


Query Page: Query Field and Built-in Queries

Query Field

At the bottom of the Query page is the Query field in which RQL search statements can be entered or selected from the stock queries found in the pull-down list to the right of the Query field.


Query:

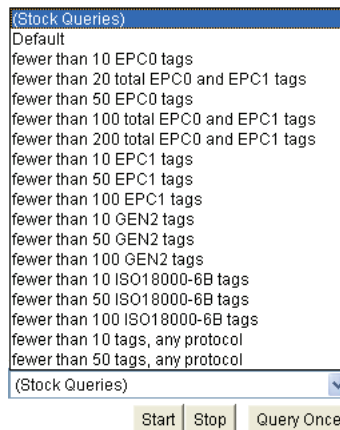
-  For more information on RQL, consult the *RQL Reference Guide* on the ThingMagic web site under support.

The RQL search statement in the Query field specifies which tag protocols will be read, which antenna ports are to be used, how long the query is to be run, and other read operation parameters. You can type in and modify the Query field contents, then run the query. The query can be run once or continuously.

Built-in Query List

The following stock queries are available from the pull-down list.

-  Depending on your region and firmware version loaded on the reader, this list may vary.



Query Results: Tags Found

Total tags seen

during current

search

Date and time on reader

Bignum check box

Clear Output button

34 results Tue Aug 08 13:14:37 EDT 2006 Copy Display to Raw bignum Show Raw Font Size: 16 Clear Output

Order in which tags first seen

1	2	9551A5A5FFFF80008004	65365745	UHF1	EPC1
2	1	D5D5A5A5FFFF80008004	65365741	UHF1	EPC1
3	2	EF04020000A9E2016840		UHF1	ISO18000-6B
4	5	EF04020000A9E1A2B89A		UHF2	ISO18000-6B
5	6	EF04020000A9A0616F48		UHF2	ISO18000-6B
6	5	EF04020000A9DB57ED7E		UHF2	ISO18000-6B
7	1	EF04020000A9D2C825B0		UHF1	ISO18000-6B
8	3	EF04020000A9E19A0FC1		UHF2	ISO18000-6B
9	4	EF04020000A9A087F2A0		UHF2	ISO18000-6B
10	3	EF04020000A9C1829A1E		UHF1	ISO18000-6B
11	2	EF04020000A9DB11C57C		UHF2	ISO18000-6B
12	9	30182EB70000008000000585CC50		UHF2	EPC0
13	4	30182EB700000080000005B0AAA6		UHF2	EPC0
14	2	30182EB700000080000005C1C410		UHF1	EPC0
15	3	30182EB70000008000000584DC71		UHF2	EPC0
16	5	00132183F000000000000173D49C		UHF1	GEN2
17	5	00132183F0000000000001A8AE8A		UHF1	GEN2
18	5	00132183F0000000000001CD9289		UHF2	GEN2
19	4	0F04028F4F2778F60100001ED183		UHF1	GEN2
20	4	00132183F0000000000001822BA2		UHF1	GEN2
21	3	00132183F0000000000001B47D37		UHF1	GEN2
22	5	00132183F0000000000001800BE0		UHF2	GEN2
23	5	00132183F0000000000002C32614		UHF1	GEN2
24	5	0F040253F7079BDE0100001D6355		UHF2	GEN2
25	3	00132183F0000000000001779418		UHF2	GEN2
26	12	00132183F0000000000002B71807		UHF2	GEN2
27	2	00132183F0000000000002B248A2		UHF1	GEN2
28	3	00132183F0000000000001D05115		UHF2	GEN2
29	4	00132183F0000000000002AE9B1F		UHF2	GEN2
30	4	00132183F0000000000001A75F65		UHF1	GEN2
31	5	00132183F0000000000001ACEE0E		UHF1	GEN2
32	3	00132183F0000000000001AB9EE9		UHF1	GEN2
33	3	00132183F00000000000018DDA4D		UHF2	GEN2
34	3	00132183F0000000000002B53845		UHF2	GEN2

Show Raw Data button

64-bit tag ids and CRCs

96-bit tag ids and CRCs

Last antenna on which tag was seen

Tag protocol

Built-in query pull-down list:

(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
 fewer than 10 tags, any protocol

Cumulative read count of each tag

Query: SELECT read_count, protocol_id, antenna_id, id FROM tag_id set time_out=1200

