THINGMAGIC IZAR USER GUIDE

JADAK
A Novanta Company

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1 Revision History

Table 1: Revision History

Revision	Author	Change
04182018		Initial release
04302018	Victoria M.	Updated figure table and removed obsolete links
05162018	Victoria M.	Updated FCC and IC warnings

2 Introduction

This document applies to IZAR Readers with firmware version 5.3.0 or later, used in conjunction with API version 1.31.1 or later. It explains how to set up the IZAR Readers, how to configure them for network operation, and how to use the browser-based interface. See the corresponding IZAR Firmware Release Notes for operational differences from what is in this User Guide specific to a firmware version.

Any new features or known issues that are not reflected in this User Guide will be found in the Release Notes for the version of firmware you are using. Release notes are downloaded from the same web site where you obtained this document.

Separate appendices contain specifications and antenna information that are specific to the IZAR Reader.

Applications to control the IZAR from an external host can be written using the high level MercuryAPI. The MercuryAPI supports Java, .NET and C programming environments. Applications to control the IZAR using its internal processor can be written via the C programming environment. The MercuryAPI Software Development Kit (SDK) contains sample applications and source code to help developers get started demonstrating and developing functionality. For more information on the MercuryAPI see the MercuryAPI Programmers Guide and the MercuryAPI SDK, available on the JADAK website (www.jadaktech.com).

This document is broken down into the following sections:

Development Kit Quick Start Guide - Provides the minimal number of steps to begin reading tags using the Web User Interface and IZAR Reader with an IZAR Development Kit.

Hardware Overview - Provides detailed specifications of the IZAR hardware and physical interfaces.

Programming Interfaces - Describes the programming interfaces, including on-reader applications, where to find code samples, and the LLRP interface.

The following sections explain the methods available for connecting to the IZAR over the Ethernet, and USB interfaces:

Setting Up the Reader - Connect using a direct Ethernet connection from a Host PC to the IZAR.

Networking Settings - Connect over Ethernet LAN using DHCP, self-allocated, or static IP settings.

Connecting to the USB Console Port - Connect to the IZAR console for command-line interface access and troubleshooting.

Using GPIO - Details the GPIO physical interface specs and how to control it via the MercuryAPI.

Controlling the Reader - Describes the browser-based interface and the configuration and testing options available through it.

Protocol Support - Provides descriptions of the IZAR advanced protocol specific configuration options that are supported through the use of the MercuryAPI

Reader RF Power - Provides guidelines and limitations for setting the RF Power of the IZAR.

IZAR Specifications - Table of IZAR specifications.

Compliance and IP Notices - Regulator notices.

Appendix A: IZAR Antenna and Cable Information - Lists the authorized antennas and cables which can be used with the IZAR in FCC regions.

Mounting the Reader and Appendix B: IZAR Dimensions - Provides details of the physical dimensions of the IZAR.

Appendix C: Advanced Administration - Provides the steps for some advanced administration settings, such as changing reader passwords.

Appendix D: Troubleshooting - Provides recommended debugging steps for common problems and instructions for gathering log data when submitting a problem case to RFID support.

3 Development Kit Quick Start Guide

Figure 1: Assembled Development Kit and Reader

If you have purchased an IZAR Development Kit with your IZAR Reader, you will have received the following accessories listed below. NOTE: The numbers following the descriptions are the SKU numbers, should you wish to purchase additional units.

Development kit part number PLT-RFID-IZ6-DEVKIT contains:

- RP-TNC to RP-TNC RF Cable (CBL-P6)
- RFID Antenna (ANT-WB-6-2025)
- LAN cross-over Cable
- Sample Tag Pack

***Note: Some of these parts cannot be ordered separately.*

If you are not using Power Over Ethernet, you must also purchase one of these power adapters:

- 24V Power Adapter.
  - PLT-RFID-PWRADP-IZ6-NA (North America plug)
  - PLT-RFID-PWRADP-IZ6-EU (EU Plug)

To make the required physical connections to the reader (8 steps):

1. Attach RF cable to the “1” port of the reader, and to the antenna as shown in Figure 2.
2. Attach the LAN cable to the reader LAN/POE connector and to your network or directly to your PC. Note that a cross-over cable is not needed. Either the IZAR LAN interface or your PC will adjust their polarity to compensate for the other side.

Figure 2: Power, LAN, and RF Connections to the Reader

3. Connect the 24V DC power adapter to the IZAR Reader DC9-30V connector. Install the correct prong assembly for your AC service onto the adapter and plug it into an AC outlet.

   WARNING - Powering the reader with a USB cable is not supported.

   When the multicolor LED to the right of the USB HOST connector turns green (Figure 3), the reader has obtained a network address from the network's DHCP server, or negotiated one with your PC. This can take several minutes.

4. Disable any proxy settings on your computer's IP profile. In your browser settings, disable LAN automatic configuration both proxy server. and See Figure 4.

