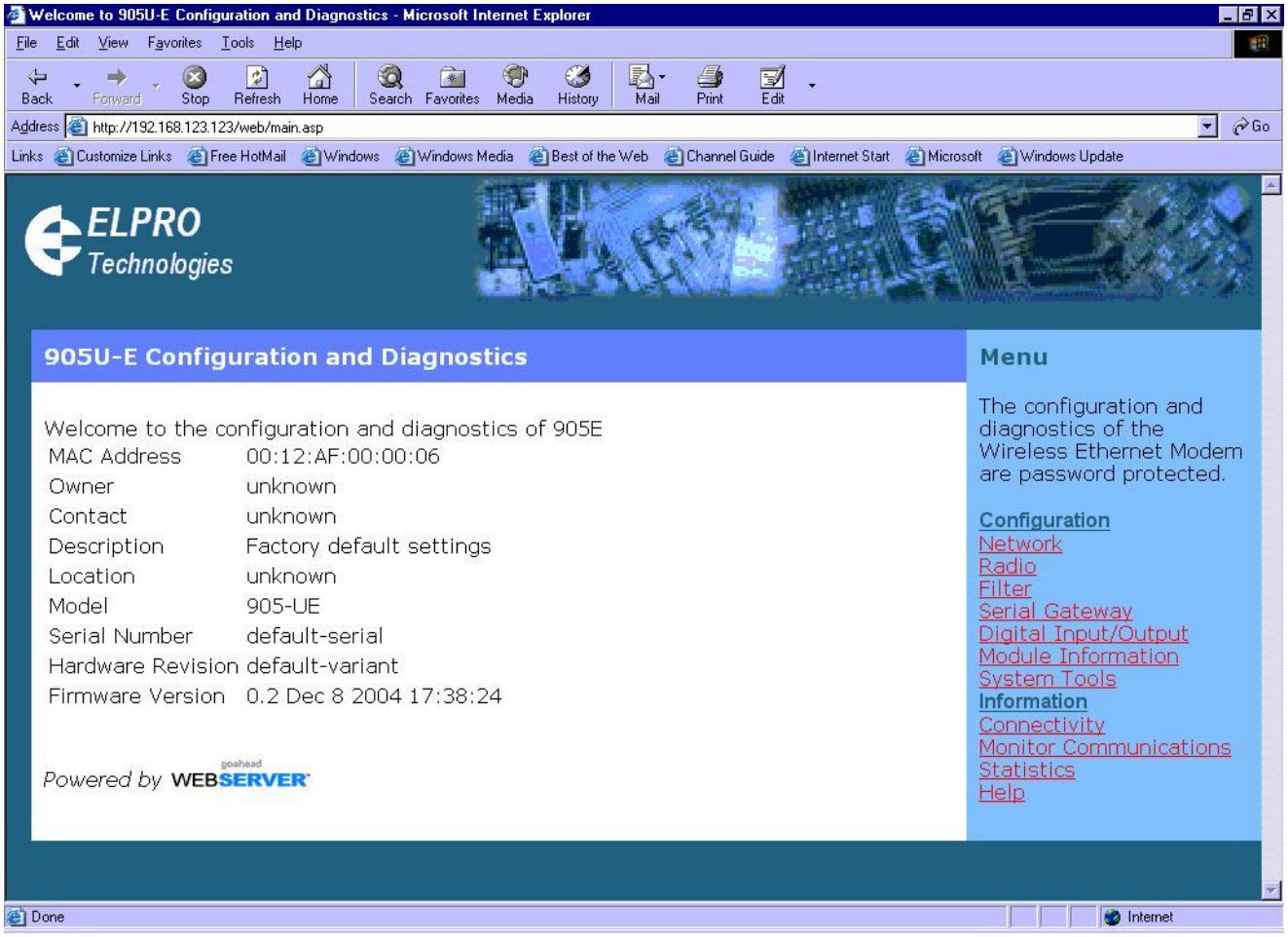


On the General tab enter IP address 192.168.123.1, Subnet mask 255.255.255.0, and default gateway 192.168.123.1.



Open Internet Explorer and ensure that settings will allow you to connect to the IP address selected. If the PC uses a proxy server, ensure that Internet Explorer will bypass the Proxy Server for local addresses. This option may be modified by opening Tools -> Internet Options -> Connections Tab -> LAN Settings->Proxy Server -> bypass proxy for local addresses.

Enter the webpage http://192.*168.123.123*/ A welcome webpage should be displayed as illustrated below.



Configuration and Diagnostics may be opened by clicking on any of the menu items, and entering the default username "*user*" and password "*user*".

Switch dip-switch on 905U-E to RUN (OFF) position, and cycle power to resume normal configured operation.