Start Stop Query Once

Query field: Select a query from pull-down list

Start continuous query

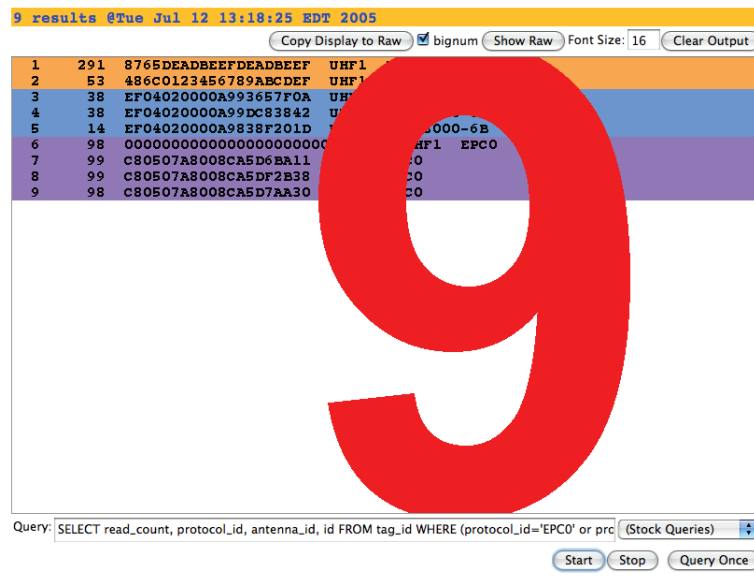
Stop continuous query

Run query once

Query Page: Bignum and Font Size

Bignum displays the total number of unique tags read during the current query until you clear the display. When you're operating the reader on your own, with no assistance, this feature can come in handy so you can watch the screen as you move tags and antennas around to check read rates. The total is displayed in large red numbers directly over the tags read. Each row in this example shows sequential tag number, number of times tag was read, tag data, antenna, and protocol.

- › Click the Bignum check box to experiment with this option.
- › When finished, stop the tag search, uncheck the Bignum check box.



Tag Number	Read Count	Tag Data	Antenna	Protocol
1	291	8765DEADBEEFDEADBEEF	UHF1	
2	53	486C0123456789ABCDEF	UHF1	
3	38	EFO4020000A993657FOA	UHF1	
4	38	EFO4020000A99DC83842	UHF1	
5	14	EFO4020000A9838F201D	UHF1	
6	98	000000000000000000000000	UHF1	EPC0
7	99	C30E07A8008CA5D6BA11	UHF1	EPC0
8	99	C30E07A8008CA5DF2B38	UHF1	EPC0
9	98	C30E07A8008CA5D7AA30	UHF1	EPC0

Query: SELECT read_count, protocol_id, antenna_id, id FROM tag_id WHERE (protocol_id='EPC0' or prc... (Stock Queries)

Start Stop Query Once

Font Size

By default, font size is set for 16 points. This can be increased to meet your viewing requirements, such as displaying the results with an LCD projector.

- › Enter a larger font number in the font size field to increase the size of the font displaying tag data.

Query Page: Raw Tag Data Display

› Click on the Show Raw button at the top right of the Query page.

Show Raw starts the display of raw tag data. This is the actual console output returned from the query. Each row in this example shows read_count, protocol_id, antenna_id, and tag id for each tag found. A space separates groups of tags found during each query. Raw data can be easily copied and pasted into other documents.

› Clear Output button clears the data displayed.

› Hide Raw button stops the display of raw tag data.

read_count:
times tag was
seen during this
query

protocol_id:
see list below

antenna_id:
antenna which
saw the tag

tag ids and CRCs

Query: SELECT read_count, protocol_id, antenna_id, id FROM tag_id WHERE (protocol_id='EPC0' or pro (Stock Queries)

Tag Data

Depending on the fields included in the query, you may display a variety of tag data:

id: Tag id (in hex) and trailing 4-digit (16-bit) CRC cyclical redundancy check.

Note: EPC1 tag ids' CRCs are the leading 4 digits of the tag id.

read_count: Number of times the tag was seen during query.

protocol_id: EPC1 = 1; ISO18K = 8; EPC0 = 9; GEN2 = 12

antenna_id: From 1 to 4 depending on which antenna saw the tag.

frequency: frequency in KHz in hop table at which tag was seen.

timestamp: Unix time in seconds and microseconds from 1-1-1970 when tag was seen. Ex: 3004832.188394

dspmicros: microseconds after start of reading out the tag cache – per protocol.

Write Page

Use the Write page to encode or replace the tag's id or user data.

Double-click an EPC below. Click "Make Update" to create a query for writing the selected EPC to a tag.

Place a tag 1-2 feet in front the antenna. DO NOT place the tag closer than 1 foot when writing, or it may be damaged!

Click "Submit Query" to write the tag. If successful, the ID should appear in the status window below.

64-bit IDs

0123456789ABCDEF
8000800400001234
80000003FFFE1234
DEADBEEFDEADBEEF
FEDCBA9876543210

96-bit IDs

0123456789ABCDEF01234567
FFFFFFFFDDDDCCCCBBBBAAAA
1123581321345589144233FF

EPC0 EPC1 ISO18000-6B GEN2

Click Make Update, Make Select, or write your own RQL query here:

Status

 Consider the following guidelines when writing to tags:

- › Always place a tag 0.3-0.6m (1-2ft) from the transmit antenna when writing. The tag may be damaged if it is positioned too close to the antenna during a write operation.
- › Only unlocked GEN2, EPC0+, EPC1 or ISO18000-6b tags can be written. EPC0 tags are always locked and cannot be recommissioned.
- › The id to be written must match exactly the number of hexadecimal characters (numerals from 0-9 and letters from A-F) specified by the tag's protocol. For example: 96-bit tag ids are 20 hexadecimal characters long; 64-bit tag ids are 16 hexadecimal characters long.
- › Always place only one tag in the antenna's field when writing. If multiple tags are present, they will all be encoded with the same EPC data.
- › Antenna 1 is used as the default for writing tags.