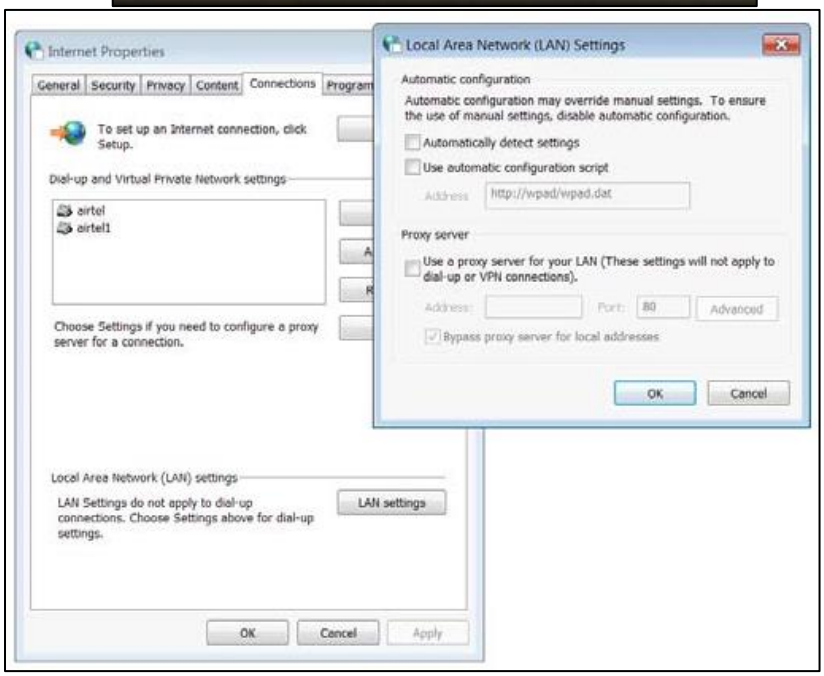


Figure 4: Disabling Proxy Settings in Computer's IP Profile

5. Enter the URL of the reader, printed on a label as shown in Figure 5 into your web browser (Figure 6). **If the IZAR Reader is directly connected to a PC, append ".local" to the URL**. When prompted, enter "web" as the username and "radio" as the password. After a few moments, you will be connected to the IZAR status screen.

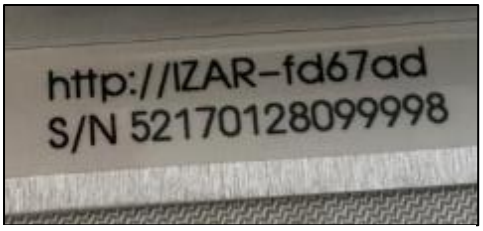


Figure 5: Host Name on Reader

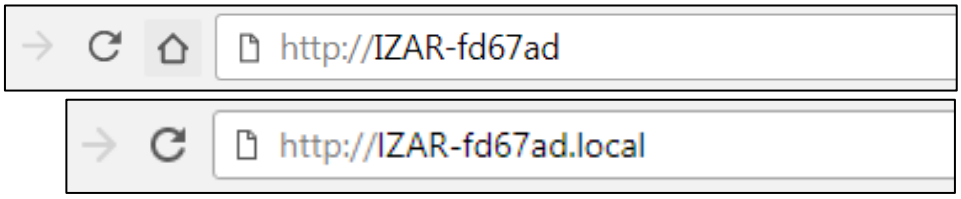


Figure 6: Entering Host Name as URL

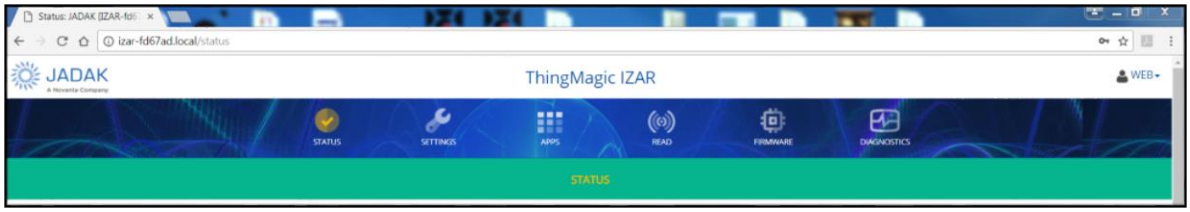


Figure 7: Initial Web Interface Screen

6. Navigate to the Settings-->Reader screen. Select "Antenna 1", de-select all other antennas (Figure 8). Press "Save Reader Settings".

