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**Installation Manual
R500HA Long Range RFID
Reader**



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1.1 Product Overview

The R500HA Long Range RFID Reader is a uniquely addressable passive antenna that can be daisy chained together on one CAT5 COM Port. Up to 254 unique addresses are possible.

Custom manufactured for iAutomate.com for home automation (HA) applications, the HA Edition R500HA Long Range RFID Reader is used in conjunction with HomeSeer™ Software or Crestron™ Systems (Sold Separately) and is specifically designed for detection (or absence) of people, vehicles, and personal assets. The R500HA RFID (**R**adio **F**requency **I**dentification) Reader provides near field or long-range coverage for real-time detection of people, pets, vehicles or anything else you can associate with one of the various RFID Tags.

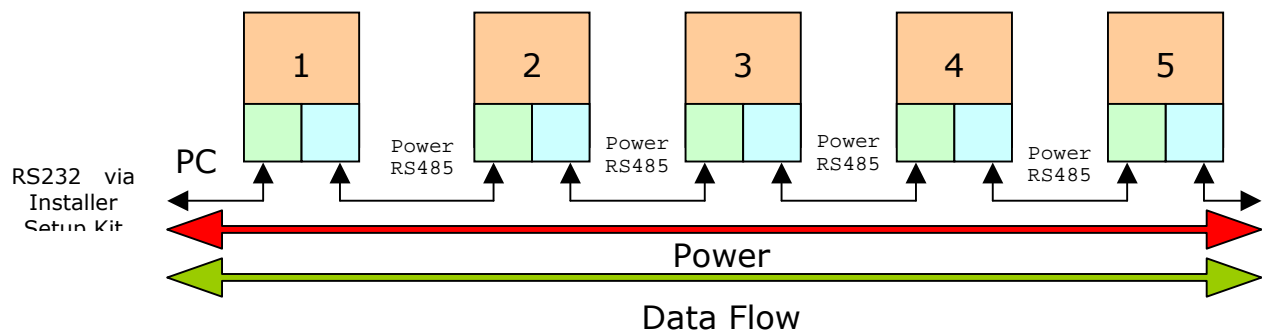
The R500HA Reader communicates with either:

- A PC via a standard COM Port Running HomeSeer™ Software
- Serial Port of a Crestron System

Additional Readers can be daisy chained to permit many Readers on one CAT5 wire system. Each Reader is range settable via software to adjust for the requirements of the room or application. Range adjustable antennas can be discretely concealed in walls, ceilings, and doorways to identify and track Tag activity. The R500HA can simultaneously read multiple RFID Tags at ranges of up to 450 feet (free air), and can also register and report the disappearance or unauthorized movement of individual RFID Tags. This model is for use ONLY with Crestron systems or HomeSeer™ v1.7 or later. A FREE HomeSeer™ plug-in or Crestron™ module is included with the [Installer Setup Kit](#).

1.2 Network Wiring and Power

The R500HA Readers are connected together in a daisy chain topology. That is, Reader 1 is connected to Reader 2, which, in turn, is connected to Reader 3, etc. Up to 254 Readers can be interconnected in this manner. Readers are joined to one another with a single cable, utilizing four wires to carry both data and power. Reader-to-Reader communication is accomplished over one pair of wires via RS485 protocol; while a second pair of wires carries power. The network of Readers can be connected to either a PC's standard RS232 serial port or a Crestron System (running the Crestron Software Module).



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1.2 Network Wiring and Power (cont'd)

Be certain to follow all local and national codes when installing network wiring. Avoid installing wiring near electrical and electronic equipment, high-powered equipment, motors, and other potential sources of RF interference.

Do NOT use standard four-pair (eight wire) Ethernet Wiring Connections or DAMAGE will result. Refer to Figure 3 or Figure 2 and ONLY connect the 4 wires between Readers:

- Power
- Ground
- RS485+
- RS485-

These connections have been arranged in such a way that the cable forms a straight-through connection and does not require twisting or changing of any wires between Readers. This makes the installation of this network very simple. Since each RS485 connection between Readers is theoretically a separate network, distances between them can be up to 2000 ft, according to the RS485 standard, depending on the quality of the cable used. RS485 termination resistors are included in each Reader's circuitry and therefore do not need to be added.

The network operates at 57,600 baud, with data being sent bidirectionally. The ReaderNet may be supplied with power from multiple points within the network, but when more than one power supply is used; the supplies must be interconnected via the ground line.

Only the **SPS1212** Power Supply may be used to power the Network. (Using any other power supply will void the Reader warranty). Up to ten Readers can be powered with a single [SPS1212 Power Supply](#), which delivers 1.2A@12VDC.

Pin	Pin Name	Description
1.	RS232 RXD	RS232 RXD to PC TXD
2.	RS232 TXD	RS232 TXD to PC RXD
3.	PWR	+12VDC
4.	GND	Ground
5.	RS485+	Non-Inverted RS485
6.	RS485-	Inverted RS485
7.	NOT USED	NOT USED
8.	NOT USED	NOT USED

Left RJ45 Connector

Pin	Pin Name	Description
1.	NOT USED	NOT USED
2.	NOT USED	NOT USED
3.	PWR	+12VDC
4.	GND	Ground
5.	RS485+	Non-Inverted
6.	RS485-	Inverted RS485
7.	NOT USED	NOT USED
8.	NOT USED	NOT USED

Right RJ45 Connector

Note: Pins 1 and 2 used ONLY on 1st Reader.
On the first Reader, this is handled by the [R5000HA-ISK](#) PC Breakout Cable

1.2 Network Wiring and Power (cont'd)

The **SPS1212** Power Supply is included with the R500HA Installer Setup Kit. Also included with the [Installer Setup Kit](#): PC Interface cable for connecting the first R500HA Reader to the PC, 30-Day Homeseer™ Trial, FREE iAutomate R500 Plug-in for Homeseer™, and Crestron™ Software Module for Crestron™ Systems. For specific pin outs and color codes, please [download the latest diagram](#) from our website.

1.3 Tooling and Connectorization

iAutomate.com highly recommends the [EZ-RJ45 Crimp Tool](#) and Connectors for making trouble-free Reader terminations the very first time. This high-quality crimp tool is designed to quickly crimp and cut the wires of the EZ-RJ45 ® Connector in a single, simple operation. The crimp tool also works on most other brands of RJ45 Connectors. No home automation installer should be without this time saving tool and a bag of EZ-RJ45 Connectors.

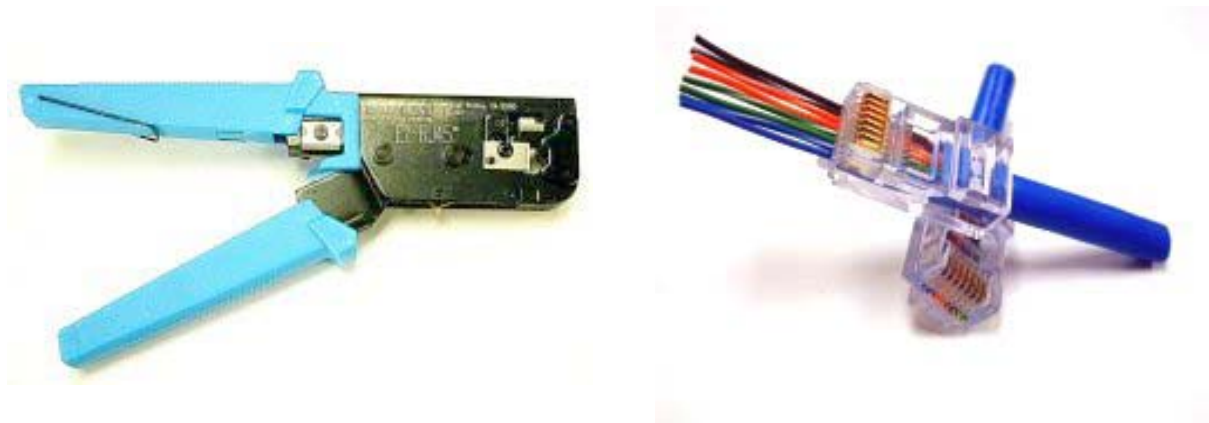


Figure 4

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2.1 RF Basics Relating to the R500HA RFID Reader

A typical radio-communication system is comprised of two main components, namely a transmitter (Tx) and a receiver (Rx). The transmitter generates electrical oscillations at a given radio frequency and the receiver detects these electrical oscillations if it is tuned to the same frequency. The frequency used is called the carrier wave.

