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Set Your Computer's Network Properties

☞ These instructions assume you are using Windows XP. For other operating systems, consult your network administrator.

› From the Start bar, select Start ▷ Control Panel.
› Double click the Network Connections icon.
› Disable your PC's wireless connection, if this exists.
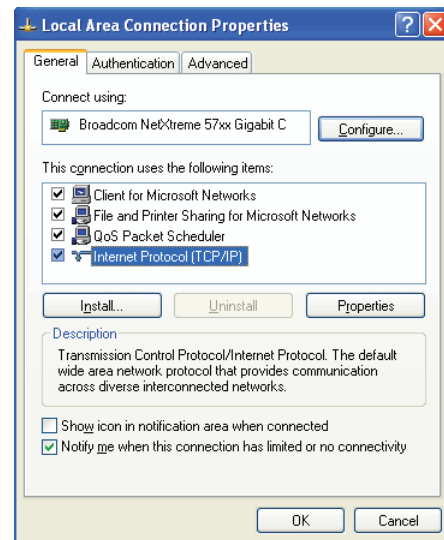› Double click the Local Area Connection icon.

The local area Connection Status window appears.
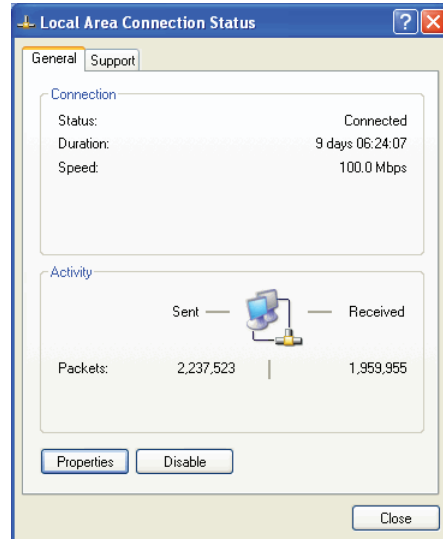
› Click the Properties button.

› Scroll down to the bottom of the list and select the Internet Protocol (TCP/IP) item.
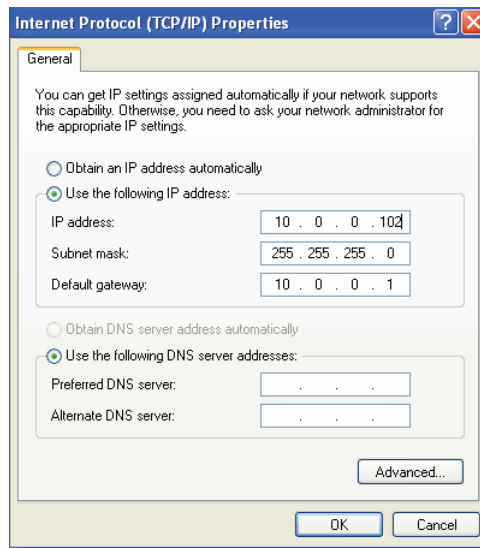
› Click on the Properties button.

The Internet Protocol (TCP/IP) Properties window appears. (see below).

› Select the radio button "Use the following IP address" to enter your PC's static network settings:

   IP address: 10.0.0.102

   Subnet mask: 255.255.255.0

   Default gateway: 10.0.0.1

› Click the **OK** button to save and exit the Internet Protocol Properties window.

› Click the **Close** button at the Local Area Connection Properties window.

Several moments will pass as the PC saves its new network settings.

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Log on to the Reader

🖿 These illustrations are taken from Internet Explorer. However, you can use any browser to connect to the reader.

🖿 **10.0.0.101** : The reader's default IP address is **10.0.0.101** Use this address when connecting directly to the reader with a crossover Ethernet cable.

› Launch your web browser and log on to the reader by entering its IP address in the address bar: http://10.0.0.101 and press Enter:
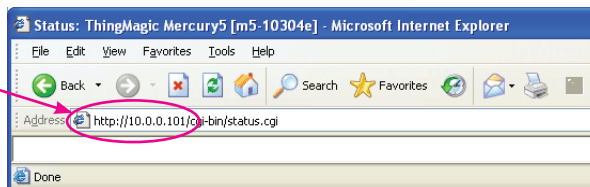
The reader's logon dialog screen appears:

🖿 **web /radio :** The reader's default User name is: **web** and its password is: **radio** – all lowercase.