Option 2 – Set 905UE to same network as PC

a) Switch dip-switch on 905U-E to SETUP (ON) position.

b) Open a terminal package with 19200bps data rate, 8 data bit, 1 stop and no parity.

c) Power up 905U-E. Basic network settings will be displayed on the terminal as illustrated below. When prompted, hit enter key to stop automatic boot process.

```
My Right Boot 2.1
 Copyright 1999-2004 Cybertec Pty Ltd, All rights reserved.
 This software is provided by Cybertec ``as is'' and with NO WARRANTY.
   http://www.cybertec.com.au/

ROM :   256KB @ 0xffe00000
RAM :  8192KB @ 0x00000000 (140KB / 0x00023214)

ROM Configuration table ... PASSED.
RAM address pattern check . PASSED.
RAM address bus check ..... PASSED.

Product       : E900P
Variant       : default-variant
Serial No.    : default-serial
Release       : default-release
Released date :
Released host :
Build date    : Oct 12 2004, 17:27:32
Build host    :
Boot Flags    : no RAM test, no ROM test, bus timer on, wdog on
                static IP, auto-boot, net-boot, reset on
                local file, no binary load
Boot delay    : 1
Boot Filename : /memory/0xffe40000,0x50000
Boot Address  : 169.254.101.93
Boot Netmask  : 255.255.255.0
Boot Gateway  : 169.254.101.1
Boot Host     : 169.254.101.1
Boot Mac 0    : 00:12:af:00:00:04

RTE data store .... no error
Setting bus timer (on) and watchdog (on) ... PASSED

eip: mount point /memory
fec0: connected at 10M Half Duplex.
fec0: local ip = 169.254.101.93, server ip = 169.254.101.1

Press ENTER to abort automatic booting ... 30
```

d) Check values for Boot Address, Boot Netmask, and Boot Gateway. These values should be set to reflect those of the PC you are using to configure the unit. If these are correct skip to step (h). You may check settings again with the *rct* command. For further help, type the *help* command.

e) Set Boot Netmask to the same settings as the computer you have the ethernet cable connected to. This may be performed with the command: *bnm <Type the netmask>*

f) Set Boot Gateway to the same settings as the computer you have the ethernet cable connected to. This may be performed with the command: *bgw <Type the gateway IP address>*

g) Choose an IP address for the 905U-E being upgraded. This IP address must be on the same network as the computer you have connected the ethernet cable to. This may be performed with the command: *bip <Type the IP address>*

h) Set boot delay to 1 second with the command *bdelay 1*

i) Switch dip-switch on 905U-E to RUN (OFF) position.

j) Type the command *reset*. The 905UE will reset and start with the network settings you have entered.

k) Open Internet Explorer and ensure that settings will allow you to connect to the IP address selected. If the PC uses a proxy server, ensure that Internet Explorer will bypass the Proxy Server for local addresses. This option may be modified by opening Tools -> Internet Options -> Connections Tab -> LAN Settings->Proxy Server -> bypass proxy for local addresses.

l) Enter the webpage http://*xxx.xxx.xxx.xxx*/ where *xxx.xxx.xxx.xxx* is the IP address selected for the module. A welcome webpage should be displayed as illustrated.

m) Clicking on any of the menu items, and entering the default username "user" and password "user" may open Configuration and Diagnostics. If the password has previously been configured other than the default password, then enter this instead.

Modifying an existing configuration

Open Internet Explorer to the IP address set for the module (ie http://xxx.xxx.xxx.xxx/ where xxx.xxx.xxx.xxx is the IP address set on the 905U-E.), and use menu system to open the item you wish to modify. When prompted for username and password, enter "user" as the username, and the previously configured password in the password field.

If IP address or password has been forgotten, the Factory Default switch may be used to access the existing configuration. Refer to Option 1 Accessing Configuration inside a module for the first time.

Remote modification of an existing configuration

Care must be taken if modifying the configuration of a module remotely. If the network link is via a radio link, some changes made may cause loss of the radio link, and therefore the network connection.

It is advisable to determine path of the links to the modules you wish to modify, and draw a tree diagram if necessary. Modify the modules at the "leaves" of your tree diagram. These will be the furtherest away from your connection point in terms of the number of radio or ethernet links.

In a simple system, this usually means modifying the Client modules first and the Access Point last.

Network Settings Webpage Fields

Device Mode	Used to select Bridge or Router mode. By default this is set to Bridge.
Operating Mode	Used to select Access Point or Client mode. By default this is set to Client.
Bridge Priority	The priority of the 905U-E, if configured as a bridge, in the Bridge Spanning Tree algorithm. By default this is set to the lowest priority at 255.
FTP Enabled	Check this item to enable the FTP server on the 905U-E. The FTP

	server is not secure, and should be disabled for normal operation of the unit. By default this is enabled.
MAC Address	This is the unique hardware address of the 905U-E. This item is for information purposes only. This unique identifier is assigned to the 905U-E when built in the factory.
Gateway IP Address	The IP address of the default gateway. By default this is set to 192.168.123.1.
Ethernet IP Address	The IP address of the 905U-E on the RJ-45 ethernet port. By default this is set to 192.168.123.123.
Ethernet IP Subnet Mask	The IP network mask of the 905U-E on the RJ-45 ethernet port. By default this is set to 255.255.255.0.
Wireless IP Address	The IP address of the 905U-E on the radio port. If the unit is configured as a bridge this address must be the same as the ethernet IP address. If configured as a router, the IP address must be different from the Ethernet IP Address. By default this is set to 192.168.123.123.
Wireless IP Subnet Mask	The network mask of the 905U-E on the radio port. If configured as a Bridge, this must be the same as the Ethernet IP Subnet Mask. By default this is set to 255.255.255.0.
System Address	This field must be the same value for all 905U-E intended to interact with each other using the radio. All units intended to operate within the same radio cell must have the same system address configured. By default System Address is set to “905E”.
Radio Encryption Enabled	Check this field to enable encryption of data transmitted over the radio. By default Radio Encryption is disabled.
Encryption Keys 1 to 4	These are the keys used to encrypt radio data to protect data from unwanted eavesdroppers. These keys must be set the same for all 905U-E intended to operate in the radio cell. Each of the fields are 5 bytes in length, and must be entered as hexidecimal numbers separated by colons. Eg 12:AB:EF:00:56 Encryption keys must not be all zeros, ie 00:00:00:00:00
Save and Reboot.	Save settings to non-volatile memory, and reboot 905U-E.