Write Page: Writing Tag IDs

To write an id to a tag:

1. Click the Write link on the navigation menu. The Write page appears.
2. In the middle pane, type or paste a hexadecimal tag id to be written to the tag in the RQL statement after `tag_id=0x` . For example: 16 hex characters for 64-bit tags, 20 characters for 96-bit tags, etc.
3. Click the Make Update button. A query designed to write the highlighted data to the tag appears in the center pane.
5. Place the tag 0.3-0.6m (1-2ft) from the antenna. Verify that no other tags are in the antenna's field.
6. Click the Submit Query button to write the data. If the write was successful, the new tag id appears in the bottom pane.

To search for a tag:

1. Display the Write page (click the Write link on the navigation menu).
2. Click the Make Select button. A query designed to find the selected tag type from the antenna appears in the center pane. Choose the radio button for the tag type of interest.
3. Place the tag to be read within the detection zone of the antenna.
4. Click the Submit Query button to find the selected tag type . Query results appear in the bottom pane. Note that the query can be run only once, unlike on the Query page.



Settings Page

Use the Settings page to change RFID protocol, network and reader security settings. The page is divided into five sections: RFID Protocol Settings; Network Settings: All Interfaces; Network Settings: Ethernet Interface; Boot Options and Security Settings.



The following settings assume North American firmware. Regional differences may occur on some settings. Please consult MercuryOS Release Notes for your region for further details.

Instructions for Modifying the Settings

Changing these parameters changes the reader's settings used on startup. RFID protocol settings, boot options and network settings can be modified. Take care to use correct values or you might be unable to connect the reader without restarting into Safe Mode.

IMPORTANT: Do not disconnect power until the save process is complete.

Note that new RFID, network and security settings take immediate effect after saving. Boot-related options are saved but **DO NOT** take effect until the reader is restarted (see Restarting the Reader on page 35). Therefore, to ensure that all new settings take effect, it is recommended that you restart the reader whenever reconfiguring and after saving the new settings.

1. Click the Settings link on the navigation menu. The Modify Settings page appears.
2. Enter the required settings.
3. Click the Save changes button at the bottom of the screen to save the new settings. Saving overwrites the reader's configuration file with the current settings and reloads the Status page.

Detailed descriptions of each setting follow.

Settings Page, continued

Status	Modify Settings
Query	Use the following form to change the reader settings. For help on the acceptable values of a given field, please see Settings Help . Note that these s
Write	RFID Protocol Settings
Settings	UHF Power (dBm) <input type="text" value="32.5"/>
Firmware	EPC1 Tag ID length ¹ <input checked="" type="radio"/> 64-bit/96-bit <input type="radio"/> 96-bit <input type="radio"/> 64-bit
Restart	EPC0 Search Depth <input type="text" value="80"/>
Diagnostics	Gen2 Init Q <input type="text" value="5"/>
Help	Gen2 DRM On <input checked="" type="radio"/> No <input type="radio"/> Yes
	Default RQL Query <input type="text"/>
	Network Settings: All Interfaces
	Automatic Hostname ² <input checked="" type="radio"/> On <input type="radio"/> Off
	Hostname ³ <input type="text" value="m5"/>
	NTP Server <input type="text" value="pool.ntp.org"/>
	Domain Name <input type="text" value="thingmagic.com"/>
	Primary DNS Server ⁴ <input type="text" value="10.0.0.1"/>
	Secondary DNS Server ⁴ <input type="text"/>
	Network Settings: Ethernet Interface
	Use DHCP? <input checked="" type="radio"/> Yes <input type="radio"/> No
	Vendor Class Identifier <input type="text" value="mercury5"/>
	Use DHCP-Server supplied hostname <input type="radio"/> Yes <input checked="" type="radio"/> No
	LAN IP Address <input type="text" value="10.0.0.101"/>
	LAN Netmask <input type="text" value="255.255.255.0"/>
	LAN Gateway <input type="text" value="10.0.0.1"/>
	Fallback IP Address <input type="text"/>
	Fallback Netmask <input type="text"/>
	Fallback Gateway <input type="text"/>

Settings Page, continued

Boot Options	
Boot Config Options	<input type="text"/>
Boot Config	<input type="text"/>
Boot Firmware Options	<input type="text"/>
Boot Firmware	<input type="text"/>
Syslog Host	<input type="text"/>
Security Settings	
Secure Shell Only (disable telnet)	Yes <input type="radio"/> No <input checked="" type="radio"/>
Secure Web Only (disable standard http)	Yes <input type="radio"/> No <input checked="" type="radio"/>
Secure RQL Only (disable non-tunneled RQL)	Yes <input type="radio"/> No <input checked="" type="radio"/>
<input type="button" value="Save Changes"/>	
<ol style="list-style-type: none"> 1. Disabling 96-bit support for Class 1 results in faster read rates for populations of 64-bit tags. 2. Turning on automatic hostname will append the last six numbers of the reader's MAC address to the text in the Hostname field. 3. The hostname will give the device a name; however, resolving the device name from inside your network is dependent upon your DNS server's configuration. With a properly configured DN DNS server for proper name resolution. If you are not using DHCP you will need to configure the DNS server manually. 4. When using DHCP, assigning values here will override any DHCP assigned DNS servers. DNS servers are optional; however, if DNS servers are not specified either through DHCP or man settings such as the NTP server. 	