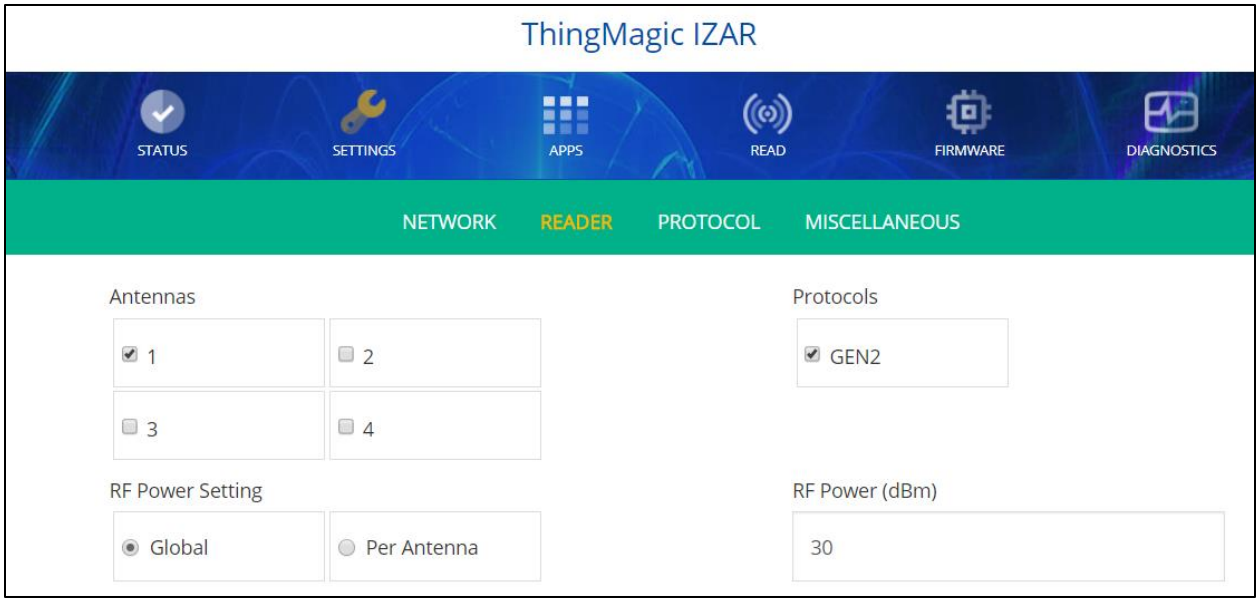
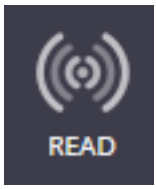
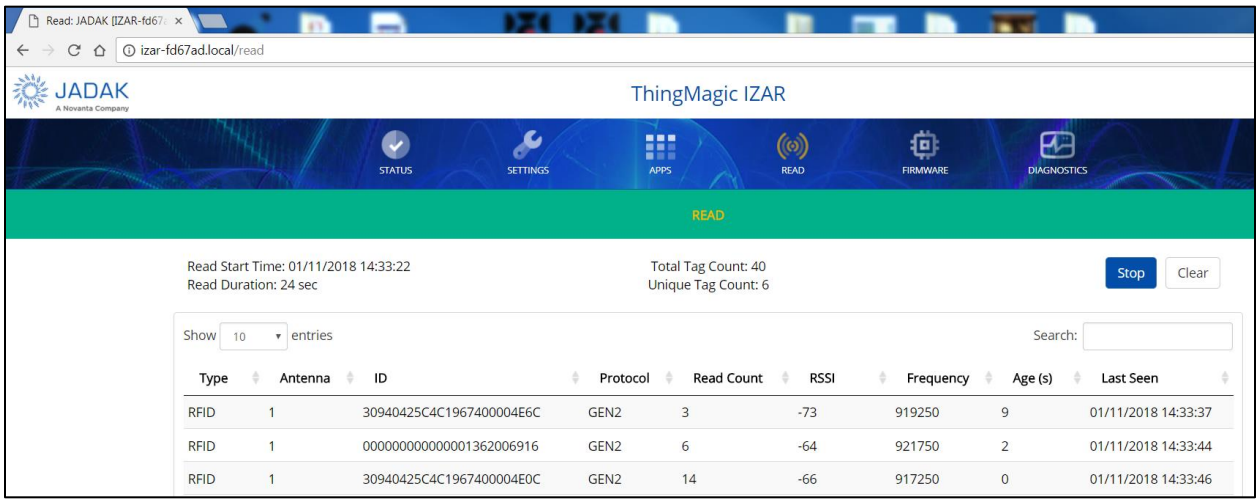


Figure 8: Selecting the Active Antenna Port

7. Click on the "READ" icon at the top of the screen (pictured below).



8. In the READ screen, click on the "Start" button at the upper right. Tag reading result will appear on the main screen. To suspend reading, click on the "Stop" button.



At this stage, you may want to explore the other screens in the web interface or use Universal Reader Assistant to show more advanced features of the reader.

4 Hardware Overview

4.1 Ports and Connectors

4.1.1.1 Antenna Connections

The IZAR supports four monostatic bidirectional RF antennas through four Reverse Polarity TNC (abbreviated to “RP-TNC”) connectors: labeled 1 through 4 on the IZAR (Figure 9).

The maximum RF power that can be delivered to a 50 ohm load from the external port is 1.4 Watts, (+31.5 dBm). Depending on the antenna used and the local regulations for your region of operation, the maximum permitted level may be lower than this.

The RF ports can only be energized one at a time, but the reader can be configured to alternate between antennas many times per second, often resulting in the appearance of continuous reading on all antennas.

Figure 9: IZAR RFID Antenna Ports

Antenna Requirements

The performance of the IZAR is affected by antenna quality. Antennas perform best if they provide good 50 ohm match at the operating frequency band. The degree of antenna match is measured as a return loss, in negative dBm units, with a higher numerical (more negative) value being a better match. Specified sensitivity performance is achieved with antennas providing -17 dB return loss or better across the operating band. Damage to the reader will not occur for any return loss of -1 dB or greater.