Radio Settings Webpage Fields

Power Level	The transmitter power level desired in mW. By default this is set to maximum power of 1 Watt.
Data Rate	The radio baud rate in bits per second (bps). Available rates are 19200, 57600, 115200, 230400bps and auto. By default, this is set as auto.
Fade Margin	When automatic rate is selected, the 905U-E chooses a rate based on the received signal strength of transmissions. The value nominated by the Fade Margin, is subtracted from this average of RSSI and then used to decide which rate to transmit at. A higher value in Fade Margin will decrease the threshold in signal strength used to switch down rates. By default this is set to 10 dB.
Dwell Time	The amount of time, in milliseconds, the 905U-E remains on a particular frequency whilst frequency hopping. This parameter may be modified in the event of severe interference to smaller periods of time. This also has an impact on the maximum size of Fragmentation Threshold that may be configured. By default this is set to 400 milliseconds.
Beacon Period	This interval is the period between beacon transmissions sent by an Access Point. The Beacon Interval is also related to the scan period on a Station. ??Reassociation interval is ?? times the Beacon Interval Units will timeout after ?? times the Beacon Interval if no response is heard. Refer to ?? for more information. By default this is set to 20 seconds.
Frequency Hopset	If configured as an Access Point, the unit will use the value nominated in Frequency Hopset to select which pseudo-random frequency hopping sequence to use. Clients automatically adujst their Frequency Hopset to synchronise with the selected Access Point. By default this is set to 0.
Frequency Hop Pattern	This feature is not implemented in the beta release. This option allows modifies the selected hopset pattern, to produce a larger number of effective hopsets. By default this is set to 0.

Fragmentation Threshold	The maximum transmission unit (MTU) of data over the radio. This selects the maximum number of bytes that will be transmitted in one message. If more than this number of bytes is input into the 905U-E, the module will transmit more than one message. By default this level is set to 500 bytes
RSSI Threshold	The received signal strength level at which beacons from Access Points are to be ignored. This prevents Clients from establishing links to Access Points beyond a sustainable range. By default this level is set below the noise floor at -150 dBm.
Apply Changes	Update settings in RAM.
Apply Changes and Save	Update settings in RAM and save to non-volatile memory.

Filter Webpage Fields

Add Entries	Enter the MAC addresses of devices to be added to the list. Multiple entries must be separated by a semi-colon.
Delete Entries	Check the box alongside entries selected for removal from the list.
Whitelist or Blacklist	Uncheck the box to make the list a blacklist. This will ban all devices with a MAC address in the list from communicating with the 905U-E or utilising the radio link. Check the box to make the list a whitelist. This will only alow devices with the MAC addresses listed to communicate with 905U-E and utilise the radio link. All other devices are banned from accessing the 905U-E and utilising the radio link. **CAUTION: It is important to add the MAC Address of the configuration PC when creating a whitelist. If the configuration PC is not on the whitelist, it will be unable to communicate with the 905U-E for further configuration. It is advisable to use the Apply Changes button to test the configuration entered. Once the configuration is determined to be correct, the Apply Changes and Save button should be used. In the event that the configuration is incorrect, a power reset will revert the unit to previously saved configuration.**
Apply Changes	Update settings in RAM.
Apply Changes and Save	Update settings in RAM and save to non-volatile memory.

Serial Gateway Webpage Fields

This feature is not implemented in the beta release.

Enable	Tick to enable serial gateway access.
Data Rate	Select serial data rate
Data-Parity-Stop bits	Data bit – Parity – Stop bits
Flow Control	Enable hardware flow control
Character Timeout	Packets are transmitted once a ?? bytes have reached or there have been no characters received on the serial port for the time nominated in Character Timeout.
Listen Port	The port address on which the 905U-E is to listen for a socket.
Send IP Address	The IP address to which the 905U-E is to attempt to connect the serial port to.
Send Port	The port address to which the 905U-E is to attempt to connect the serial port to.
Apply Changes	Update settings in RAM.
Apply Changes and Save	Update settings in RAM and save to non-volatile memory.

Module Information Webpage Fields

This configuration page is primarily for information purposes. With the exception of the password, the information entered here is displayed on the root webpage of the 905U-E.

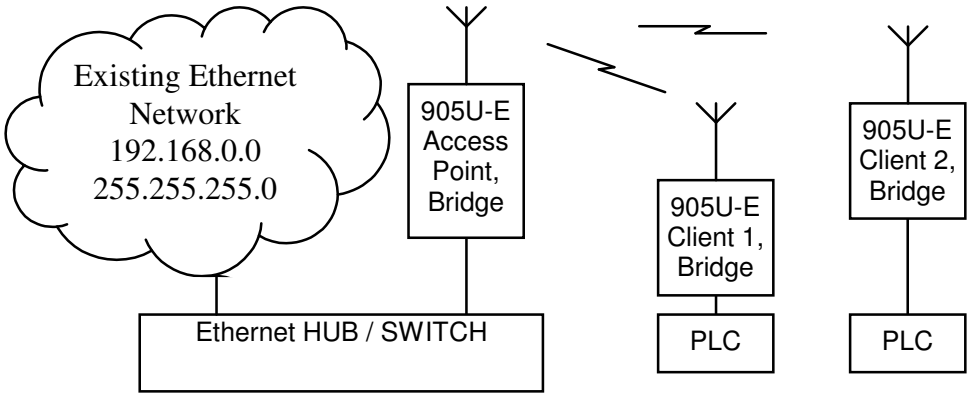
Password	Configuration password. When changing the password on this screen, it will be sent unencrypted over any wired network. If encryption is enabled on the 905U-E, any radio communications are encrypted, and therefore hidden from radio eavesdroppers. Caution must only be taken if there are potential eavedroppers on the wired network.
Device Name	A text field for a nickname of the particular 905U-E.
Owner	A text field for owner name.
Contact	A text field for owner phone number, email address etc.
Description	A text field used for a description of the purpose of the unit.
Location	A text field used to describe the location of the 905U-E.