Settings Page: RFID Protocol and Network

RFID Protocol Settings

The RFID protocol settings take effect immediately on the reader upon saving them. A restart is not required. The Default RQL Query runs continuously at startup and thus a change to this setting requires a restart of the reader.



For further details on protocol-specific settings and values, see the respective EPC Global and ISO specifications for radio-frequency identification protocols.

RFID Protocol Settings	
UHF Power (dBm)	UHF Output power in dBm. This setting must be adjusted carefully to comply with FCC regulations.
EPC1 Tag ID length	Radio buttons that enable combined 96- and 64-bit tag support or single tag id lengths. If the reader will only be reading 96- or 64-bit tags, select that radio button to optimize read rates.
EPC0 Search Depth	Maximum number of EPC0 tags to be singulated on each query.
Gen2 Init Q	Initial value of Q when a search on a GEN2 target begins for the first time.*
Gen2 DRM On	Radio button sets the reader in and out of Dense Reader Mode when performing Generation 2 searches.*
Default RQL Query	Initial query to be run continuously when reader starts up.

*See EPC Global Generation 2 Specification for further details.

Settings Page: Network Settings

Network Settings

Static network settings are ignored when in DHCP mode, and DHCP related settings are ignored when in static IP mode. 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.

Network Settings: All Interfaces	
Automatic Hostname	Turning on automatic hostname will append the last six numbers (3 bytes) of the reader's MAC address to the text in the hostname field.
Hostname	Name of the reader
NTP Server	Server or servers to use for network time protocol
Domain Name	Network domain name
Primary DNS Server	Allow the Mercury4/5 to resolve hostnames to IP addresses
Secondary DNS Server	Allow the Mercury4/5 to resolve hostnames to IP addresses
Default Gateway	Radio button to select the default interface for network communications.

Network Settings: Ethernet Interface	
Use DHCP?	If Yes, the reader will automatically look for its LAN IP, Netmask and Gateway addresses from a DHCP Server.
Vendor Class Identifier	Name to be used by DHCP Server to manage options assigned to clients identified by vendor type and to configure groups of Mercury4/5 readers.
Use DHCP Server-supplied hostname?	If Yes, the manually supplied hostname (see Hostname) will be overridden by the hostname supplied by the DHCP Server.
LAN IP Address	If Use DHCP? is Yes, the LAN IP, Netmask and Gateway values will be supplied by the DHCP Server. Default or manually entered addresses will be dimmed out and bypassed. If Use DHCP? is No, you should manually enter the LAN IP, Netmask and Gateway settings.
LAN Gateway	The gateway IP address for the local network, typically the IP address of a router.
LAN Netmask	The subnet mask IP address used to determine to which TCP/IP subnet the reader belongs. Devices in the same subnet can be communicated with locally without going through a router.

Settings Page: Boot Options and Security

Boot Option Settings

The boot option settings specify the location of downloadable firmware and configuration files and their optional parameters, and the location of a syslog server to which all reader events may be sent.

Boot Options	
Boot Config Options	Optional parameters used when downloading a new configuration file to the reader. -f : force a downgrade if config file version is lower than that currently running on the reader. -p : preserve configuration settings under a wipe -w : wipe flash memory and settings -a : add the reader's MAC address to download filename
Boot Config	URI to the tm.conf file to be downloaded on startup. Specify local:default for local tm.conf file.
Boot Firmware Options	Same as Boot Config Options used when downloading new firmware to the reader.
Boot Firmware	URI to the firmware file to be downloaded at startup.
Syslog Host	Name of host for remote logging. All log levels in syslog will be sent to this host.

Security Settings

These settings control secure access to the reader using a combination of SSH, HTTPS and secure RQL ports.

Security Settings	Description
Secure Shell Only (disable telnet)	If Yes, the telnet server is disabled, and reader access can only be performed via a secure shell (SSH).
Secure Web Only (disable standard http)	If Yes, reader will only respond to requests using https URLs.
Secure RQL Only (disable non-tunneled RQL)	If Yes, RQL no longer listens on Port 8080 for remote access. RQL is still accessible via an SSH tunnel.

Firmware Update Page

1. Click the Firmware link on the navigation menu. The Firmware Upgrade page appears.

2. Place the cursor in the Filename field and type the complete URI network pathname of the firmware file or click the Choose file button to locate the new firmware file.



WARNING! If you

select the “Erase contents before installing” check box, you will erase

all user-installed programs or files residing on the reader. DO NOT select this option if you wish to preserve any user programs residing on the reader.



WARNING! If you select the “Revert to factory settings” check box, you will erase any

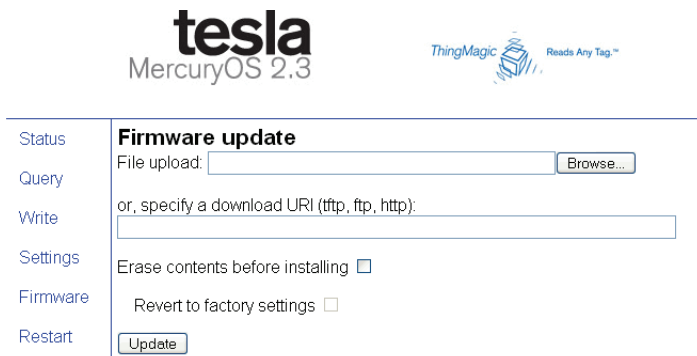
changes made to the reader’s configuration settings and revert to factory default settings. If you select this option, the reader’s current configuration settings will be erased. DO NOT select this option if you wish to preserve the reader’s current configuration settings.