WARNING – Damage may occur if antennas are disconnected during operation or if the IZAR sees an open or short circuit at its antenna port.

WARNING – To comply with FCC’s RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 23 cm is maintained between the radiator (antenna) and people in front of the antenna at all times and must not be co-located or operating in conjunction with any other antenna or transmitter unless appropriate additional proximity restrictions are imposed.

4.1.1.2 DC 9 - 30V Power

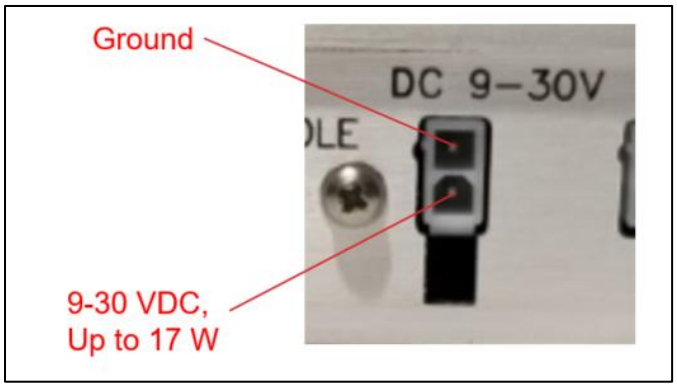
See Figure 10: IZAR Power and LAN connection

The DC 9 - 30V input connector has the following specifications:

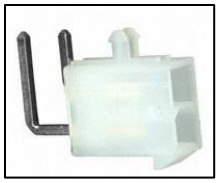
- Accommodates a power adapter with 2 row receptacle for DC 9-30V
- Adapter should be capable of suppying 17W of power. See the section, Power, for DC Power supply

Figure 10: IZAR Power and LAN connection

If you wish to create your own DC supply cable, the DC connector pin-out is shown here:



The connector on the reader is a Molex 0039301021:



The mating connector is a Molex 0039012025:

Crimp Pins:

The crimp pins you wll need for the mating connector are Molex 0039000073 (for 18-24AWG wire). Make sure your wire guage can handle the current generated by 17 W at your input voltage..

4.1.1.3 Using Power over Ethernet (POE)

Another way of powering up the IZAR Reader is to use a single Ethernet cable that is connected to a Power over Ethernet (PoE) network. In this configuration a power converter is not used.

To power up the IZAR Reader over a PoE network:

1. Connect one end of an Ethernet cable to the IZAR Reader
2. Connect the other end to a certified IEEE 802.3af compliant PoE port.

Note: For operation in the EU region, you must use the Ferrite Bead included with the IZAR Reader when powering-up the Reader over a PoE network, in order to meet ETSI regulatory requirements. For the Ferrite Bead to be effective, you must install the Ferrite Bead on the Ethernet cable at the end closest to the IZAR Reader. Ideally, the Ferrite Bead should not be more than two inches away from the connector, as shown in Figure below.

Figure 11: Ferrite Bead

W A R N I N G !

When using PoE as a power source, the PoE must be supplied by a UL Listed ITE device.

W A R N I N G !

When using PoE as a power source the unit cannot be connected to an Ethernet network with outside plant routing, including a campus environment. The network must be contained within a single building.

W A R N I N G !

Do not use POE and DC power at the same time. If making a change, always disconnect one before introducing the other.

4.1.1.4 Ethernet ("LAN/POE")

The LAN interface is a 10/100 RJ45 jack with 2 indicator LEDs.

4.1.1.5 Micro USB ("Console")

The USB 2.0 micro-USB client port looks like 3 interfaces to connected hosts:

1. A serial "Gadget" port that provides access to the console interface
2. A USB "thumb drive" interface that provides access to internal memory on which the USB drivers for the console and USB LAN interfaces are stored
3. A USB LAN interface (RNDIS). To connect to the USB console port, see Connecting to the USB Console Port.

4.1.1.6 External Memory ("Micro SD")

A Micro SD, 3.3 V, interface available for various standard and custom purposes. Future firmware versions are anticipated to use this interface as a source of new firmware and for portable tag data storage.

4.1.1.7 Control and Indicator Interfaces ("GPIO")

Four (4) Input and four 4 output opto-isolated GPIO lines, are available for customizing reader control and result indication. The GPIO available consists of 4 lines of general purpose output, and 4 lines of general purpose input. These lines are writeable and readable by user programs running on the reader. This is a 12-pin connector. There is also supporting power and grounds to convert them into TTL level logic, in and out. See *Section 9: Using GPIO*.