› Enter **web** in the User name field and **radio** in the Password field and click OK.

The reader's Status page appears.

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MercuryOS 2.3

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Status
Query
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Restart
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Help

Mercury5 Status

Device Status		
LAN Connection:	Online	
Wireless Connection:	Disabled	
Connected Antenna Ports:	Port 1:	Connected
	Port 2:	Connected
	Port 3:	Not Connected
	Port 4:	Not Connected

MercuryOS and AFE Versions	
MercuryOS Version:	2.3.28
Slot 1:	None
Slot 2:	M5 915 Bistatic

LAN Configuration	
LAN IP Address:	10.0.0.101
LAN Subnet Mask:	255.255.255.0
LAN Gateway:	10.0.0.1
LAN MAC Address:	00:12:A4:10:12:C6

› Check to see that all antenna ports are connected. Green = Connected.

› Note the reader's MAC address. This will be important for networking.

Congratulations! You've successfully set up the reader for single-user operation.

Next Steps.

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Networking the Reader

Background

You can set up the reader to use either manual IP addressing or DHCP. By default, the reader has automatic addressing enabled: it boots up looking for a DHCP server. DHCP can be used to automatically assign the reader's IP address, subnet mask, default gateway, NTP Server, DNS server and hostname. If the reader does not get a DHCP-assigned IP address during its initial boot sequence, it defaults to the static IP address of 10.0.0.101, but will periodically check to see if a DHCP server is available. The following sections detail how to set up your PC and reader for automatic DHCP configuration, as well as manually configuring the reader without a DHCP server and using the ZeroConf protocol – Bonjour™ – for subnet reader discovery without a DHCP server.

Hardware Set Up

Power Up Network. Whether you use DHCP or static network addressing, make sure the network is connected before powering up the reader. In the event the reader does not get a lease from a DHCP server, it will fall back to its static IP address of 10.0.0.101, subnet mask 255.255.255.0 and gateway 10.0.0.1.

Use Shielded UTP-Cat5 Cabling with Network. To connect the reader to a network hub or switch, you will need enough network cable to run from the reader to your network connection. While most switches and network hubs can detect and compensate for crossover cables, we recommend using shielded UTP-Cat5 straight through Ethernet patch cabling.

› Connect one end of the Ethernet cabling to the reader and the other end to the Ethernet switch or hub.
› Check that all antennas are securely connected, and power up your reader.
› Connect your computer to the same network as the reader using normal Ethernet cabling.

Enable Your Computer for DHCP Networking

To enable automatic assigning of your PC's IP address by DHCP:

› From the Start bar, select Start ▷ Control Panel.
› Double click the Network Connections icon.
› Disable your PC's wireless connection, if this exists.
› Double click the Local Area Connection icon.
The local area Connection Status window appears.
› Click the Properties button.
› Scroll down to the bottom of the list and select the Internet Protocol (TCP/IP) item.
› Click on the Properties button.
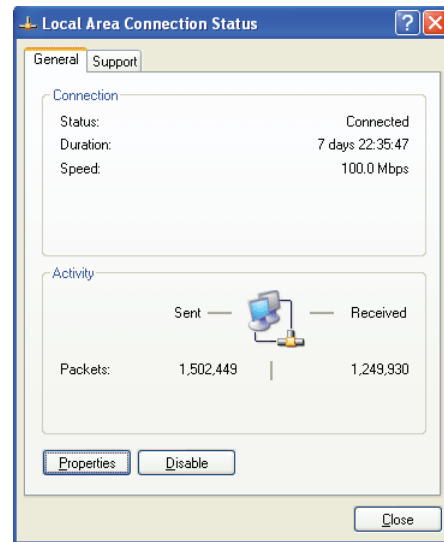
The Internet Protocol (TCP/IP) Properties window appears.
› Select the radio button "Obtain an IP address automatically"
› Click the OK button to save and exit the Internet Protocol Properties window.
› Click the OK button at the Local Area Connection Properties window.
› Click the Close button at the Local Area Connection Status window.
Several moments will pass as the PC saves its new network settings.
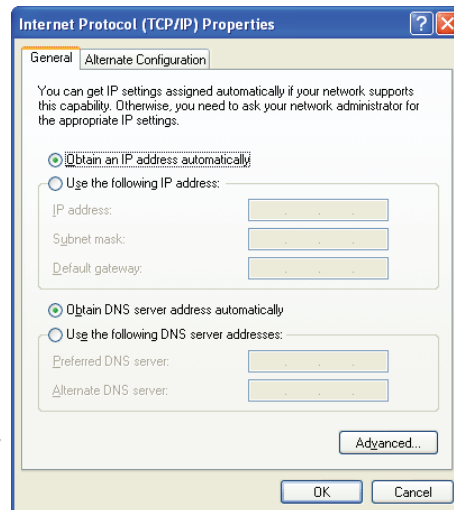
Networking the Reader: Automatic Hostname