In general, FM radio works the same way that AM radio works; the difference is in how the carrier wave is modulated, or altered. With AM radio, the amplitude, or overall strength, of the signal is varied to incorporate the digital information. With FM, the frequency (the number of times each second that the current changes direction) of the carrier signal is varied.

FM signals have an advantage over AM signals. Though both signals are susceptible to slight changes in amplitude, with an AM broadcast, these changes result in static, while with an FM broadcast, slight changes in amplitude don't generate static. Since the FM signal is conveyed through changes in frequency, the FM receiver can just ignore changes in amplitude. On the other hand, AM has a distinct advantage over FM in terms of power consumption. AM signals can be transmitted at a much lower power consumption level than any other modulation at 433 MHz. It is purely for reasons of power conservation (longer battery life) that AM modulation is used for the RFID Tags.

2.1 RF Basics Relating to the R500HA RFID Reader (Cont'd)

In the earth's atmosphere, the physical characteristics of air can cause variations in the speed at which radio waves travel. These variations can be a cause of problems in any communication system. This is why you might notice different performances from the same RF System on different days as the weather or atmospheric conditions change. Many natural events (such as storms, or excessive solar activity) and man-made electrical devices can adversely affect RF Transmissions.

Because data is transmitted in digital form from the Tag to the Reader, the norm to use is either Amplitude Shift Keying (ASK) or Frequency Shift Keying (FSK). The R500HA RFID Reader uses ASK as the preferred method solely because of the power saving characteristics of the ASK technique of data coding.

2.2 RF Range and Antenna Polarization

The distance an RF Transmission will travel is primarily determined by the transmitter's output power and the receiver and antenna's power (GAIN) and is influenced by environmental conditions and structures. Although the level of available power is the main determinant of transmission range, the manner and efficiency in which that power is deployed will also play a role.

The design of the transmitter's antenna determines the shape of the field delivered. The field (or wave) delivered from an antenna extends into the space surrounding it, and its strength diminishes with respect to distance. In any space free of obstructions

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or absorption, the strength of the field reduces in inverse proportion to the square of the distance. Effective range is also ** influenced by the angle (polarization) between the transmitter's and receiver's antennas. ** For an RF wave travelling through an area in which it can be reflected off of the ground or from metal obstacles, the reduction in strength can be quite considerable. Where different travel paths are created in this manner, the phenomenon is termed "multi-path attenuation." Absorption of RF Energy due to the presence of moisture, both in the atmosphere and in objects in the environment can further influence effective range.

It is VERY important to determine how the environment, both internal and external, can influence the range of the R500HA RFID Readers before permanently installing wiring or mounting the Readers. We recommend temporary wiring and temporary mounting of antennas as a method of range testing the components while connected to the PC to determine the best locations for optimum signal strength and range.

2.2 RF Range and Antenna Polarization (Cont'd)

It is far better to find a Reader location that will afford maximum range, and then tune the Reader down if necessary, as opposed to selecting a weak location and then trying to boost the signal, which might be impossible.

Here is an example of the coverage pattern of the R500HA Reader when using the supplied dipole (whip) antenna. This is how the pattern would look with the Reader mounted vertically. The tip of the antenna is where X & Y intersect in the center of the "Donut.":

Note that the pattern is both horizontal AND vertical. Care must be taken to place readers is such a way that tags are not detected from a floor above or floor below.

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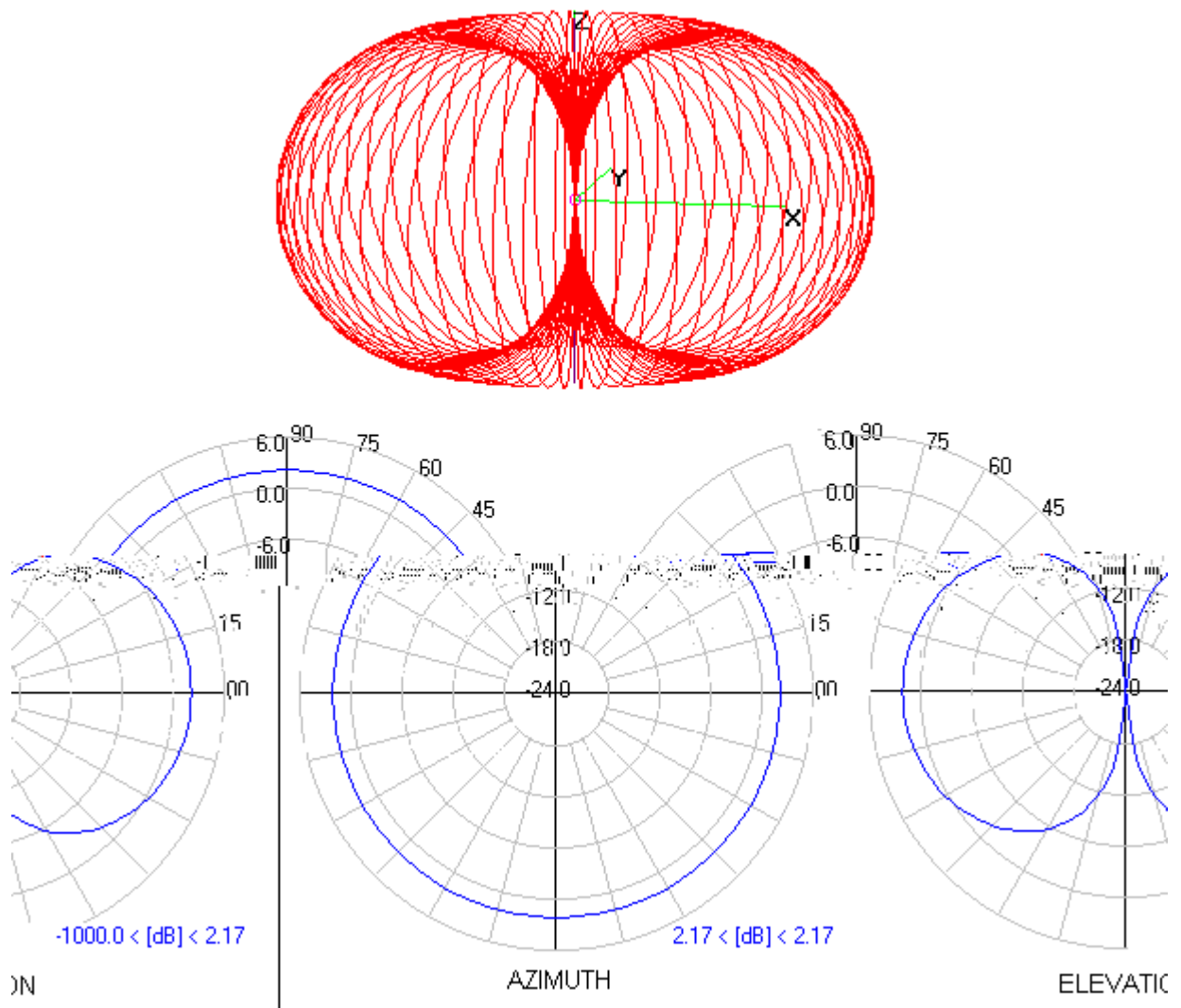


Figure 5

Look at what happens to the pattern if you lay the R500HA Reader flat, or at a 90 Degree angle from vertical:

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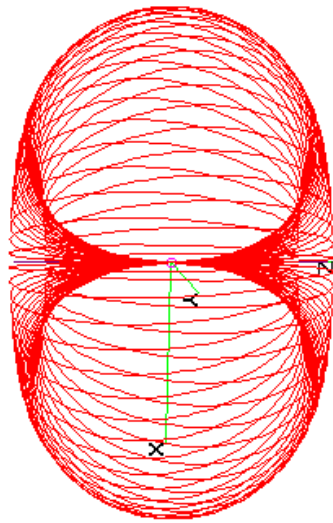


Figure 6

Effective range is influenced by the angle (polarization) between the transmitter's and receiver's antennas. Because of this, the same holds true for the orientation of the Tags as for the Reader. By orienting the Tags at different angles (polarization) to the antenna, you can impact the range and performance of the Tags. For Maximum range, the angle of polarization of the Tag and R500HA RFID Reader should be the same.