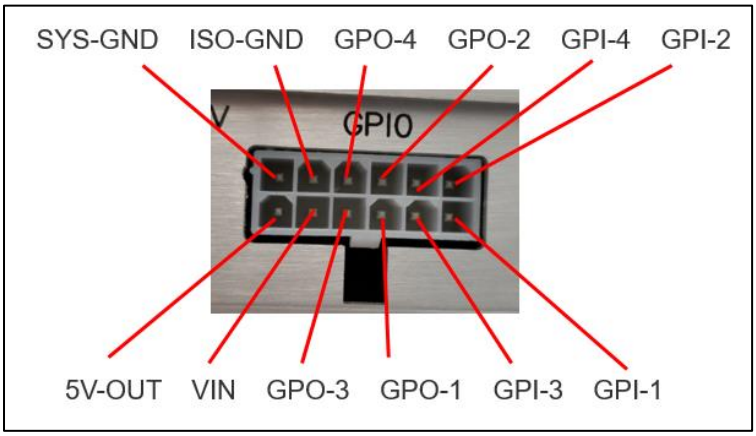


Figure 12: GPIO connector

4.1.1.8 Video Output Interface ("HDMI")

The HDMI interface is not active at this time as we have been unable to find cables (with or without ferrite beads) which will prevent RF radiation from the cables at levels higher than allowed by many regional authorities.

4.1.1.9 USB Host

A USB 2.0 host interface provides host-USB connectivity (with 5V power) for various standard and custom purposes. This interface will support a variety of accessories, such as wireless LAN interfaces, and adapters that support other RFID technologies, such as Bluetooth Low Energy (BLE).

5 Programming Interfaces

5.1 Mercury API

Applications to control the IZAR Reader, and all ThingMagic reader products, can be written using the high level MercuryAPI. The MercuryAPI supports Java, .NET and C (for on-reader applications) programming environments. The MercuryAPI Software Development Kit (SDK) contains sample applications and source code to help developers get started demonstrating and developing functionality. For more information on the MercuryAPI see the MercuryAPI Programmers Guide and the MercuryAPI SDK, available on the ThingMagic website.

5.2 Demo Applications

As the starting point for learning the capabilities of the IZAR Reader, and also a starting place for building custom applications, a demo application is provided in the MercuryAPI SDK package. The executable for this example is included in the MercuryAPI SDK package (available on jadaktech.com website) See the **Universal-Reader- Assistant User Guide** (available on jadaktech.com website) for usage details.

5.3 LLRP

LLRP is the EPCglobal standard (http://www.gs1.org/epcrfid/epc-rfid-llrp/latest) used for communication between the IZAR and a client application. The IZAR should be “drop-in compatible” with systems supporting the standard LLRP protocol. Middleware such as BizTalk and WebSphere have standard LLRP adapters that can work with the IZAR. We have also extended LLRP through custom extensions to support non-standard configuration options and commands, which are supported by ThingMagic readers. We offer a package for LLRP Commander which includes these extensions in XML format.

For more information on direct use of LLRP, the ThingMagic custom extensions and the open source LLRP Toolkit please contact support (RFID-support@jadaktech.com).

5.4 On-Reader Applications

The IZAR supports running custom applications on the reader, built using the MercuryAPI C Language interface. Most programs written using the C API can be compiled to run as a client application or run on the reader. An application note explaining how to develop and distribute on-reader programs may be downloaded from www.jadaktech.com.

6 Setting Up the Reader

This section describes the steps necessary to setup all the necessary components and connect to the Reader's browser-based interface.

6.1 Equipment Required

To set up Single Reader Operation, you need the reader and some additional hardware. The additional hardware required includes:

- A computer with a web browser
- Ethernet cable (CAT5e; shielded is recommended)
- Antenna(s) which are tuned for the frequency range of operation.
- Coax cable(s) (RP-TNC connectors)
- Optionally, you should have a USB cable (PC type A connector to IZAR micro-USB connector) in case console access is required.

Note: To initiate tag reading with the IZAR Reader, no host software is required aside from a browser. To set up the Reader as part of a larger scale deployment that uses a LAN connection, refer to Networking Settings.

6.2 Setup Procedure

The steps required to set up and run the IZAR Reader are contained in the following sections:

- Connecting Antenna(s) to the Reader
- Powering Up the Reader
- Connecting Your PC to the Reader
- Communicating with the Reader using a Link-local Address
- Logging On to the Reader

In this procedure, various interfaces will be described. They are shown in thre Figure below.

Figure 13: IZAR Reader Interfaces

6.2.1.1 Connecting Antenna(s) to the Reader

The IZAR Reader supports up to four monostatic antennas. The default power setting is a convenient way to set the power of the antennas, although per-antenna settings are supported. See Settings page for configuration options. Before you apply power to the Reader, you must connect at least one antenna to an RFID antenna port.

NOTE: Authorized antennas and cables have been certified for use with this reader are recommended. Local regulations may permit antennas of the same type, but lower gain, to be used. *See Appendix A: IZAR Antenna and Cable Information.*

6.2.1.2 Powering Up the Reader

Power up the IZAR using a DC power supply.

NOTE: Sold separately to power up the IZAR Reader using a DC power supply:

1. Plug the power supply into the Reader's DC 9 – 30V power input connector.
2. Connect the extension cord to the power supply and plug it into a 100-240VAC power outlet.

The Reader immediately begins to power up. There is no on/off switch on the Reader. While the Reader is powering up, the red RFID status LED, adjacent to the USB HOST connection, will be on. The Reader is ready for operation after approximately 60 seconds when the LED is illuminated green.

Powering up using POE is supported. See **4.1.1.4 Ethernet ("LAN/POE")**.

W A R N I N G !

Do not use POE and DC power at the same time. If making a change, always disconnect one before introducing the other.