4.6 Configuration Examples

Setting a 905U-E to Factory Default Settings

1. Access configuration webpages of 905U-E. Refer section *Accessing Configuration inside a module for the first time*, or *Modifying an existing configuration*.
2. Click on System Tools Menu Item
3. Enter username “user” and password “user”, when prompted for password.
4. Click on Factory Default Configuration Reset, and wait for unit to reset. When reset, the LINK LED will flash.

Extending a wired network



Access Point Configuration

1. Connect straight through ethernet cable between PC and 905U-E.
2. Ensure configuration PC and 905U-E are setup to communicate on the same network
3. Set 905U-E to start with factory default settings. Refer to section *Setting a 905U-E to Factory Default Settings*.
4. Power up unit, and wait for LINK led to cease flashing.

Option A – Adjust PC network settings

a) Set Configuration PC network card with network setting of IP address 192.168.123.1, netmask 255.255.255.0

b) Open configuration webpage with Internet Explorer at address http://192.168.123.123/

Option B – Adjust 905U-E network settings (assuming configuration PC is on existing network)

Open terminal program with settings with data rate 19200bps, 8 data bits, 1 stop bit and no parity.

Connect straight through serial cable to 905U-E and power up unit.

When prompted, strike the Enter key to abort automatic boot

Set IP address of 905U-E to 192.168.0.200 with command bip 192.168.0.200

Set netmask of 905U-E to 192.168.0.200 with command bnm 255.255.255.0

Set gateway address of 905U-E to 192.168.0.1 with command bgw 192.168.0.1

Reset 905U-E with reset command.

Open configuration webpage with Internet Explorer at address http://192.168.0.200/

5. Click on Network settings menu option.
6. When prompted for password, enter default username “user” and password “user”
7. Set the Operating Mode to Access Point
8. Device Mode should be set to Bridge.
9. Set the Gateway IP address to 192.168.0.1

10. Set the Ethernet IP address to 192.168.0.200, network mask 255.255.255.0
11. Set the Wireless IP address to 192.168.0.200, network mask 255.255.255.0
12. Set the system address to "ExampleSystem1"
13. Enable Radio Encryption and enter key 1 as 01:02:03:04:05, key 2 as 06:07:08:09:0A, key 3 as 0B:0C:0D:0E:0F, key 4 as 10:11:12:13:14.
14. Click on button Save to Flash and Reset. Webpage will display that message indicating details are being written to flash. Wait for 905U-E to reboot before removing power.

Client 1 Configuration

Perform the same configuration steps as the Access Point configuration with the following differences:

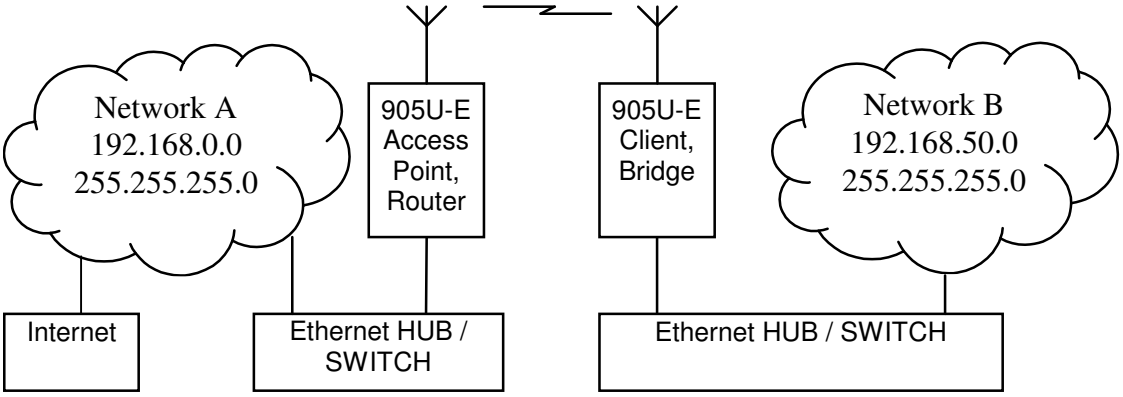
- At step 0 in Option B, set IP address of 905U-E to 192.168.0.201 with command bip 192.168.0.201
- At step 0 in Option B, open configuration webpage with Internet Explorer at address http://192.168.0.201/
- At step 7, set the Operating Mode to Client.
- At step 10, set the Ethernet IP address to 192.168.0.201, network mask 255.255.255.0
- At step 11, set the Wireless IP address to 192.168.0.201, network mask 255.255.255.0

Client 2 Configuration

Perform the same configuration steps as the Access Point configuration with the following differences:

- At step 0 in Option B, set IP address of 905U-E to 192.168.0.202 with command bip 192.168.0.202
- At step 0 in Option B, open configuration webpage with Internet Explorer at address http://192.168.0.202/
- At step 7, set the Operating Mode to Client.
- At step 10, set the Ethernet IP address to 192.168.0.202, network mask 255.255.255.0
- At step 11, set the Wireless IP address to 192.168.0.202, network mask 255.255.255.0

Connecting two separate networks together



Network A Configuration

In this example, network A is connected to the internet via a router at IP address 192.168.0.1.