Automatic Hostname: m5-xxxxxx. By default at startup, the reader generates an 'automatic hostname' by appending the last three bytes of its MAC address to its hostname, such as m5-6b3043. Please note that your network needs to have properly configured DNS servers if you wish to connect to the reader via its hostname. Usually when using DHCP, the DHCP server will add the hostname to the DNS server's database.

MAC Address. The reader's MAC address can be found on a white label attached next to the Ethernet port. You can also find the reader's MAC address on the Status page. The first 6 bytes are ThingMagic's manufacturer's code; the last 6 bytes are specific to the reader and the ones to use for automatic hostname addressing.

Using the Reader's Automatic Hostname

› Obtain the reader's MAC address, then launch your web browser and log on to the reader by entering its automatic hostname in the address bar:
For M4: http://m4-xxxxxx (the last 6 digits of the reader's MAC address) and press Enter.
For M5: http://m5-xxxxxx.
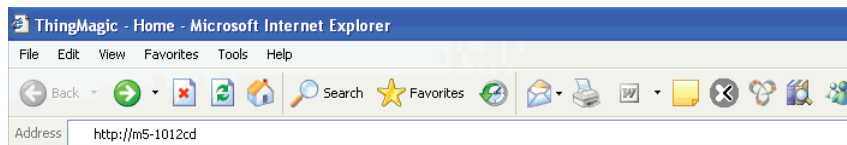
The reader's logon dialog screen appears.

› Enter **web** and **radio** for User name and Password fields and click OK.
The reader's Status page appears.
› Check to see that all the Antenna ports are connected. Green = Connected.

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Mercury5 Status

Device Status		
LAN Connection:	Online	
Wireless Connection:	Disabled	
Connected Antenna Ports:	Port 1:	Connected
	Port 2:	Connected
	Port 3:	Not Connected
	Port 4:	Not Connected

MercuryOS and AFE Versions	
MercuryOS Version:	2.3.28
Slot 1:	None
Slot 2:	M5 915 Bistatic

LAN Configuration	
LAN IP Address:	10.0.0.132
LAN Subnet Mask:	255.255.255.0
LAN Gateway:	10.0.0.1
LAN MAC Address:	00:12:A4:10:12:C6

ThingMagic Reads Any Tag.™

🕸 Networking the Reader: Using Bonjour

Another way of finding readers on a network is to use the Zeroconf protocol, which Apple calls Bonjour™ (formerly called Rendezvous). Bonjour works on networks without any DHCP server. Apple provides a downloadable Bonjour plug-in for Windows Internet Explorer at their web site: http://www.apple.com/macosx/features/bonjour/.

Once you have installed Bonjour, reboot your PC and launch your copy of Internet Explorer. The Bonjour button icon 🕸 will appear on the top menu bar of the browser.

To access Bonjour-enabled readers available on your subnet:

1 Click on the Bonjour icon in the top menu bar of Internet Explorer.

As a result, Bonjour opens a device panel column on the left side of the browser with the names of all active Bonjour devices available.