3. If either of these erase options are required, select their respective check boxes.

4. Click the Update button to download the new firmware to the reader. The status frame at the bottom of the page displays the progress of the update.

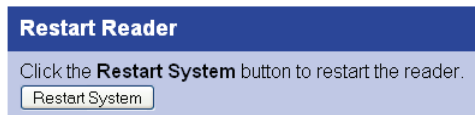
5. You will be prompted to restart the reader to activate the new firmware. Until the reader is restarted, the old firmware will still be active.

In the unlikely event that a firmware update fails, perhaps due to a power failure, the device will restart in Safe Mode (see page 38). Use the Restart page to restart the reader (see page 35).

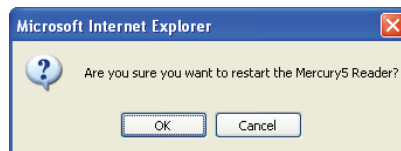


Restart Page

1. Click the Restart link on the navigation menu; The Restart Reader page appears.
2. To restart the reader, click the Restart System button.

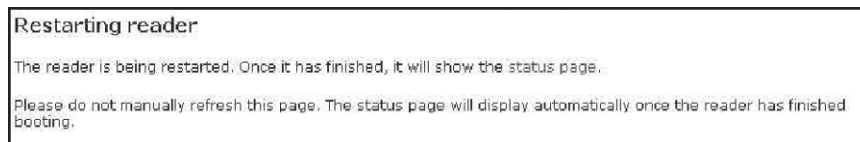


The following dialog box appears.



3. Click OK.

The following message appears and remains on the screen until the reader restarts. Then the Status page appears.

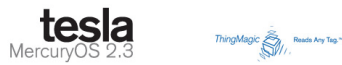


Wait for at least 60 seconds for the reader to boot up. The Power/Heartbeat LED is solid green while the reader boots. When the LED begins blinking, the boot process is complete.



Diagnostics Page

The diagnostics page expands on information found on the Status page, including the current settings of the reader, comprehensive version information, error log file access, restart button and current status of network interfaces.



Status	Mercury5 Diagnostics
Query	Device Status
/Write	LAN Connection: Online
Settings	Wireless Connection: Disabled
-irmware	Connected Antenna Ports
Restart	Port 1: Connected
Diagnos	Port 2: Connected
	Port 3: Not Connected
	Port 4: Not Connected
-help	MercuryOS and AFE Versions
	MercuryOS Version: 2.3.28
	Slot 1: None
	Slot 2: M5 915 Bistatic
	Kernel Version: Linux 2.4.27-uc1 2006-07-25T14:52:11-0400
	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:A4:10:30:4E
	Other Settings
	Primary DNS Server: 10.0.0.6
	Secondary DNS Server:
	NTP server: 10.0.0.6 maxpoll 6 iburst
	Uptime: 15:37:54 up 2:20, load average: 0.00, 0.00, 0.00
	View Log File
	Click the View Log button to view the log file.

Help Page

Use the Help page for quick reference of web interface operations.

Quick Reference

Status

Displays the current status and configuration of the reader.

Query

Provides a browser-based tag-reading interface.

- Click "Start" to start reading tags.
- Click "Stop" to stop reading tags.
- Click "Show/Hide Raw" to change the output mode.
- Click "Query Once" to run a limited round of tag reading.
- "Stock Queries" provides common query strings.

Write

Provides a browser-based tag-writing interface.

- Select an EPC from the top box (double-click, mouse drag, or Shift-cursor.) You may enter your own EPC's here, too.
- Click "Make Update" to generate a query that will write the selected EPC.
- Click "Submit Query" to execute the query.
- Check the results in the bottom box.

Settings

Displays and changes device settings.

- Click "Save Changes" to apply your changes and save them.

Firmware

Upgrades the reader firmware.

- Browse to a new firmware file and click "Upgrade" to send it to the reader. Reset the system to make the new firmware take effect.

Restart

Provides a means to restart the reader.

Diagnostics

Displays extended diagnostic information about the reader including log files.

Interpreting the Reader Indicator LEDs

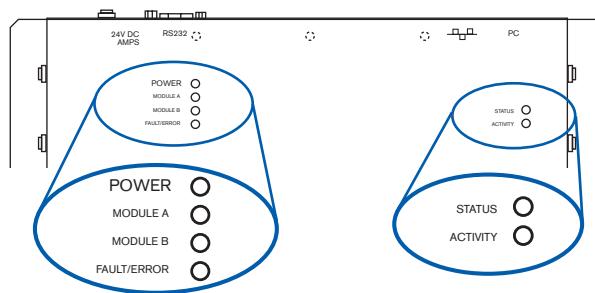
There are four LEDs on the reader indicating reader activity:

Power – When solid, the reader is booting. When pulsing, reader is ready for operation.