Devices on Network A that only require access to devices on Networks A and B, should have their gateway IP address set to the 905U-E Access Point as 192.168.0.200.

Devices on Network A, that must interact with devices on Networks A and B and the internet must have routing rules established. On PCs, this may be achieved with the MS-DOS command ROUTE. For this example use: ROUTE ADD 192.168.0.50.0 MASK 255.255.255.0 192.168.0.200

Network B Configuration

All devices on Network B should be configured so their gateway IP address is that of the 905U-E Access Point as 192,168.50.200.

Access Point Configuration

1. Connect straight through ethernet cable between PC and 905U-E.
2. Ensure configuration PC and 905U-E are setup to communicate on the same network
3. Set 905U-E to start with factory default settings. Refer to *Setting a 905U-E to Factory Default Settings.*
4. Power up unit, and wait for LINK led to cease flashing.

Option A – Adjust PC network settings

Set Configuration PC network card with network setting of IP address 192.168.123.1, netmask 255.255.255.0

a) Open configuration webpage with Internet Explorer at address http://192.168.123.123/

Option B – Adjust 905U-E network settings (assuming configuration PC is on network A)

Open terminal program with settings with data rate 19200bps, 8 data bits, 1 stop bit and no parity.

Connect straight through serial cable to 905U-E and power up unit.

When prompted, strike the Enter key to abort automatic boot

Set IP address of 905U-E to 192.168.0.200 with command bip 192.168.0.200
Set netmask of 905U-E to 192.168.0.200 with command bnm 255.255.255.0
Set gateway address of 905U-E to 192.168.0.1 with command bgw 192.168.0.1
Reset 905U-E with reset command.
Open configuration webpage with Internet Explorer at address http://192.168.0.200/

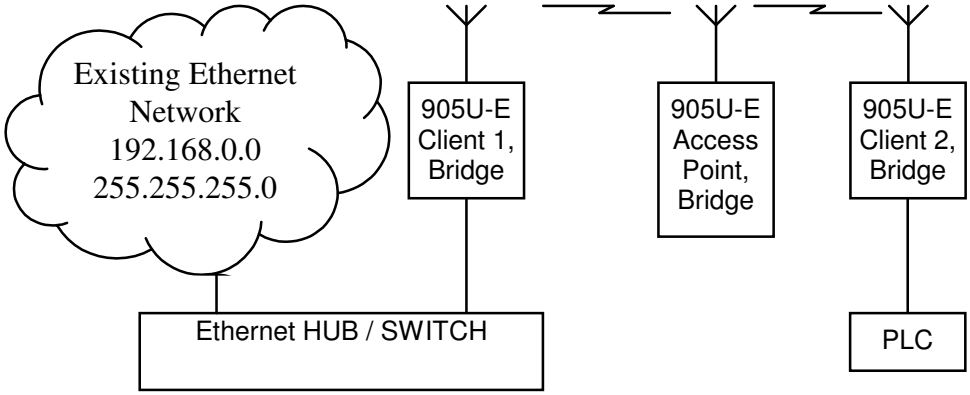
5. Click on Network settings menu option.
6. When prompted for password, enter default username "user" and password "user"
7. Set the Operating Mode to Access Point
8. Device Mode should be set to Router.
9. Set the Gateway IP address to 192.168.0.1
10. Set the Ethernet IP address to 192.168.0.200, network mask 255.255.255.0
11. Set the Wireless IP address to 192.168.50.200, network mask 255.255.255.0
12. Set the system address to "ExampleSystem1"
13. Enable Radio Encryption and enter key 1 as 01:02:03:04:05, key 2 as 06:07:08:09:0A, key 3 as 0B:0C:0D:0E:0F, key 4 as 10:11:12:13:14.
14. Click on button Save to Flash and Reset. Webpage will display that message indicating details are being written to flash. Wait for 905U-E to reboot before removing power.

Client Configuration

Perform the same configuration steps as the Access Point configuration with the following differences:

- At step 0 in Option B, set IP address of 905U-E to 192.168.0.201 with command bip 192.168.0.201
- At step 0 in Option B, open configuration webpage with Internet Explorer at address http://192.168.0.201/
- At step 7, set the Operating Mode to Client.
- At step 8, set Device Mode to Bridge.
- At step 9, set the Gateway IP address to 192.168.50.200
- At step 10, set the Ethernet IP address to 192.168.50.201, network mask 255.255.255.0
- At step 11, set the Wireless IP address to 192.168.50.201, network mask 255.255.255.0

Extending range of a network with a Store and Forward hop



Configure units as described in Section *Extending a wired network*. Place the Access Point at the remote intermediate store and forward location.