6.2.1.3 Interpreting the Reader Indicator LEDs

The IZAR Reader has an operational status LED, near the USB HOST connector, which allow you to determine the current operational readiness and activity of the IZAR Reader.

The colors displayed by the LED include:

- **Red LED on:** Reader is starting up.
- **Red LED blinking:** Reader is attempting to obtain an IP address using the default or configured methods. (Reader can be accessed through the USB interface when in this state.)
- **Green LED on:** Reader has a valid IP address and is ready for operation.
- **Green LED blinking:** RF field is ON and the unit is attempting to read tags.
- **Alternate Red and Green LED blinking:** Reader is being accessed through USB port and is actively reading.

6.2.1.4 Connecting Your PC to the Reader

Network connectivity to the IZAR Reader is provided via its LAN/POE port. For instructions on connecting the Reader to a network, see the section Networking Settings.

When connected directly to a computer, with default/factory configuration the reader will use Zero Configuration networking (also referred to as Link Local or Automatic Private IP Addressing on Windows) to negotiate a valid IP address.

To connect your Reader directly to your PC:

1. Connect an Ethernet cable to your PC.
2. Connect the other end of the Ethernet cable to the Reader's LAN/POE port.

6.2.1.5 Communicating with the Reader using a Link-local Address

If you are using an operating system other than Windows 7, consult your network administrator regarding how to set up your PC's TCP/IP connection.

If you are using Windows 7, perform the following steps to set up (or verify) your PC's TCP/IP connection. On most PCs this is the default configuration:

1. Select Start from the Start bar, and then select Control Panel.
2. Under Network and Internet, select "View network status and tasks".
3. In the left menu select "Change adapter settings".
4. The Local Area Connection Status window appears, as shown in Figure 12.

NOTE: Link-local addressing is the default fallback method if no DHCP server is present. If this is your preferred IP addressing method, obtaining a Link Local IP address will occur much more quickly if it is made the primary IP address source in instead of a fallback method. *See Section 7: Network Settings*.

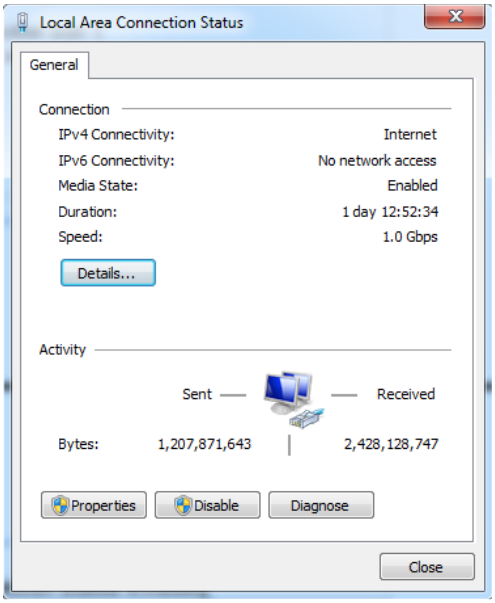


Figure 14: Local Area Connection Status Window

5. Click the Properties button. The Local Area Connections Properties window appears, as shown in Figure 13.

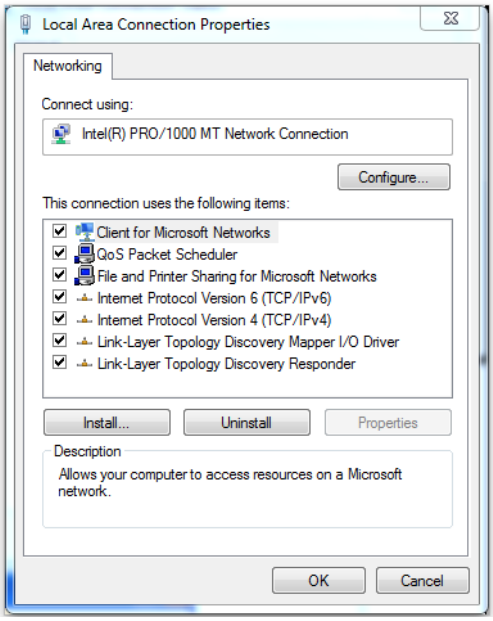


Figure 15: Local Area Connection Properties Window

6. Scroll down and select the Internet Protocol (TCP/IP) version you're using. If you don't know which, change both.

7. Click on the Properties button.

The Internet Protocol (TCP/IP) Properties window appears. The General tab should have both “Obtain an IP Address automatically” and “Obtain DNS server address automatically” selected. On the Alternate Configuration tab “Automatic private IP address” should be selected, as shown in Figure 14.