In some instances the wiring between Readers can function as part of the antenna. For this reason it is required that field wiring be installed in such a way that Tags do not come in contact or near contact with the field wiring in the course of normal activity. Since such interference cannot be avoided, ferrite chokes are supplied which will snap over each of the CAT 5 cables at each reader as shown in Figure 7.

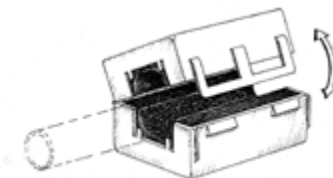


Figure 7

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2.3 Antenna Placement and Signal Strength Testing

Suggested Reader Locations for Localized Automation
 Mount Readers on floor joist below Room or in Attic Above Room



Figure 8

Initial trial with temporary wiring for signal strength showing Reader locations centralized under internal rooms but favoring outside (driveway) wall of Garage to maximize Automobile Tag Range. A variety of antennas are available for longer range and exterior applications. Note that the R500HA Reader antenna **may be removed** when only near field detection is required, or the desired range cannot be lowered enough via software.

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3.1 The RFID Tags

There are four basic Tags available at the time of the publishing of this manual. Each RFID Tag performs a little bit differently from the other. In addition to the different styles of Tags, most are available with optional features such as: Tamper Detect, which transmits a tamper alarm, and Motion Sensing, which transmits data when the RFID Tag experiences even slight motion.

3.1.1 The T800 Tag Primary Use:

Place on the **outside** of Metallic Assets, such as toolboxes, metalized windshields, metal carts, metal trash cans as well as plastics or fiberglass containing a high metallic content (such as laptop and desktop computer systems, office machines, hospital equipment, telephones, etc.), as RF signals will have a very low transmission range, if the Tag is placed within a metalized object.

T800	Standard RFID Tag
T800-TD	RFID Tag with Tamper Detect and Magnet
T800-MS	RFID Tag with Motion Sensor and Tamper Detect



3.1.2 The T501 Tag Primary Use:

Windshields, Personnel, Non Metallic Assets

T501	Standard RFID Tag
T501-TD	RFID Tag with Tamper Detect and Magnet
T501-MS	RFID Tag with Motion Sensor and Tamper Detect



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The RFID Tags (Cont'd)

3.1.3 The T100 Tag Primary Use:

Use for covert mounting under the hood of a car or behind the grill. Small size permits installation in an optional RF-transparent weatherproof enclosure. Antenna is external to the Tag and can be "trimmed" by altering its length.

- T100** Standard RFID Tag
- T100-TD** RFID Tag with Tamper Detect and Magnet
- T100-MS** RFID Tag with Motion Sensor and Tamper Detect



3.1.4 The T1200 Wrist Band Tag Primary Use:

Use for patient monitoring, pet monitoring, personnel monitoring, child monitoring in theme parks. This Tag is removable and is secured by strapping, as used in hospital admissions or theme parks. The Wrist Band Tag is NOT waterproof but ultrasonically sealed.

- T1200** Standard RFID Tag
- T1200-MS** RFID Tag with Motion Sensor



3.1.5 The T700 KeyFOB Primary Use:

The KeyFOB Tag is generally used for key tagging, although it may be used in other applications such as personnel monitoring and has a built-in panic button. The KeyFOB Tag is NOT waterproof but is ultrasonically sealed.

- T700** Standard RFID KeyFOB Tag
- T700-MS** RFID Key Fob Tag with Motion Sensor



4.1 HomeSeer™ Plug-In Installation

The installation of the R500HA plug-in for HomeSeer™ is straightforward, and is similar to that of some other HomeSeer™ plug-ins. The plug-in consists of the single Wise installer file *RFIDinstall.exe*, which is executed to launch the installer. This program installs the necessary files and some sample RFID Scripts and also registers the components with the operating system. The Plug-In can also be installed via the HomeSeer™ Updater.

Once the R500HA plug-in is installed on your HomeSeer™ system, it must be activated for use within HomeSeer™ before you can use it. If you installed the R500HA plug-in via the HomeSeer™ Updater, this step will not be necessary. To activate the plug-in, go to the HomeSeer™ Windows User Interface and click "View" on the menu bar. On the View menu, find "Options" and select it. The HomeSeer™ configuration option pages will be displayed, with the default page (Default) appearing. Using the tabs at the top of the configuration pages, select "Interfaces" to display the interface configuration options. The interfaces configuration page will look similar to Figure 9:

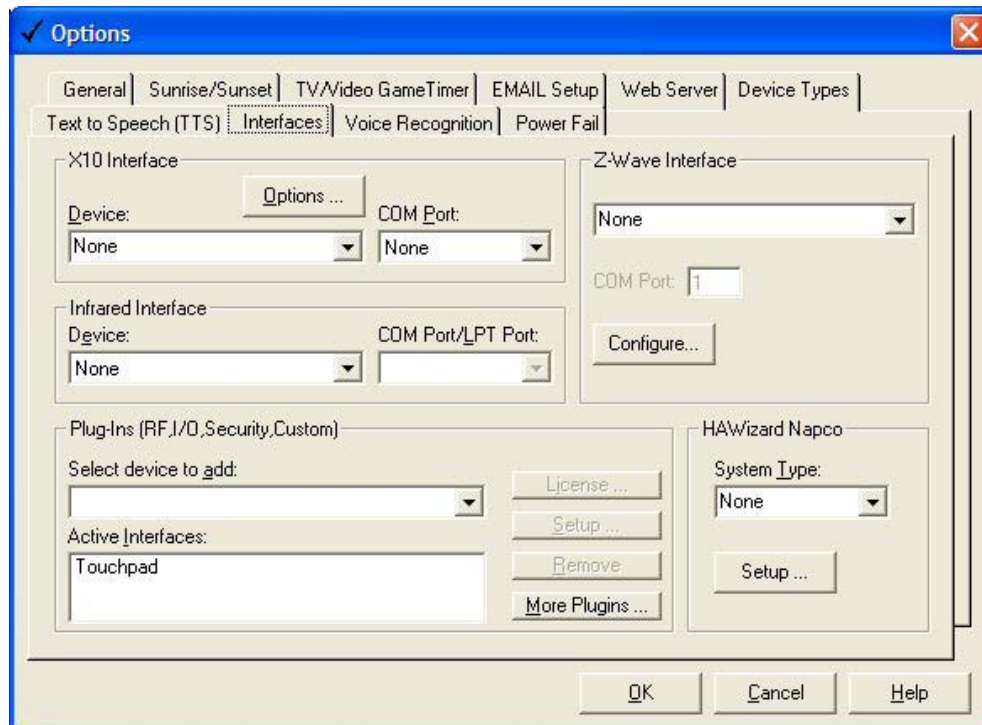


Figure 9

At the bottom of the screen, find the "Plug-Ins (RF,I/O,Security,Custom)" section – this is where we will add the iAutomate RFID plug-in to activate it within HomeSeer™. Click on the drop down list under "Select device to add:" and find the iAutomate RFID plug-in. If the plug-in was installed correctly, you should find it in the list similar to this section of the screen shown in Figure 10:

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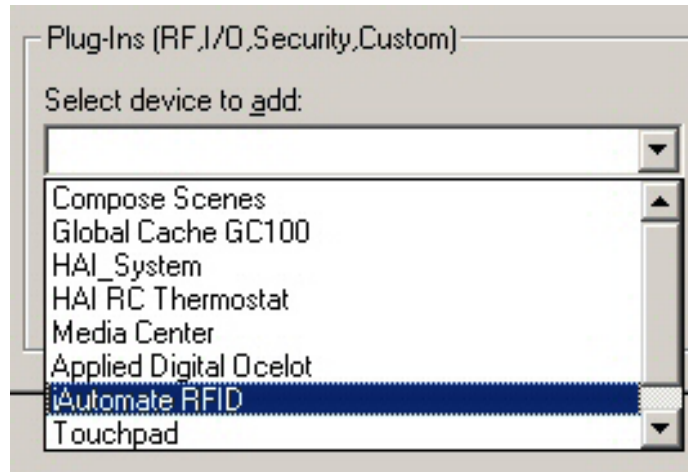


Figure 10

After selecting this plug-in, click "OK" to close the interface tab. You will be reminded to restart HomeSeer™ to activate the changes you have made. Shut down HomeSeer™ and restart it to continue setting up the plug-in. After restarting, return to the interface configuration screen. Your Plug-Ins list should look similar to Figure 11:

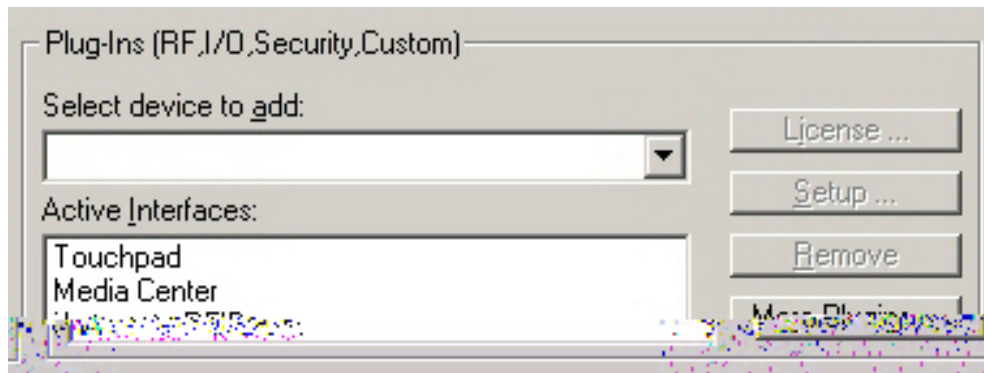


Figure 11

4.3 HomeSeer™ Plug-In and R500HA System Configuration

When HomeSeer™ is restarted, your HomeSeer™ log will display this error:

[Error initializing Custom Interface: Goto \rfid_config and set the COM port.](#)

The error may also appear like this if the plug-in has been partially or incorrectly configured:

[2/21/2005 8:46:16 PM~!~iAutomate RFID~!~Error 8002, Invalid port number on line 0](#)

[2/21/2005 8:46:16 PM~!~iAutomate RFID~!~InitIO Error 8012, The device is not open on line 0](#)

These error messages are normal as the plug-in does not know which COM port to use for the plug-in. To correct this and to set up your Readers and Tags, go to the configuration screen using your web browser. (See HomeSeer™ documentation for details.)

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If you do not use custom links at the top of your HomeSeer™ web pages, the plug-in will add itself to the list of links that appears with the title "R500 Configuration". Select this link.

If you do use custom links, and plug-in registered links are not automatically added to your custom links, you can go to the configuration page by entering the URL directly in your web browser. The configuration page is at the address rfid_config. As an example, if your HomeSeer™ system has the web server configured for port 82, you would enter the address similar to Figure 12:

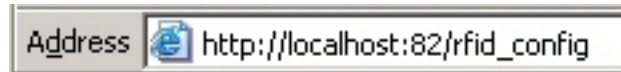


Figure 12

If you are able to successfully access the configuration screen, it will appear similar to Figure 13:

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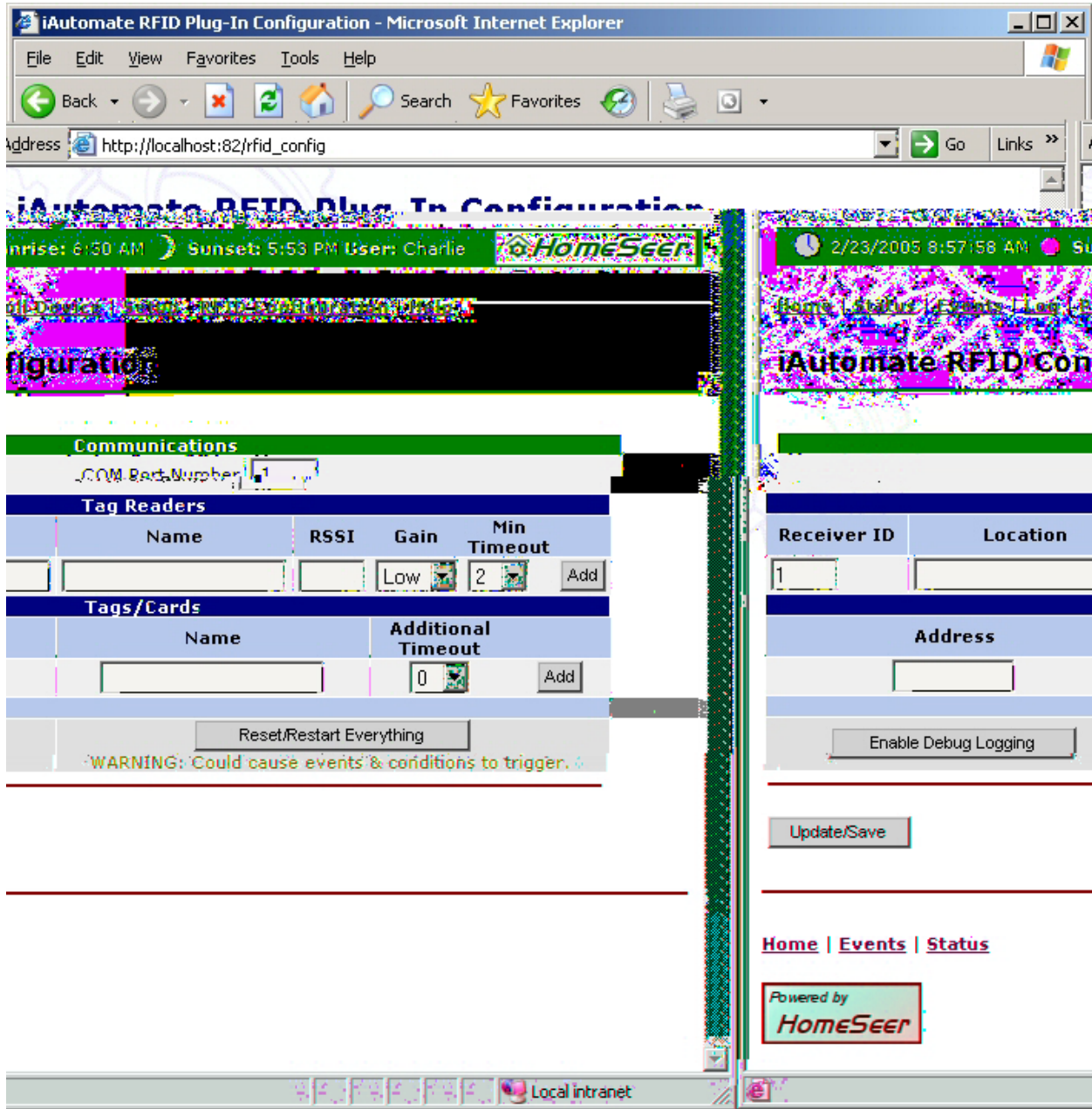


Figure 13

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The first configuration setting to make is the COM port that the first R500HA Reader is connected to on your HomeSeer™ PC. At the top of the configuration, find the COM port setting (as shown in Figure 14):

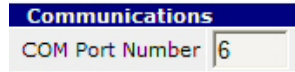


Figure 14

Enter the number for the COM port on your system that the R500HA network is connected to, then click on the "Update/Save" button at the bottom of the screen to save your changes.