Module A – Operational only on older model M4 readers.

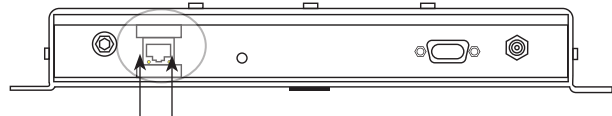
Module B – Flashes continuously when RF is transmitting on any antenna.

Fault/Error – When solid red, the reader has crashed.



Two LEDs on top of the reader, labeled Status and Activity, are not currently operational.

Two small LEDs adjacent to the Ethernet port indicate Status (left) and Activity (right) when connected to a PC or network plug.



Using Safe Mode

There are two main reasons to enter Safe Mode. One is to perform a firmware update to repair a corrupted filesystem. The second is to change settings that are preventing the reader from operating normally. Both of these tasks can be performed via the web interface.

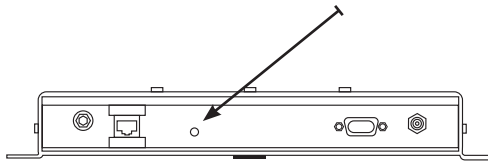
Use the recessed Safe Mode button on the reader connector panel to recover from errors which prevent the reader from operating in normal mode. In Safe Mode the reader looks for a DHCP server, but will fall back to a static IP address of 10.0.0.101 if none is found. Safe Mode operation restores factory default settings as follows:

Firmware Version:	factory installed version
IP Address:	10.0.0.101 if no DHCP server available
Hostname:	Mercury4 (or Mercury5)

Although the browser-based interface pages are displayed in red when operating in safe mode, the reader is still functional, although it cannot read or write tags. In most cases, the reader will need to be reconfigured for operation with the reader application after starting in Safe Mode.

To reboot into Safe Mode:

1. With the reader running, hold down the recessed reset button for 4 seconds, using a non-conductive object.



2. Release the button

3. The green LED should turn solid as soon as the button is released, indicating the reader is rebooting. It should take approximately 30 seconds to boot into Safe Mode.

The web server, telnet server and SSH server run in Safe Mode, however none of the RFID features are activated. To communicate with the reader in Safe Mode, a PC must have an IP address and subnet mask that are compatible with the reader settings, for example:

```
IP address 10.0.0.102
netmask 255.255.255.0
```

4. Once the maintenance has been performed, restart the reader to activate the changes and return to normal operation.

Mounting the Reader

You can place the reader on any clean, flat surface such as a shelf, or mount it to a wall.

To mount the reader on a wall:

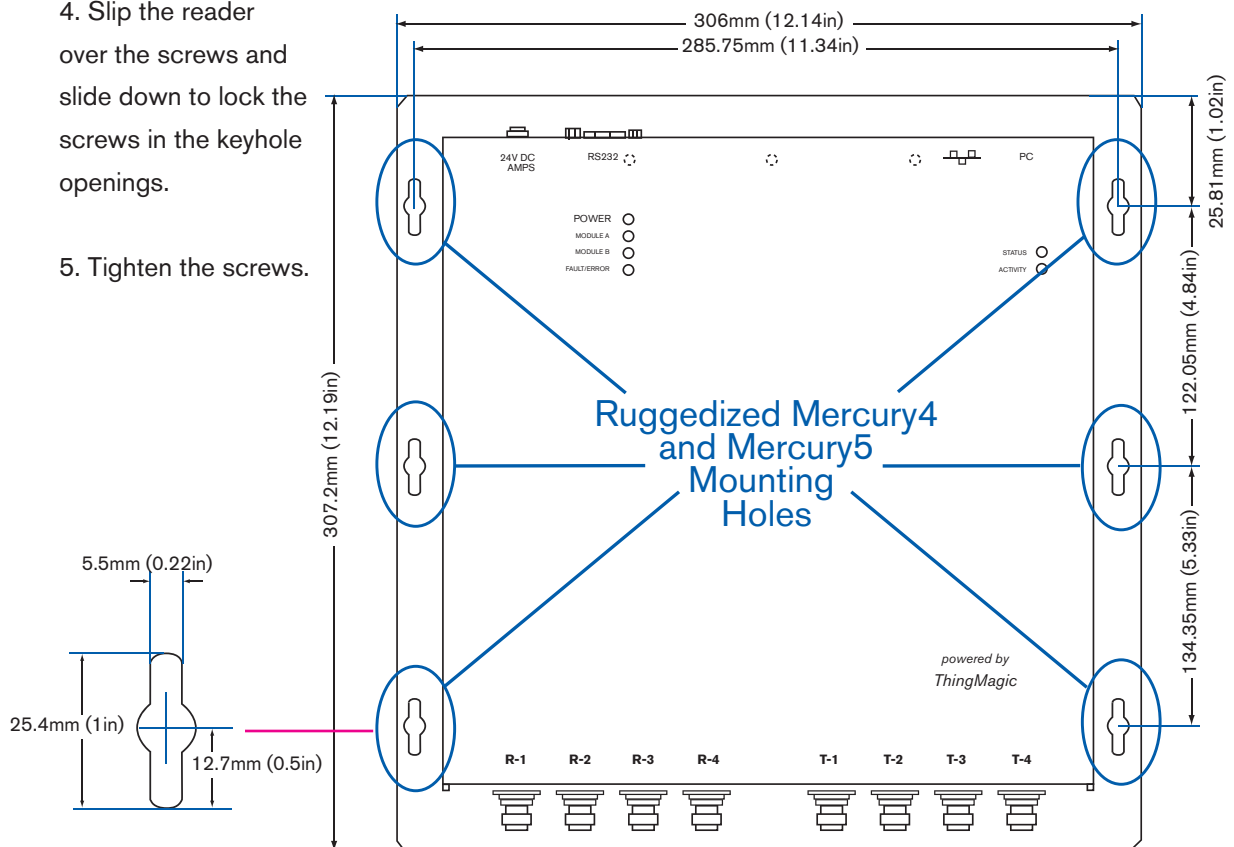
1. Hold the reader in its mounting location and mark the position of the six mounting screws. Recommended screw size is #12.