2 Double-click on the name of the reader of interest.
This will load the login dialog to connect to the reader.

3 Type in the factory-default name and password: web / radio and click the OK button.
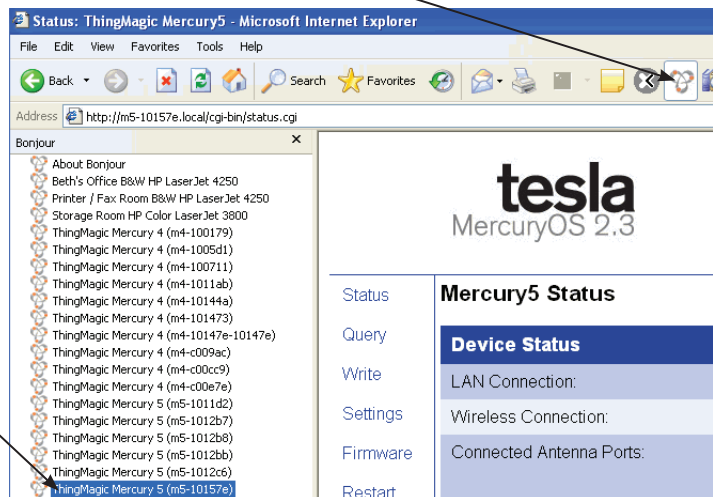
This will take you to the status page of the reader of interest.

This listing is periodically refreshed so that new Bonjour-enabled devices will appear as they come on line. Note that each ThingMagic reader is referenced by the domain name – ThingMagic – then the hostname – Mercury4 and Mercury5, then an automatic name m4- or m5- followed by the last six digits of the device's MAC address, such as m4-10148c.

Setting the Reader's Maximum RF Power

Background

During initial installation, the reader must be properly configured to use the correct RF power to comply with FCC regulations.

The maximum RF power is determined from antenna gain and antenna cable loss using the formula: P_{max} = 36 dBm - Antenna Gain + Cable Loss

DO NOT increase the power beyond this level.

For example, if the antenna has a maximum gain of 6 dBi, and the cable has a minimum loss of 0.6 dB, the maximum RF power that may be set is (36- 6 + 0.6) = 30.6 dBm.

Case Study.

Using ThingMagic shielded 25' coaxial antenna cables TM-M5CAB-TT-P25 type LMR-195 and ThingMagic Dual Antenna TM-ANT-NA-2CX.

Total 25' cable insertion loss = 3.1 dB.

Antenna gain = 7.0 dB

P_{max} = 36 dBm - 7.0 dB + 3.1 dB = **32.1 dB** maximum reader RF power.

Cable Loss Values for LMR-195 Shielded Coaxial Cable

Cable Length	Insertion Loss
6 ft	0.9 dB
20 ft	2.5 dB
25 ft	3.1 dB

Consult **Appendix A: Antenna Information** for further information on cable loss and antenna gain values for other configurations.

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Using the Browser to Set Maximum RF Power

The Reader RF Power can be set using the Modify Settings Page of the browser-based interface. Note that in no case may the power be set higher than 32.5 dBm.

› Log on to the reader using your browser. The reader's Status page appears.

› Click on the **Settings** tab. The first field on the Settings page is UHF Power dBm – the maximum RF power. Its factory default value is 32.5 dBm.

› Enter the maximum setting based on your cable type, length and antenna type. › ›

› Scroll down to the bottom of the Settings page, and click **Save changes** button to save the settings.

The Status page will reload automatically after the settings been saved.

If the Status page does not appear after a few moments, manually recycle the power on the reader. After repowering, load the settings page again and check the new maximum RF power setting.

Reader Operation

Using the Browser-Based Interface

The Mercury4/5 Reader browser-based interface communicates directly with the RFID reader. It includes several tools that enable you to monitor reader performance, change reader settings, and upgrade reader firmware.

A navigation menu provides access to the following pages:

Status   Displays current operational settings.

Query   Allows the user to perform anti-collision RFID tag searches and to specify the constraints used in the search.

Write   Allows the user to write tags; this is only applicable to tags that are writeable.

Settings   Allows the user to modify network settings.

Firmware   This page can be used to upgrade the tag reader with new firmware images supplied by ThingMagic.

Restart   Allows the user to restart the reader via a "warm boot."

Diagnostics This page provides the current operating settings of the reader.

Help   This page provides information that is helpful in operating the tag reader.

The browser-based interface can be run from any PC on the network.

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Log on to Reader

⌐ Follow instructions for setting up (p. 2) and networking (p.10) your reader in the previous sections of this manual.

1. Start a Java-enabled web browser from any network-enabled PC.

2. Type the IP address or hostname of the reader to which you want to communicate in the Address field of the browser or use Apple's Bonjour™ protocol to browse to it.

3. A log-on dialog appears. Enter the factory-installed name: **web** and the password: **radio** (all lower-case).

A navigation menu and the reader's Status page appear in the browser.