At this point you could use the "Reset/Restart Everything" button to begin using the plug-in with your Reader network, but without any Readers or Tags configured, it will not have much benefit, so please continue.

4.3.1 Adding Readers

The first section of the configuration screen after communications is "Tag Readers". This section is used to define the Readers that you have on your R500HA network. It is important to note that only ONE Reader can be added at a time between restarts/resets of the plug-in. Only one Reader should be configured at a time, because the plug-in enumerates (examines) the R500HA network to find the single new Reader that exists on the network for which it does not already have a configuration (Reader ID) applied. When it finds this Reader, it takes the configuration settings for this Reader and applies it to the new Reader. Node IDs are assigned automatically based upon position in the network, thus the addition of a node between two existing nodes will change the Node IDs for all of the Readers. For this reason, a secondary addressing technique is used that does not change once the address is assigned to the Reader. In order to guarantee that the secondary address information is applied to the correct Reader, only one Reader can be added at a time between restarts of the plug-in.

To add a Reader, fill in the information on the row that ends with the "Add" button. The values you can enter are described in the following sections; refer to the example Reader configuration image in Figure 15 as needed.

Tag Readers						
Receiver ID	Location	Name	RSSI	Gain	Min Timeout	
1	Family Room	Reader	50	Low	3	Delete
2	Living Room	Reader	50	High	4	Delete
3	Kitchen	Reader	40	Low	4	Delete
4	Garage	Reader	0	High	6	Delete
5				Low	2	Add

Figure 15

4.3.2 Receiver ID

The Receiver ID is automatically generated by the plug-in for new Readers, but it may be changed at a later date. The Reader ID must be unique across the network of Readers. Once the Reader ID has been programmed into a Reader, it may be moved in its location amongst the other Readers on the network and still retain its identity and associated configuration.

4.3.3 Location and Name

The Location and Name fields are for your own identification of the Reader at this time – no HomeSeer™ devices are created using these names, but the location and name fields follow the HomeSeer™ nomenclature in case future revisions create devices to work with the plug-in.

4.3.4 RSSI (Received Signal Strength Indicator)

The RSSI indicates the strength of the signal from a Tag when it is received at a Reader. This configuration setting for the Reader determines the MINIMUM value of RSSI before the Reader will acknowledge the Tag's signal. For example, a Tag that is very close to a Reader may send a signal that is received by the Reader measuring an RSSI of 130. When that same Tag is 350' away from the Reader, the measured RSSI of the received Tag signal may only be 50. If the Reader RSSI setting is 60, the Tag signal from 350' away will not be acknowledged by the Reader, whatsoever. Although the various Reader and Tag combinations will have different characteristics for RSSI, the current R500HA Readers and Tags generally have RSSI values between 30 and 130. Readers that you wish to configure for the maximum range should be set to zero, and anything 30 or higher will begin to affect the range at which Tags are detected.

4.3.5 GAIN

The receiver GAIN setting sets a characteristic of the receiver's radio that affects the range of the Tags it can "hear." If you are seeking the highest possible range of Tags to be received, set this to HIGH, otherwise set it to LOW. Change to HIGH only if you cannot get the range you seek for the application of the Reader.

4.3.6 Min Timeout (Minimum Timeout and Additional Timeout)

When a Reader no longer hears a Tag signal, it is considered "absent" from the Reader. In a single-Reader, single-Tag system, updates from the Reader will occur approximately at 0.8 second intervals, but updates increase dramatically with multiple Readers and multiple Tags. In a large system, a Tag signal may not be received for a few seconds, so the timeout parameter helps prevent the plug-in from assuming a Tag is absent when it actually is not. When the last time a Tag has been "seen" and the current time are different from the total timeout period (or more), then the Tag is removed from the list of Tags associated with that Reader, and the "Tag is absent from Reader" trigger (if there is one used in the system) is raised. The total timeout period consists of the minimum timeout,

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which is set for each Reader (this configuration setting) and the additional timeout that is configured with each Tag. This setting is in seconds, and the minimum value for this setting is 2 seconds.

If the Reader you are configuring is used for applications such as a "sign of life" where a Tag can come into and out of range of a Reader frequently without adversely affecting your use of it, then set this to its minimum value. If you are using the Reader for applications such as lighting or music, and you do not want to change the music or lighting frequently or in error, then set this to a higher value.

Likewise, as with the Reader timeout, the additional timeout associated with the individual Tags can help customize the system. If the Tag is one that does not move very often or moves slowly, you can set the additional timeout to a value perhaps 3 to 5 seconds. If, on the other hand, the Tag is on something expected to move in and out of range of many Readers very often, you can leave the additional timeout at its default value of zero.

4.3.7 Adding Tags

The plug-in will only acknowledge signals from Tags that you have configured in the system. The Tag's address number can be found on the Tag itself. The portion of the configuration screen that you add Tags to the system with is shown in Figure 16:

Tags/Cards				
Tag ID	Tag Model	Name	Additional Timeout	
154	L-TG 501 Standard	Peter's Car	10	Delete
153	L-TG 501 Standard	Kim's Car	10	Delete
152	L-TG 501 Motion	Kailey's Tag	5	Delete
151	L-TG 501 Motion	Kyle's Tag	5	Delete
155	L-TG 501 Standard	Mail Truck (heh)	5	Delete
137	L-TG 700 Keyfob	Peter's Key Fob	5	Delete
181	L-TG 501 Standard	Peter's Pocket	10	Delete
156	L-TG 501 Standard	Trash Can	10	Delete
			0	Add

Figure 16

4.3.8 Tag ID

The Tag's ID Number is unique to each tag and is found on a sticker on the Tag. There should only be one of any given address in your R500HA RFID system. The Tag's address can be anywhere from 1 to 10 digits.

4.3.9 Tag Model

The tag model must be set to the model number of the tag being used. The model number is usually on stamped on the back of the tag. Selecting the proper model of tag enables tag specific triggers (such as Keyfob button pressed) to be utilized in various events.

4.3.10 Name

The name assigned to the Tag is for your identification only. When setting up triggers and conditions, the Tag name prevents you from having to remember the Tag's address.

4.3.11 Additional Timeout

Please see section topic *Min Timeout (Minimum Timeout and Additional Timeout)* 4.3.6 Min Timeout (Minimum Timeout and Additional Timeout) for information on this setting. The timeout setting here is for the Tag, and is added to the timeout setting of the Reader when it comes within range.

4.3.12 Saving Changes and Additional Control Buttons

The bottom of the R500HA RFID configuration screen has additional control buttons and the "Save/Update" button to save changes made to Tags and Readers. This section looks like Figure 17:



Figure 17

4.3.13 Enable Debug Logging

The "Enable Debug Logging" button changes to "Disable Debug Logging" if debug logging is enabled. Pressing this button causes the plug-in to begin logging very detailed plug-in information to the file iAutomateRFID.log in the HomeSeer™ root folder. This information may be necessary to assist support personnel resolve issues with the plug-in. Turning this on unnecessarily will cause the plug-in to slow and the log file to grow in size very rapidly. Please note that this operation is "On the Fly" and you do not need to restart anything to enable or disable this feature.