2. Drill holes for the screws and install wall anchors if required.

3. Insert the screws and tighten until almost flush with the wall.

4. Slip the reader over the screws and slide down to lock the screws in the keyhole openings.

5. Tighten the screws.



Reader Performance Considerations

Reader performance may be affected by external factors including tag variables and environment. Performance tests conducted under typical operating conditions at your site are recommended to help you optimize system performance.

Tag Variables

There are several variables associated with tags that can affect reader performance:

- › Application surface - Some materials interfere with tag performance including metal and moisture. Tags applied to items made from or containing these materials may not perform as expected.
- › Tag orientation - Reader performance is affected by the orientation of the tag in the antenna field.
- › Tag model - many tag models are available. Each model has its own performance characteristics.

Environment

Reader performance may be affected by the following:

- › Metal surfaces such as desks, filing cabinets, bookshelves, and wastebaskets may enhance or degrade reader performance.

Mount antennas as far as possible from metal surfaces that are adversely affecting system performance.

- › Devices that operate at 900 MHz, such as cordless phones and wireless LANs, can interfere with reader performance. These devices may degrade performance of the reader. The reader may also adversely affect performance of 900 MHz devices.



- › Antennas from other readers operating in close proximity may interfere with one another, thus degrading reader performance.

- › Interference from other antennas may be eliminated or reduced by using either one or both of the following strategies:
 - Affected antennas may be synchronized by a separate user application using a time-multiplexing strategy.
 - Antenna power can be reduced by reconfiguring the RF Transmit Power setting for the reader.

- › Fluorescent lighting fixtures are a source of strong electromagnetic interference and should be replaced if possible, or if not, keep cables and antennas away from them.

- › Uncoil completely all coaxial cables leading from readers to antennas: they can be a strong source of electromagnetic radiation and should be laid flat and not coiled up.



Appendix A: Mercury4 Antenna Information

Authorized Antennas

IMPORTANT The only antennas authorized by the FCC for use with the Mercury4 Reader are listed below. Detailed information on each antenna is available from their respective manufacturers.

IMPORTANT: No other antennas may be used with the Mercury4 Reader without violating FCC regulations. It is the responsibility of the user to comply with this requirement.

	ThingMagic Dual Antenna	Sensormatic OMNIPOINT Antenna
Model	TM-ANT-NA-2C	ID-ANT-20TNA25
Gain	6 dBi max.	5.75 dBi max.
Connector	Reverse TNC	Reverse TNC
	M/A-COM Dual Antenna	Matrics General Purpose Antenna
Model	MAANAT0141	ANT-GPHP
Gain	5.9 dBi max.	5.75 dBi max.
Connectors	Reverse TNC	Type N
Part No.		250012-001
	Alien Dual Antenna (Circular/Linear)	Alien Dual Antenna (RH/LH Circular)
Model	ALR9611-CR+CL	ALR9611-CR+CL
Gain	6 dBi max.	6 dBi max.
Connectors	integral 20 ft. cable with Reverse TNC	integral 20 ft. cable with Reverse TNC

Authorized Antenna Cables

IMPORTANT The only antenna cables authorized by the FCC for use with the Mercury4 Reader are listed below. Detailed information on each antenna cable is available from their respective manufacturers.

IMPORTANT: No other antenna cables may be used with the Mercury4 Reader without violating FCC regulations. It is the responsibility of the user to comply with this requirement.

	Long TNC/TNC	Long TNC/N
ThingMagic Part No.	TM-CAB-TT-P25	TM-CAB-TN-P25
Length	25 ft.	25 ft.
Cable Loss	3.1 dB min.	3.1 dB min.
Connector	Reverse TNC to Reverse TNC	Reverse TNC to Type N
	Short TNC/TNC	Short TNC/N
ThingMagic Part No.	TM-M4CAB-TT-P6	TM-M4CAB-TN-P6
Length	6 ft.	6 ft.
Cable Loss	0.9 dB min.	0.9 dB min.
Connector	Reverse TNC to Reverse TNC	Reverse TNC to Type N

The two Alien antennas have permanently attached cables with reverse TNC connectors. Cable loss is 2.2 dB minimum at 902 to 928 MHz. Do not use these antennas with additional cables.