Chapter Six TROUBLESHOOTING

6.1 Diagnostics Chart

INDICATOR	CONDITION	MEANING
OK LED OFF	Continuously	• Power supply failure • CPU failure
OK LED ON	Continuously	• Normal Operation
Radio TX LED ON	Flashes briefly	• Radio transmitting
Radio RX LED ON	GREEN flash RED flash	• Radio receiving data • Weak radio signal (< -95dBm)
Serial RX LED ON	GREEN flash RED flash	• Serial Port Receiving • Input buffer almost full
Serial TX LED ON	Flashes briefly	• Serial port transmitting
LINK LED ON	Continuously	• A radio link has been established.

The green OK LED on the front panel indicates correct operation of the unit. This LED extinguishes on failure as described above. When the OK LED extinguishes shutdown state is indicated. On processor failure, or on failure during startup diagnostics, the unit shuts down, and remains in shutdown until the fault is rectified.

6.1 Connectivity

6.1 Monitor Communications

6.1 Statistics

6.1 PING

6.1 IPCONFIG

6.1 ARP

6.1 ROUTE

Chapter Six GLOSSARY

ACK	**Acknowledgment.**
Access point	**An access point is the connection that ties wireless communication devices into a network. Also known as a base station, the access point is usually connected to a wired network.**
Antenna Gain	**Antennae don't increase the transmission power, but focus the signal more. So instead of transmitting in every direction (including the sky and ground) antenna focus the signal usually either more horizontally or in one particular direction. This gain is measured in decibels**
Bandwidth	**The amount of "transportation" space an Internet user has at any given time.**
Bridge	
Collision avoidance	**A network node characteristic for proactively detecting that it can transmit a signal without risking a collision.**
Crossover cable	**A special cable used for networking two computers without the use of a hub. Crossover cables may also be required for connecting a cable or DSL modem to a wireless gateway or access point. Instead of the signals transferring in parallel paths from one set of plugs to another, the signals "crossover." If an eight-wire cable was being used, for instance, the signal would start on pin one at one end of the cable and end up on pin eight at the other end. They "cross-over" from one side to the other.**
	CSMA/CA is a "listen before talk" method of minimizing (but not eliminating) collisions caused by simultaneous transmission by multiple radios. IEEE 802.11 states collision avoidance method rather than collision detection must be used, because the standard employs half duplex radios—radios capable of transmission or reception—but not both simultaneously. Unlike conventional wired Ethernet nodes, a WLAN station cannot detect a collision while transmitting. If a collision occurs, the transmitting station will not receive an ACKnowledge packet from the intended receive station. For this reason, ACK packets have a higher priority than all other network traffic. After completion of a data transmission, the receive station will begin transmission of the ACK packet before any other node can begin transmitting a new data packet. All other stations must wait a longer pseudo randomized period of time before transmitting. If an ACK packet is not received, the transmitting station will wait for a subsequent opportunity to retry transmission.
CSMA/CD	**A method of managing traffic and reducing noise on an Ethernet network.**

	A network device transmits data after detecting that a channel is available. However, if two devices transmit data simultaneously, the sending devices detect a collision and retransmit after a random time delay.
DHCP	**A utility that enables a server to dynamically assign IP addresses from a predefined list and limit their time of use so that they can be reassigned. Without DHCP, an IT Manager would have to manually enter in all the IP addresses of all the computers on the network. When DHCP is used, whenever a computer logs onto the network, it automatically gets an IP address assigned to it.**
Dial-up	**A communication connection via the standard telephone network, or Plain Old Telephone Service (POTS).**
DNS	**A program that translates URLs to IP addresses by accessing a database maintained on a collection of Internet servers. The program works behind the scenes to facilitate surfing the Web with alpha versus numeric addresses. A DNS server converts a name like mywebsite.com to a series of numbers like 107.22.55.26. Every website has its own specific IP address on the Internet.**
DSL	**Various technology protocols for high-speed data, voice and video transmission over ordinary twisted-pair copper POTS (Plain Old Telephone Service) telephone wires.**
Encryption key	**An alphanumeric (letters and/or numbers) series that enables data to be encrypted and then decrypted so it can be safely shared among members of a network. WEP uses an encryption key that automatically encrypts outgoing wireless data. On the receiving side, the same encryption key enables the computer to automatically decrypt the information so it can be read.**
Firewall	**Keeps unauthorized users out of a private network. Everything entering or leaving a system's internal network passes through the firewall and must meet the system's security standards in order to be transmitted. Often used to keep unauthorized people from using systems connected to the Internet.**
Hub	**A multiport device used to connect PCs to a network via Ethernet cabling or via WiFi. Wired hubs can have numerous ports and can transmit data at speeds ranging from 10 Mbps to multigigabyte speeds per second. A hub transmits packets it receives to all the connected ports. A small wired hub may only connect 4 computers; a large hub can connect 48 or more.**
HZ	**The international unit for measuring frequency, equivalent to the older unit of cycles per second. One megahertz (MHz) is one million hertz. One gigahertz (GHz) is one billion hertz. The standard US electrical power**