4.3.14 Reset/Restart Everything

There are two circumstances when the "Reset/Restart Everything" button should be used: 1.) If you are adding Readers to the network, you can configure the new Reader, add the new Reader to the network, and then press this button to reset the network and allow the plug-in to discover and configure the new Reader. 2.) If at startup the network does not reset fast enough for the plug-in to discover all of the Readers, you can press this button to attempt a restart without having to shut down HomeSeer™. Note: Since this will remove all of the discovered Readers from the network, Tag/Reader triggers and conditions can be affected.

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4.3.15 Suspend Plug-In - Resume Plug-In

These two buttons provide additional control of the plug-in to suspend RFID activity or resume RFID activity if maintenance or troubleshooting is being performed on the system.

4.3.16 Update/Save

Making changes and then pressing the "Update/Save" button can change readers and Tags that are already configured. If you make changes to configured Readers and Tags and press one of the Add buttons (to add a new Reader or Tag), your changes will be LOST. Remember to press this button after making changes and before adding any new Tags or Readers.

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4.4 HomeSeer™ Plug-In Triggers and Conditions

The HomeSeer™ event triggers and conditions provided by this plug-in are where the power of the R500HA RFID system is exposed. An event in HomeSeer™ is a collection of actions to be performed when the event triggers. When a trigger becomes true, the event is checked for any conditions that may be applied to the trigger, and the event actions are carried out only if the trigger happens AND any conditions applied are evaluated to be true.

4.4.1 Triggers

All of the triggers provided in the plug-in have a Tag and Reader component. The triggers are found under the list of triggers available under the heading "R500 Tag Triggers". In the trigger configuration screen, there is a selection for the Tag, the type of trigger you desire, the Reader, and the duration or RSSI value (required for certain trigger types). The trigger types and their features are described in the next sections.

4.4.2 Enters Reader's Range

As the name implies, the "Enters Reader's Range" trigger is set to true when the selected Tag is first detected as being within range of the selected Reader. (Note: The Reader's RSSI affects when this happens.)

4.4.3 Leaves Reader's Range

When a Tag leaves the range of a Reader, or when the Reader's RSSI causes the received Tag signal to be ignored, the Tag is considered "absent" from the Reader. When the Tag has been absent for a time period exceeding the total timeout value (see the previous discussions on total timeout), then the "Leaves Reader's Range" trigger will be true.

4.4.4 Has been in Reader's Range for a Time Period

The plug-in keeps track of how long a Tag has been present at each/every Reader it is detected. The "Has been in Reader's Range for a Time Period" trigger allows you to trigger an event after a Tag has been present for at least a given period of time. At the bottom of the trigger configuration screen is a text box where you can enter the time that the Tag needs to be within range of the Reader to satisfy the trigger. You can enter a duration of seconds (up to several days) for the time period. Separate each component of time by a colon using the format days:hours:minutes:seconds. If you enter a larger value for any of the time periods than the period calls for (e.g. 200 seconds), the value will be converted to higher time period values when the trigger is saved. For example, 0:2:318:2519 will change to 8 hours, 0 minutes, and 59 seconds.

This trigger type will only allow an event to trigger ONCE during the period that the Tag is within range of the Reader for each of these types of triggers that are configured. The reason for this is simple: Once a Tag has been in range for a period of time, 1 minute for example, then after 1 minute has elapsed, the trigger would evaluate to "true" and would continue to be true until the Tag moves away from the Reader. Triggers happen rapidly and having the trigger remain in a true state would cause hundreds of triggers per minute to be evaluated by HomeSeer™. For this reason, the Tag must move away from the Reader and return to the Reader for a configured time period to be able to trigger again.

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4.4.5 Update/Save

Making changes and then pressing the "Update/Save" button can change readers and Tags that are already configured. If you make changes to configured Readers and Tags and press one of the Add buttons (to add a new Reader or Tag), your changes will be LOST. Tag is Moving

Since a Tag can only be determined to be moving when it is in range of a Reader, this first of two "Moving" triggers allows you to check for a Tag to be moving regardless of the Reader the Tag is near. When configuring the "Tag is Moving" trigger, only the Tag and this trigger type need to be chosen – the Reader selection is ignored. If the selected Tag is moving and is in range of any of the Readers in the network, this trigger will be true. (Note: A "Movement" type Tag is required.) This type of trigger can happen repeatedly, so please consult and use one of the methods for reducing unnecessary rapid triggering as mentioned in the WARNING after the description of the trigger "4.4.8 Tag's RSSI at Reader is Greater Than/Less Than (Value)".

4.4.6 Tag in Reader's Range is Moving

The "Tag in Reader's Range is Moving" trigger is identical to the previous trigger described in Tag is present at a specific Reader and is moving. The Tag, this trigger type, and a Reader are required to configure this trigger. The same warning about rapidly repeating triggers applies to this trigger as well. (See the warning after the paragraph "4.4.8 Tag's RSSI at Reader is Greater Than/Less Than (Value)".)

4.4.7 Tag Goes Into/Leaves Security Alarm (Removed or Present)

The "Tag Goes Into/Leaves Security Alarm (Removed or Present)" trigger is based upon each Tag's capability to be used as a security sensor. Using a magnet, you can set a switch inside the Tag to a secure (magnet is present) state. If the magnet is removed (or the Tag removed from the magnet), this trigger would become true. Refer to the specifications for the Tag you are using for the optimum placement of the magnet at the Tag. You can also experiment and listen for a "click" when the magnet changes the state of the switch in the Tag to determine the placement of the magnet. When the magnet is properly placed at the Tag, the "Tag Leaves Security Alarm" trigger would become true.

4.4.8 Tag's RSSI at Reader is Greater Than/Less Than (Value)

When a Tag is within range of a Reader and is moving, the received signal strength will vary. Ideally the RSSI will decrease as the Tag moves away from the Reader, and will increase as the Tag moves closer to the Reader. It should be noted, however, that RF characteristics are affected by atmospheric conditions, objects, and other variables and are, therefore, not always the same from one time to the next. Generally, however, a value of RSSI can be found that does fairly accurately convey the distance of the Tag from the Reader. This trigger exploits this characteristic by examining the RSSI and triggering when the RSSI is greater than the value you specify or less than the value you specify. In the text box at the bottom of the trigger configuration screen, enter the RSSI value to which you want the Tag's RSSI to be compared.

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WARNING: This type of trigger CAN cause rapid triggering to occur. For example, if a Tag is presented to a Reader and then moves close enough to trigger the "Greater Than" RSSI trigger, this trigger condition remains true and so the plug-in will try to trigger the event as many times as it can, causing the plug-in (and thus HomeSeer™) to suffer greatly reduced performance, or perhaps even a plug-in induced resource lock-up. For this reason, you should always use HomeSeer's trigger option "Cannot trigger for ____ seconds" OR use additional conditions on the trigger to prevent/control this. One suggestion is to set a flag (HomeSeer™ device) to ON when the "Greater Than" trigger happens and if the device is currently in an OFF state, and then change the device to OFF when the "Less Than" trigger happens and if the device is currently in an ON state. Checking the state of the flag device can be done using a "Device Status" condition applied to the event trigger.

4.4.9 Has Been Out of Readers Range for a Time Period

The plug-in keeps track of how long a Tag has been present at each/every Reader it is detected. The "Has been Out of Reader's Range for a Time Period" trigger allows you to trigger an event after a Tag has been missing for at least a given period of time. At the bottom of the trigger configuration screen is a text box where you can enter the time that the Tag.

4.4.10 Keyfob Button is Pushed

When the button is pushed on the specified Keyfob and it is within the range of *any* Reader on the network, the Trigger will occur

4.4.11 Keyfob Button in Reader's Range is Pushed

When the button is pushed on the specified Keyfob and it is within the range of *the specified* Reader on the network, the Trigger will occur. This permits the Keyfob button to initiate different triggers based upon location.