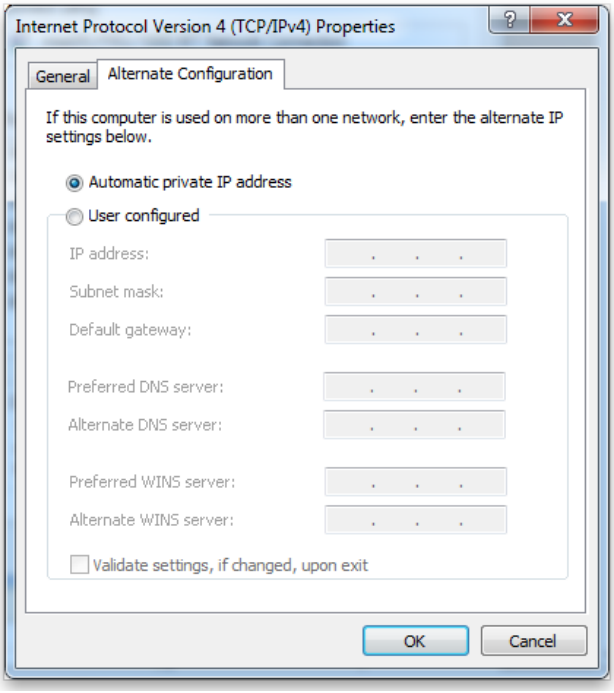


Figure 16: Internet Protocol TCP/IP Properties Window

8. Click OK to save and exit the window.
9. Click OK in the Local Area Connection Properties window.

6.2.1.6 Logging On to the Reader

You may use any web browser to log on to the Reader. Before logging into the reader, ensure that all proxy settings are disabled in your browser

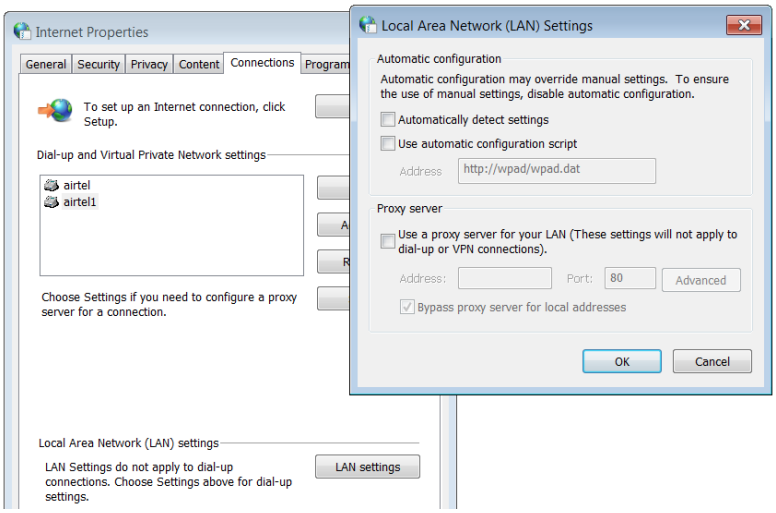


Figure 17: Typical Browser Proxy Settings

To log on to the Reader:

1. Launch your web browser and log on to the Reader by entering the Reader's URL address in the browser address bar. This URL will be displayed on a label on the reader, for example, “http://IZAR-b65b2f”. If your reader is directly connected to the computer, then append the suffix “.local” to the URL, for example: “http://IZAR-b65b2f.local”
2. Press Enter. The Login dialog box appears.
3. Enter the following:
   Default user name: “web”
   Password: “radio” (all lower-case).
4. Click OK. The Reader displays its browser-based interface. The initial page that appears is the Status page, as shown in Figure 16.

NOTE: On some systems, especially when communicating with the Reader using a Linklocal Address, the hostname must end in “.local” for the connection to succeed. i.e. http://IZAR-21071f.local