	frequency is 60 Hz, the AM broadcast radio frequency band is 535—1605 kHz, the FM broadcast radio frequency band is 88—108 MHz, and wireless 802.11b LANs operate at 2.4 GHz.
IEEE	**Institute of Electrical and Electronics Engineers, New York, www.ieee.org. A membership organization that includes engineers, scientists and students in electronics and allied fields. It has more than 300,000 members and is involved with setting standards for computers and communications.**
Infrastructure mode	**A client setting providing connectivity to an AP. As compared to Ad-Hoc mode, whereby PCs communicate directly with each other, clients set in Infrastructure Mode all pass data through a central AP. The AP not only mediates wireless network traffic in the immediate neighborhood, but also provides communication with the wired network. See Ad-Hoc and AP.**
I/O	**The term used to describe any operation, program or device that transfers data to or from a computer.**
Internet appliance	**A computer that is intended primarily for Internet access, is simple to set up and usually does not support installation of third-party software. These computers generally offer customized web browsing, touch-screen navigation, e-mail services, entertainment and personal information management applications.**
IP	**A set of rules used to send and receive messages at the Internet address level.**
IP (Internet Protocol) telephony	**Technology that supports voice, data and video transmission via IP-based LANs, WANs, and the Internet. This includes VoIP (Voice over IP).**
IP address	**A 32-bit number that identifies each sender or receiver of information that is sent across the Internet. An IP address has two parts: an identifier of a particular network on the Internet and an identifier of the particular device (which can be a server or a workstation) within that network.**
IPX-SPX	**IPX, short for Internetwork Packet Exchange, a networking protocol used by the Novell NetWare operating systems. Like UDP/IP, IPX is a datagram protocol used for connectionless communications. Higher-level protocols, such as SPX and NCP, are used for additional error recovery services. Sequenced Packet Exchange, SPX, a transport layer protocol (layer 4 of the OSI Model) used in Novell Netware networks. The SPX layer sits on top of the IPX layer (layer 3) and provides connection-oriented services between two nodes on the network. SPX is used primarily by client/server applications. Whereas the IPX protocol is similar to IP, SPX is similar to**

	TCP. Together, therefore, IPX-SPX provides connection services similar to TCP/IP.
ISA	**A type of internal computer bus that allows the addition of card-based components like modems and network adapters. ISA has been replaced by PCI and is not very common anymore.**
ISDN	**A type of broadband Internet connection that provides digital service from the customer's premises to the dial-up telephone network. ISDN uses standard POTS copper wiring to deliver voice, data or video.**
ISO Network Model	**A network model developed by the International Standards Organization (ISO) that consists of seven different levels, or layers. By standardizing these layers, and the interfaces in between, different portions of a given protocol can be modified or changed as technologies advance or systems requirements are altered. The seven layers are: Physical , Data Link, Network, Transport, Session, Presentation, Application.**
LAN	**A system of connecting PCs and other devices within the same physical proximity for sharing resources such as an Internet connections, printers, files and drives.**
Receive Sensitivity	**The minimum signal strength required to pick up a signal. Higher bandwidth connections have less receive sensitivity than lower bandwidth connections.**
Router	**A device that forwards data from one WLAN or wired local area network to another.**
SNR	**Signal to Noise Ratio. The number of decibels difference between the signal strength and background noise.**
Transmit Power	**The power usually expressed in mW or db that the wireless device transmits at.**
MAC Address	**A MAC address, short for Media Access Control address, is a unique code assigned to most forms of networking hardware. The address is permanently assigned to the hardware, so limiting a wireless network's access to hardware -- such as wireless cards -- is a security feature employed by closed wireless networks. But an experienced hacker -- armed with the proper tools -- can still figure out an authorized MAC address, masquerade as a legitimate address and access a closed network.** **Every wireless 802.11 device has its own specific MAC address hard-coded into it. This unique identifier can be used to provide security for wireless networks. When a network uses a MAC table, only the 802.11 radios that have had their MAC addresses added to that network's MAC table will be able to get onto the network.**

NAT	**Network Address Translation: A network capability that enables a houseful of computers to dynamically share a single incoming IP address from a dial-up, cable or xDSL connection. NAT takes the single incoming IP address and creates new IP address for each client computer on the network.**
NIC	**A type of PC adapter card that either works without wires (Wi-Fi) or attaches to a network cable to provide two-way communication between the computer and network devices such as a hub or switch. Most office wired NICs operate at 10 Mbps (Ethernet), 100 Mbps (Fast Ethernet) or 10/100 Mbps dual speed. High-speed Gigabit and 10 Gigabit NIC cards are also available. See PC Card.**
Proxy server	**Used in larger companies and organizations to improve network operations and security, a proxy server is able to prevent direct communication between two or more networks. The proxy server forwards allowable data requests to remote servers and/or responds to data requests directly from stored remote server data.**
RJ-45	**Standard connectors used in Ethernet networks. Even though they look very similar to standard RJ-11 telephone connectors, RJ-45 connectors can have up to eight wires, whereas telephone connectors have only four.**
Server	**A computer that provides its resources to other computers and devices on a network. These include print servers, Internet servers and data servers. A server can also be combined with a hub or router.**
Site survey	**The process whereby a wireless network installer inspects a location prior to putting in a wireless network. Site surveys are used to identify the radio- and client-use properties of a facility so that access points can be optimally placed.**
SSL	**Commonly used encryption scheme used by many online retail and banking sites to protect the financial integrity of transactions. When an SSL session begins, the server sends its public key to the browser. The browser then sends a randomly generated secret key back to the server in order to have a secret key exchange for that session**
Subnetwork or Subnet	**Found in larger networks, these smaller networks are used to simplify addressing between numerous computers. Subnets connect to the central network through a router, hub or gateway. Each individual wireless LAN will probably use the same subnet for all the local computers it talks to.**
Switch	**A type of hub that efficiently controls the way multiple devices use the same network so that each can operate at optimal performance. A switch acts as a**