Status Page

The Mercury4/5 Status page indicates the connected antennas, software version and LAN configuration of the reader.

IMPORTANT: Check to see that at least one antenna port is connected before performing any tag queries or tag write operations.

📋   The reader's IP address and its MAC address are important numbers to have on hand.

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Status	**Mercury5 Status**		
Query			
Write	**Device Status**		
Settings	LAN Connection:	Online	
Firmware	Wireless Connection:	Disabled	
Restart	Connected Antenna Ports:	Port 1:	Connected
Diagnostics		Port 2:	Connected
Help		Port 3:	Not Connected
		Port 4:	Not Connected
	MercuryOS and AFE Versions		
	MercuryOS Version:	2.3.7246000280 (2006-07-20T02:00:06-04:00)	
	Slot 1:	None	
	Slot 2:	M5 915 Bistatic (475 unit 4)	
	LAN Configuration		
	LAN IP Address:	10.0.0.101	
	LAN Subnet Mask:	255.255.255.0	
	LAN Gateway:	10.0.0.1	
	LAN MAC Address:	00:12:A4:10:12:C6	

Query Page: Read Tags

The Query page is mainly used to set up and run anti-collision searches quickly. It gives you immediate feedback on tag reads, which can be useful for verifying initial performance and for debugging.

› Click the Query link in the navigation menu.

Wait a few moments until the Java applet finishes loading, and prepare some tags for testing.

The screen will be blank except for the controls. You' re now ready to read tags.

> If the Query page does not load and you do not see the Java logo, you may need to install the Java Runtime Environment for Windows and restart your PC.

Tagreader Query Applet

Copy Display to Raw ☐ bignum Show Raw Font Size: 16 Clear Output

(Stock Queries)
Default
fewer than 10 EPC0 tags
fewer than 20 total EPC0 and EPC1 tags
fewer than 50 EPC0 tags
fewer than 100 total EPC0 and EPC1 tags
fewer than 200 total EPC0 and EPC1 tags
fewer than 10 EPC1 tags
fewer than 50 EPC1 tags
fewer than 100 EPC1 tags
fewer than 10 GEN2 tags
fewer than 50 GEN2 tags
fewer than 100 GEN2 tags
fewer than 10 ISO18000-6B tags
fewer than 50 ISO18000-6B tags
fewer than 100 ISO18000-6B tags
fewer than 10 tags, any protocol
fewer than 50 tags, any protocol

Built-in query pull-down list:

Query: SELECT read_count, protocol_id, antenna_id, id FROM tag_id WHERE (protocol_id='EPC0' or protocol_id='EPC1') set time_out=1000   (Stock Queries)

Start Stop Query Once

Query field: Select a query from pull-down list

Start continuous search

Stop continuous search

Query once initiates a single search cycle

To read tags from the Query page:

1. Position one or more tags a few feet in front of one of the antennas connected to the reader.

2. Select an appropriate built-in query from the pull-down list.

    ▪ If you are using GEN2 tags, for instance, select "fewer than 10 GEN2 tags" from the list.

    ▪ If you are using other types of tags, select an appropriate query.

    ▪ If you don't know what type of tags you have, select "fewer than 10 tags, any protocol". Using "any protocol" will slow the search somewhat since the reader will spend time looking for tag types which may not be in the field.

3. Click the Start button at the bottom right to begin continuously reading tags.

```
5 results @Tue Aug 31 12:49:42 EDT 2004
                          Copy Display to Raw  bignum  Show Raw  Font Size: 24    Clear Output
    1      20   BDBA8000800423835065   UHF1   EPC1
    2       9   EAF98000800423835374   UHF1   EPC1
    3       3   EF04020000A9DB4A2EE2   UHF1   ISO18000-6B
    4       9   C80507A800852714A074   UHF1   EPC0
    5       9   C80507A80093ED3B7DA5   UHF1   EPC0
```

Tag data is displayed. Each row in this example shows sequential tag number, number of times tag was read, tag data, antenna, and protocol.

4. Click **Stop** to stop the tag search.

    IMPORTANT: Click the Stop button before exiting. You MUST stop the query before exiting the query page or the reader will continue to transmit RF energy on its antennas.

Next Steps: We'll look more closely at using the Query field, the pull-down list and understanding the tag information the Query page provides.