Appendix B: Mercury5 Antenna Information

Authorized Antennas

IMPORTANT The only antennas authorized by the FCC for use with the Mercury5 Reader are listed below. Detailed information on each antenna is available from their respective manufacturers.

IMPORTANT: No other antennas may be used with the Mercury5 Reader without violating FCC regulations. It is the responsibility of the user to comply with this requirement.

	ThingMagic Dual Antenna	MTI Antenna
Model	TM-ANT-NA-2CX	MT-262010-TRLH
Gain	7 dBi max	6 dBi max
Connector	Reverse TNC	Reverse TNC
	M/A-COM Dual Antenna	Matrics General Purpose Antenna
Model	MAANAT0123	ANT-GPHP
Part Number		250012-001
Gain	6 dBi max	6 dBi max
Connector	Reverse TNC	Type N

Authorized Antenna Cables

IMPORTANT The only antenna cables authorized by the FCC for use with the Mercury5 Reader are listed below. Detailed information on each antenna cable is available from their respective manufacturers.

IMPORTANT: No other antenna cables may be used with the Mercury5 Reader without violating FCC regulations. It is the responsibility of the user to comply with this requirement.

	25 Foot Cable TNC/TNC	25 Foot Cable TNC/N
ThingMagic Part No.	TM-CAB-TT-P25	TM-CAB-TN-P25
Length	25 ft.	25 ft.
Cable Loss	3.1 dB min.	3.1 dB min.
Connector	Reverse TNC to Reverse TNC	Reverse TNC to Type N
	20 Foot Cable TNC/TNC	20 Foot Cable TNC/N
ThingMagic Part No.	TM-CAB-TT-P20	TM-CAB-TN-P20
Length	20 ft.	20 ft.
Cable Loss	2.5 dB min.	2.5 dB min.
Connector	Reverse TNC to Reverse TNC	Reverse TNC to Type N
	6 Foot Cable TNC/TNC	6 Foot Cable TNC/N
ThingMagic Part No.	TM-CAB-TT-P6	TM-CAB-TN-P6
Length	6 ft.	6 ft.
Cable Loss	0.9 dB min.	0.9 dB min.
Connector	Reverse TNC to Reverse TNC	Reverse TNC to Type N



Mercury4 Specifications

Electrical

Reader

UHF operating frequency: 902-928MHz (NA)

Input voltage: 24Vdc, 2.0A

Separate Power Supply

Input voltage: Nominal 100-240Vac, 50/60Hz

AC line current: Nominal 0.5A at 120V

Output voltage: Nominal 24Vdc, 2.5A peak
Certified limited power source
Class 2

Environmental

Operating temperature: 0° to 40°C (32° to 104°F)

Relative humidity: 0 to 90% non-condensing

Mechanical

Reader (TM-M4/W-NA-02)

Length: 30.5cm (12in)

Width (with mounting bracket): 30.5cm (12in)

Depth: 4.4cm (1.75in)

Weight: 2.95kg (6.5 lbs)

Supported UHF Tag Protocols

EPC Class 1 GEN2 EPC Class 0

ISO 18000-6B EPC Class 1

User Memory

64 MB DRAM

16 MB Flash



Mercury5 Specifications

Electrical

Reader

UHF operating frequency:	902-928MHz (NA)
Input voltage:	24Vdc, 2.0A

Separate Power Supply

Input voltage:	Nominal 100-240Vac, 50/60Hz
AC line current:	Nominal 0.5A at 120V
Output voltage:	Nominal 24Vdc, 2.5A peak Certified limited power source Class 2

Environmental

Operating temperature:	0° to 40°C (32° to 104°F)
Relative humidity:	0 to 90% non-condensing

Mechanical

Reader (TM-M5/W-NA-02)

Length:	30.5cm (12in)
Width (with mounting bracket):	30.5cm (12in)
Depth:	4.4cm (1.75in)
Weight:	2.95kg (6.5 lbs)

Supported UHF Tag Protocols

EPC Class 1 GEN2	EPC Class 0
ISO 18000-6B	EPC Class 1

User Memory

128 MB DRAM	32 MB Flash
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Communications Regulation Information

EMC FCC 47 CFR, Part 15
Industrie Canada RSS-210
Safety UL 60950
CSA C22.2 No 60950

FCC Compliance: This equipment complies with Part 15 of the FCC rules for intentional radiators and Class A digital devices when installed and used in accordance with the instruction manual. Following these rules provides reasonable protection against harmful interference from equipment operated in a commercial area. This equipment should not be installed in a residential area as it can radiate radio frequency energy that could interfere with radio communications, a situation the user would have to fix at their own expense.

Equipment Modification Caution: Equipment changes or modifications not expressly approved by ThingMagic, Inc., the party responsible for FCC compliance, could void the user's authority to operate the equipment and could create a hazardous condition.

Important User Information: In order to comply with FCC requirements for RF exposure safety, a separation distance of at least 22 cm (8.7in) needs to be maintained between the radiating elements of the antenna and the bodies of nearby persons.

Industry Canada Compliance: Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This device has been designed to operate with the antennas listed in Appendices A and B, and having a maximum gain of 7 dBi and antenna impedance of 50 ohms. Antennas not included in the appendices are strictly prohibited for use with this device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.





Mercury4/5 RFID Reader