4.4.12 Conditions

Conditions are just as powerful as triggers; in fact, conditions can be used as a type of trigger. When conditions are used as a trigger, they are not instantaneously detected – they are evaluated approximately once every minute. When used in conjunction with a trigger, they are evaluated when the trigger happens and are the secondary determination as to whether the event will run. Conditions are where you can make decisions with your home automation system based upon "All" and "None" of the Tags, "Any" and "None" of the Readers too.

Conditions have two parts – the Tag, and the condition. The choices for Tag include all of the configured Tags in the system as well as "(Any Tag)" and "(No Tags)". The conditions include two unique conditions as well as conditions for the selected Tag to be PRESENT at a Reader or ABSENT from a Reader and also "Tag is IN Alarm", and "Tag is NOT in Alarm". The two unique conditions are "is PRESENT at any Reader" and "is ABSENT from all Readers."

Use of the Any/None/All options in the conditions area allow you to determine factors such as the home being completely empty or when everybody is home simply and easily.

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There is one combination that can be selected which will never be true – “(No Tags) is ABSENT from all Readers.” Other than being a poor choice grammatically, this means that all Tags are present at all Readers in the system, which although possible if the Readers are all close together, is not a realistic condition.

4.5.1 Additional Information – Startup/Shutdown

When the plug-in starts or the “Reset/Restart Everything” button is pushed, the system goes through the following sequence:

1. A string of characters is sent to the Readers to break the automatic polling of Readers for Tags in the event that other software used automatic polling.
2. Automatic polling of Readers is turned off, if it was found to be on.
3. The entire network is reset causing all Readers to re-establish their node numbers.
4. The Readers are reset of any errors that may be in their memory and are queried to determine how many Readers are on the network.
5. Any Readers that are newly discovered are programmed with their appropriate Reader ID, which remains with the Reader after a power-off of the system and even if the Reader’s location on the network is changed.
6. Any configured Readers found to have an RSSI or GAIN setting that does not match the configuration values are programmed to be in compliance with the configuration.
7. The list of Readers found in the network (and the names you assigned to them) is displayed.

4.5.2 Shutdown

At shutdown, all Tags that are present at a Reader are stored in the INI file for the plug-in. This is done so that at startup, if the Tag is still present at the Reader, the length of time the Tag is present at the Reader can continue to accrue rather than treating all of the Tags as being “new” to the Reader. Note that if this does not happen due to an abnormal termination of the program or by deleting the INI file for the plug-in, all of the Tags present near Readers will trigger any configured “Enters Reader’s Range” triggers or will satisfy “Tag is Present at Reader...” conditions.

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4.6 Error Messages

The following error messages may be displayed from time to time, in the log, or configuration screens. Most of the displayed errors are self-explanatory:

Error Message	Remedy or Probable Cause
<p>iAutomate RFID~!~This BETA RFID Plug-In Expires in XX days. -or- iAutomate's BETA RFID Plug-In has Expired. Please get the production release of this plug-in. -or- This BETA RFID Plug-In Expires at the end of the day today!!! Please get the production version!</p>	<p>Download the Current Version of the plug-in via the HomeSeer Updater.</p>
<p>Error opening COM port - error is X #, (description of error) followed by: "Error opening COM port - the plug-in is therefore disabled."</p>	<p>The Specified COM Port Does not exist on the Computer. Select a known working port.</p> <p>The specified COM port is in use by another program. The specified COM port is not working properly.</p>
<p>Error: The network is missing X readers, including at least Reader ID The system will remain inoperable until this situation is corrected.</p>	<p>X = the number of readers on the ReaderNet Network. A valid COM Port was specified, but it is the <i>wrong` port</i> or the ReaderNet Wiring is disconnected or Power Supply is interrupted.</p> <p>If # is less than the number of readers on your network, then make sure you did not add two readers at once when adding new readers to the network, or check the ReaderNet wiring to the new readers. (Note: Bad wiring at one reader can affect all readers down the network after that one.)</p>
<p>iAutomate RFID~!~ The system will remain inoperable until this situation is corrected. iAutomate RFID~!~-- Automatic Reset/Retry will occur in 1 minute --</p>	<p>A valid COM Port was specified, but it is the <i>wrong port</i> or the ReaderNet Wiring is disconnected or Power Supply is interrupted. A reader was removed from the ReaderNet Network BEFORE it was removed it from the configuration in HomeSeer.</p>
<p>Tag XX has a low battery, it is estimated to have DD:HH::MM:SS Remaining.</p>	<p>Where XX = the Tag Number, YY Tag Name. The Tag has approximately DD days, HH Hours, MM Minutes and SS Seconds of use remaining before the battery begins to weaken to the point where transmissions will weaken or fail. Replace the Tag.</p>

Error Messages Cont'd	Remedy or Probable Cause
Your HomeSeer log file (ah.log) is quite large. Please consider deleting it to improve HomeSeer's performance.	Delete the ah.log file or archive the file. HomeSeer will create a new file automatically.
Your HomeSeer log file (HomeSeer.log) is quite large. Please consider deleting it to improve HomeSeer's performance.	Delete the HomeSeer.log file or archive the file. HomeSeer will create a new file automatically.
Your iAutomateRFID.log file is too large - logging is being turned off.	The RFID Logging feature is intended to be short term for diagnostic purposes and Technical Support Intervention. It should normally be "Off".
<p>RESTART REQUESTED - RESETTING THE RFID NETWORK</p> <p>RFID Operations are suspended, the COM port is closed</p> <p>RFIDResume has been called - restarting plug-in operations. Please wait.</p> <p>RFID Operations have resumed. Check for proper operation or any necessary resets.</p>	<p>This is displayed if the Network resets automatically or if the user forces a Network Reset from the Configuration Screen.</p> <p>These messages will be displayed when the user suspends or restores plug-in operations from the RFID Configuration Screen in the Web</p>

4.7 Ten Common Mistakes

1. We put this on the last page.
2. Not Reading the manual or understanding RF before installing.
3. Not using shielded cable or omitting ferrite chokes on retrofit as required.
4. Grounding the shields incorrectly. A properly grounded shield is one where the drain wire is spliced through and insulated from other conductors and electrical and earth ground at all locations EXCEPT at the PC. This is called single point grounding. If not followed, the shield works against you, inducing noise.
5. Hooking up eight wires: Reader 1 wires differently than readers 2-10, However ONLY four wires are connected to each RJ45 Connector and Reader Jack, regardless of reader number. Do NOT hook up eight wires.
6. Installing readers too close to locations where tags are most present.
7. Setting Reader Timeouts too low
8. Setting Tag Timeouts too low for motor vehicles.
9. Placing T800 Tags, which are designed to be mounted ON metal objects IN metal objects such as glove compartments.
10. Using a Power Supply other than the SPS1212 Power Supply.

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5.1 Agency Listings

The R500HA Reader and associated RFID Tags are listed with the following agencies

Acronym	Agencies
CE	17 European Countries
IDA	Infocom Development Authority Singapore
FCC	Federal Communications Committee
Industry Canada	Canadian Certification Body
C-Tick	Australia and New Zealand
SAR	Specific Absorption Rate
HERO	Military Hazards of Electromagnetic Radiation Ordinance
DO 160 C	Aircraft Industry
IS	Intrinsically Safe Certification

5.3 Using Scripts with the RFID Plug-In

Scripting with the RFID plug-in is a powerful diagnostic and data logging tool, but scripts are not intended to be the primary interface between the RFID system and HomeSeer. Several scripts are provided with the installation of the RFID plug-in to provide examples and additional functionality:

- `iAutomateRFID.vbs`: This is an example script that demonstrates the use of the scripting features of the plug-in. It will display all of the available information on the tags present at the various readers in the system.
- `iAutomate_TagStatus.vbs`: This is an example script that can be used to display the tags currently recognized by the readers in the system using the HomeSeer event log. The format is one-line per tag making it easy to read as a diagnostic tool.
- `iAutomate_TagStatus.vb`: This script is identical to the same named script with the VBS extension, except that this script was written with a few syntax changes so that it can be used with the upcoming HomeSeer version 2.0 where VB.NET scripts are compiled for faster processing.
- `iAutomate_TagBattery.vbs`: This script is called when the battery in a tag is estimated to have a month of life remaining. The script is called at noon each day and it will display information regarding the tag with the estimated low battery level. The default notification is to write a message to the HomeSeer event log. You may customize this script to use any notification method you desire. If the script is deleted, re-installing the plug-in will return the default version of the script to your scripts directory.