	networks traffic cop: rather than transmitting all the packets it receives to all ports as a hub does, a switch transmits packets to only the receiving port.
TCP	**A protocol used along with the Internet Protocol (IP) to send data in the form of individual units (called packets) between computers over the Internet. While IP takes care of handling the actual delivery of the data, TCP takes care of keeping track of the packets that a message is divided into for efficient routing through the Internet. For example, when a web page is downloaded from a web server, the TCP program layer in that server divides the file into packets, numbers the packets, and then forwards them individually to the IP program layer. Although each packet has the same destination IP address, it may get routed differently through the network. At the other end, TCP reassembles the individual packets and waits until they have all arrived to forward them as a single file.**
TCP/IP	**The underlying technology behind the Internet and communications between computers in a network. The first part, TCP, is the transport part, which matches the size of the messages on either end and guarantees that the correct message has been received. The IP part is the user's computer address on a network. Every computer in a TCP/IP network has its own IP address that is either dynamically assigned at startup or permanently assigned. All TCP/IP messages contain the address of the destination network as well as the address of the destination station. This enables TCP/IP messages to be transmitted to multiple networks (subnets) within an organization or worldwide.**
VoIP	**Voice transmission using Internet Protocol to create digital packets distributed over the Internet. VoIP can be less expensive than voice transmission using standard analog packets over POTS (Plain Old Telephone Service).**
VPN	**A type of technology designed to increase the security of information transferred over the Internet. VPN can work with either wired or wireless networks, as well as with dial-up connections over POTS. VPN creates a private encrypted tunnel from the end user's computer, through the local wireless network, through the Internet, all the way to the corporate servers and database.**
WAN	**A communication system of connecting PCs and other computing devices across a large local, regional, national or international geographic area. Also used to distinguish between phone-based data networks and Wi-Fi. Phone networks are considered WANs and Wi-Fi networks are considered Wireless Local Area Networks (WLANs).**
WEP	**Basic wireless security provided by Wi-Fi. In some instances, WEP may be all a home or small-business user needs to protect wireless data. WEP is available in 40-bit (also called 64-bit), or in 108-bit (also called 128-bit) encryption modes. As 108-bit encryption provides a longer algorithm that takes longer to decode, it can provide better security than basic 40-bit (64-**

	bit) encryption.
Wi-Fi	**Wireless Fidelity: An interoperability certification for wireless local area network (LAN) products based on the Institute of Electrical and Electronics Engineers (IEEE) 802.11 standard.**

Ad-Hoc Mode A client setting that provides independent peer-to-peer connectivity in a wireless LAN. Also see Infrastructure Mode.

AH Authentication Header. A field that follows the IP header in an IP datagram and provides authentication and integrity checking for the datagram.

ARP Address Resolution Protocol.

BER Bit Error Rate.

BPS Bits Per Second.

CCP Compression Control Protocol. Used to negotiate compression methods over PPP links.

CSMA/CA Carrier Sense Multiple Access/Collision Avoidance. CSMA/CA is the medium access method used by IEEE 802.11 WLANs.

DARPA Defense Advanced Research Projects Agency.

DES Data Encryption Standard. A cryptographic algorithm for protecting data.

DSSS Direct-Sequencing Spread-Spectrum.

ECP Encryption Control Protocol. Used to negotiate data encryption over PPP links.

ESA Encapsulating Security Payload. A mechanism which provides confidentiality and integrity protection to IP datagrams.

FHSS Frequency-Hopping Spread-Spectrum

Fresnel Zone The area around the visual line-of-sight that radio waves spread out into after they leave the antenna. This area must be clear or else signal strength will weaken.

Infrastructure Mode A client setting providing connectivity to an Access Point (AP). As compared to Ad-Hoc Mode where PCs communicate directly with each other, clients set in Infrastructure Mode all pass data through a central AP.

IP Address An IP (Internet Protocol) address is a 32-bit number that identifies each sender or receiver of information that is sent across the Internet.

IP Spoofing An attack whereby a system attempts to impersonate another system by using its IP network address.

LCP Link Control Protocol.

MAC Medium Access Control. In a WLAN network card, the MAC is radio controller protocol.

MAC Spoofing An attack whereby a system attempts to impersonate another system by using its MAC address.

NAT Network Address Translation. The translation of an IP address used within one network to a different IP address known within another network.

OSI Open Systems Interconnection. A set of international standards for networking.

PPP Point-to-Point Protocol. PPP Provides a standard method for transporting multi-protocol datagrams over point-to-point links.

Sniffer A program to capture data from a computer network.

SNMP Simple Network Management Protocol (also see TCP/IP).

SSID Service Set Identifier - wireless network name.

SSL Secure Sockets Layer. A session layer protocol that provides authentication and confidentiality to applications.

TCP/IP Transmission Control Protocol / Internet Protocol.

Topology Describes how a network is structured.

VPN Virtual Private Network.

WPA Wi-Fi Protected Access. The Wi-Fi Alliance put together WPA as a data encryption method for 802.11 wireless LANs. WPA is an industry-supported, pre-standard version of 802.11i utilizing the Temporal Key Integrity Protocol (TKIP), which fixes the problems of WEP, including using dynamic keys. WPA will serve until the 802.11i standard is ratified in the third quarter of 2003.

WEP Wired Equivalent Privacy. Encryption-based security using a pre-shared key.

WiFi (Wi-Fi) Wireless Fidelity. Wireless Local Area Networking standard.

WLAN, W-LAN Wireless Local Area Network (LAN).

WLL Wireless Local Loop.