5.3.1 Script Procedure Introduction

In order to be able to invoke the procedures available with the plug-in, you must first get a reference to it through HomeSeer, using the same method as with other plug-ins:

```
Set obj = hs.Plugin("plugname")  
Example  
Set RFID = hs.Plugin("iAutomate RFID")
```

Once this object reference has been established, you can use it to call the script procedures in the plug-in:

```
RFID.procedurename(parameters)  
Example  
RFID.GetTagByIndex(y)
```

If the procedure you are calling is a subroutine, the parenthesis around the parameters is optional. If the procedure is a function or if you are writing a VB.NET script, then the parenthesis are required.

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5.3.2 Script Procedures

5.3.2.1 GetTagCount

Input: None

Return: Integer value

Unless you know for certain that a particular tag is present at a specific reader, you will be iterating through all of the tags to get the information on all tags present at all readers. To do this, you must first know how many total tags there are present at the readers in the system, and this command provides that information. The result returned from this may then be used in a loop from 1 to the returned value so that you may process each tag in the system.

Example

```
x = RFID.GetTagCount
if x > 0 then
    for y = 1 to x
        set Tag = RFID.GetTagByIndex(y)
        ...
    next
end if
```

5.3.2.2 GetTagByIndex

Input: Integer Index Value

Return: Reference to a Tag Object

After using GetTagCount to determine the upper end of the tag count, use this function to return an object reference to a tag that you wish to work with. The structure of the object reference returned is described at the end of this section.

Example

```
set Tag = RFID.GetTagByIndex(y)
```

5.3.2.3 GetTag

Input: String Tag ID, String Reader Number

Return: Reference to a Tag Object

Unlike GetTagByIndex where you do not know which tag at reader object you will retrieve, GetTag can be used to query for a specific tag at a specific reader. If it exists, the tag object reference will be returned. If the requested object does not exist (e.g. that tag is not present at the given reader) than an empty object will be returned. You can use "is Nothing" to test for a valid object return.

Example

```
set Tag = RFID.GetTag("451", "1")
if Tag is Nothing then
    hs.WriteLog "RFID","Tag 451 is not at Reader 1."
end if
```

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5.3.2.4 GetReaderByID

Input: Integer Reader Number

Return: Reference to a Reader Object

Tag objects do not contain all of the information about the readers they are present at. The reader object can be used to get additional information regarding a reader in the system. The reader object returned by this function is described at the end of this section.

Example

```
set Reader = RFID.GetReaderByID(3)
```

5.3.2.5 TagName

Input: String Tag ID

Return: String Name of Tag

To access the name given to a tag as entered in the configuration screen, use TagName. This function is useful in diagnostic procedures to display a meaningful tag name instead of the tag ID.

Example

```
hs.WriteLog "RFID","Tag 154 is named " & RFID.TagName("154")
```

5.3.2.6 ReaderName

Input: String or Integer Reader Number

Return: String Location and Name of Reader

This is functionally identical to TagName with the exception that ReaderName returns the location and name of the reader, separated by a space.

Example

```
hs.WriteLog "RFID","Reader 2 is named " & RFID.ReaderName("2")
```

5.3.2.7 RFIDSuspend & RFIDResume

Input: None

Return: None

Occasionally for system maintenance or testing purposes, it may be necessary to temporarily suspend the RFID plug-in and free up the COM port that Reader 1 is connected to. These commands can be used to suspend plug-in operations and close the COM port, or re-open the COM port and resume plug-in operations.

Note: Resumption of the plug-in operation is done without making any RFID network configuration changes as the normal startup procedure is NOT run again – RFIDResume assumes no change to the number of readers on the network or their reader IDs.

Example

```
RFID.RFIDSuspend
```

Or

```
RFID.RFIDResume
```

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5.3.3.1 Tag Object

The tag object referred to in the scripting section has the following properties and functions:

Property Name	Type	Description
Age	Long	Tags transmit their identification signal typically every 800ms, or 0.8 seconds. Each time a signal is sent, the Age is incremented by 1. Using two age values, it is possible to calculate the time that has transpired between them by multiplying them by 0.8 and then subtracting them.
Age_First	Long	This is the age of the tag when a particular reader first saw it. (See Age above.)
Alarm	Boolean	If True, then the magnet is not present on the tag and it is considered to be in alarm. When the magnet is returned, the tag will no longer be in alarm and this value will be False.
Firmware_Version	Byte	Divide the number here by 10 to get the firmware version - e.g. 41 = 4.1
FirstSeen	Date	The Date/Time when a particular reader first saw the tag.
LastSeen	Date	The Date/Time when the tag last transmitted a signal that was heard by the particular reader that this tag packet is associated with.
Movement_SW_Count	Byte	Each time a movement capable tag senses movement; this value is incremented by one. When it reaches 256, the value is reset to 0.
Node_ID	Byte	Regardless of the assigned Reader IDs, node IDs are always assigned in sequence starting with 1 for the reader connected to the PC and incremented by 1 for each reader connected in succession. These numbers are the Node IDs and are guaranteed to be unique for each reader on the network.
Reader_ID	Byte	This is the reader number for the reader that received this tag object's signal. For example, if you have a tag ID of 100 and 3 readers on your network, it is possible to have 3 of these tag objects, each with a different Reader ID.
Reader_Set_RSSI	Byte	This is the Receiver Set Sensitivity Index that you gave this particular reader in your RFID configuration screen. Unless/Until this is changed, the number is always the same for any and all tags heard by this reader.
RealInterval	Double	Internal to the system the tag transmission interval is stored in an encoded method. This property provides the real interval value, and it will normally be 0.8.
Reed_SW_Count	Byte	The most significant bit (MSB) of this value indicates presence or absence of the magnet on

Property Name	Type	Description
		<p>when the magnet is removed or presented to the tag. Although this number increments until it reaches 127 at which time it is reset, it should be noted that the sensitivity of the alarm sensor is such that wide swings in the values are not uncommon. Furthermore, because it is the MSB that indicates magnet presence or absence, this alone causes huge swings in the value. To read the value, it is necessary to read and compare the MSB from the remaining bits separately i.e.:</p> <p>Tag.Reed_SW_Count And &H80 > 0 indicates magnet is present.</p> <p>Tag.Reed_SW_Count And &H80 = 0 indicates magnet is absent.</p> <p>(Tag.Reed_SW_Count And &H7F) = Value of the count.</p>
RSSI_Sig_Strength	Byte	This important piece of information is the strength at which this particular reader received the tag signal. The higher the RSSI, the closer the tag is to the reader. Nominal values are between 50 and 120.
Tag_Model	String	This is the tag model identifier as entered in the configuration screen.
Tag_Name	String	This is the tag name identifier as entered in the configuration screen.
Tag_ID	String	This is the tag ID number of this particular tag object's tag/reader combination.
Timeout	Integer	This is the timeout parameter entered on the configuration screen for the tag (e.g. not the reader timeout) only.

5.3.3.2 Reader Object

The reader object referred to in the scripting section has the following properties and functions:

Property Name	Type	Description
---------------	------	-------------

5.4 Licenses and Disclaimer

NOTICE TO USER

You should read the following terms and conditions carefully before installing hspi_RFID.exe (The Software) or RFID Hardware (The Hardware) for HomeSeer v1.7xx. Be aware that your use, distribution, or installation of this copy of The Software for HomeSeer v1.7x, or The Hardware indicates your acceptance of this License.

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