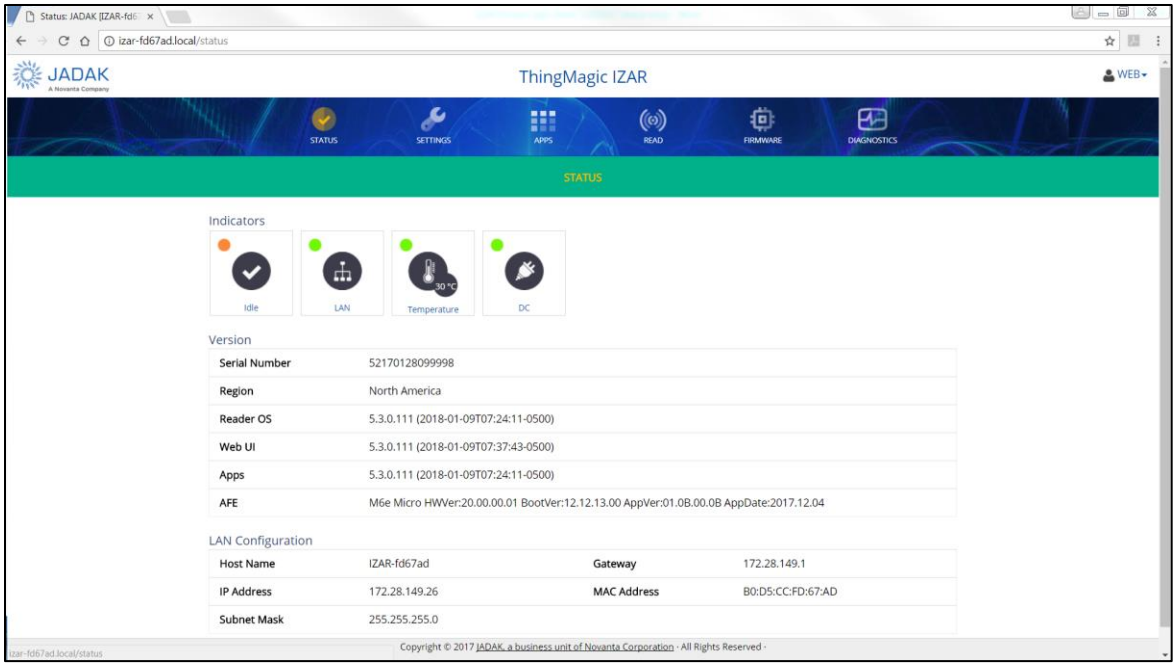


Figure 18: IZAR Status Page

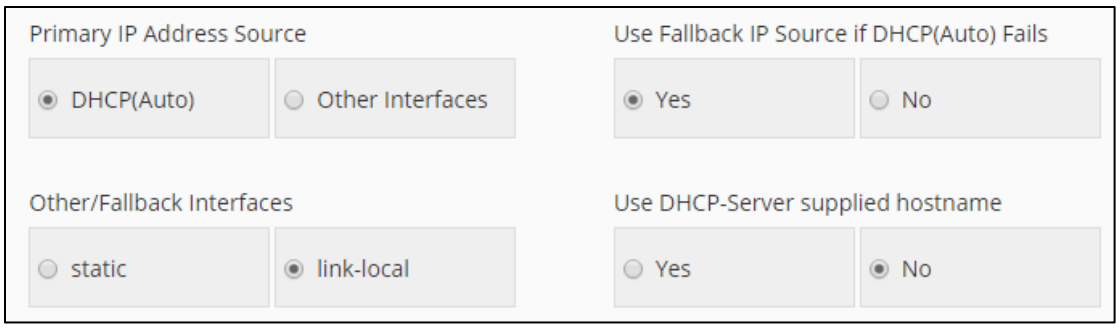
5. The next step will be to ensure that your settings are correct. The “Settings” icon at the top of the web page allows you to make changes to the reader configuration. If you are configuring from the web site, any changes will be used as your operational configuration and as the default for next time the reader reboots. If you are configuring from an external host with an application such as Universal Reader Assistant, the changes will become effective immediately, but will revert to the default settings if the reader is rebooted.

The following outline shows the hierarchy of setting screens within the IZAR Settings page.

- Network
  - General Network Settings
  - Ethernet Interface
- Reader
- Protocol
  - Tag Reader Protocol
  - Tag Population
  - Tag Repeat Rate
- Miscellaneous

7 Network Settings

You can set up the IZAR Reader to use a DHCP server, Link Local peer negotiation, or manual entry as an IP address source. By default, the Reader boots up looking for a DHCP server. If no DHCP server is found it will



negotiate a Link-local address with your PC and any other devices on the network. Optionally, you can have the reader use a static address as a primary or fallback instead of a link-local address.

DHCP will automatically provide the Reader's IP address, subnet mask, default gateway, NTP Server, and DNS (Domain Name Service) server. It will also establish a hostname and provide it to the DNS Server. During the initial boot sequence, if the Reader does not get a DHCP-assigned IP address, a link-local address will be negotiated with any connected device(s). However, the Reader will periodically check to see if a DHCP server is available. See the "Troubleshooting Table" for assistance determining the IP address if you cannot access the reader using the URL hostname.

The following section explains how to set up your PC and Reader on a network.

7.1 Setting Up the Network Hardware

Whether you use DHCP, link-local, or static network addressing, make sure that the network is connected before powering up the Reader. With default settings, if the Reader does not automatically get the address from a DHCP server, a link-local address will be negotiated with the local network. DHCP addressing can only be used as a primary method. Either static or link-local addressing can be used as a primary method or as a fallback method if DHCP address assignment is unavailable. Neither static nor Link-local addressing can be used as a fallback method for the other.

Before setting up your network:

- Connect one end of an Ethernet cable to the Reader and the other end to an Ethernet switch or hub.
- Check that all antennas are securely connected, and then power-up the Reader.
- Connect your PC to the same network as that of the Reader.

NOTE: Some older 10baseT network hubs may not work properly with the Reader. If you encounter connectivity problems, we recommend using nothing below 10/100baseT hubs/switches.

7.1.1.1 Using Power over Ethernet (PoE)

Another desirable way of powering up the IZAR Reader is to use a single Ethernet cable that is both a communication link and a power source, called Power over Ethernet (POE). Power must either be input with the Ethernet signal compliant with IEEE 802.11AF (POE or POEplus), or via a dedicated DC input port that accepts 9 to 30 VDC input. Contact RFID-support@jadaktech for recommendations of PoE adapters that we have tested successfully with the IZAR Reader.

WARNING!

Do not use POE and DC power at the same time. If making a change, always disconnect one before introducing the other.

7.2 Using DHCP

7.2.1.1 IZAR Setup

DHCP addressing can be used with any LAN interface. To enable DHCP, follow these steps:

1. Click on Settings icon at the top of the Web Interface navigation menu to access the Settings Page.
2. Select Use DHCP = Yes radio button under the General Network Settings section of the Settings screen.
3. Click the Save Network Settings button at the bottom of the page.

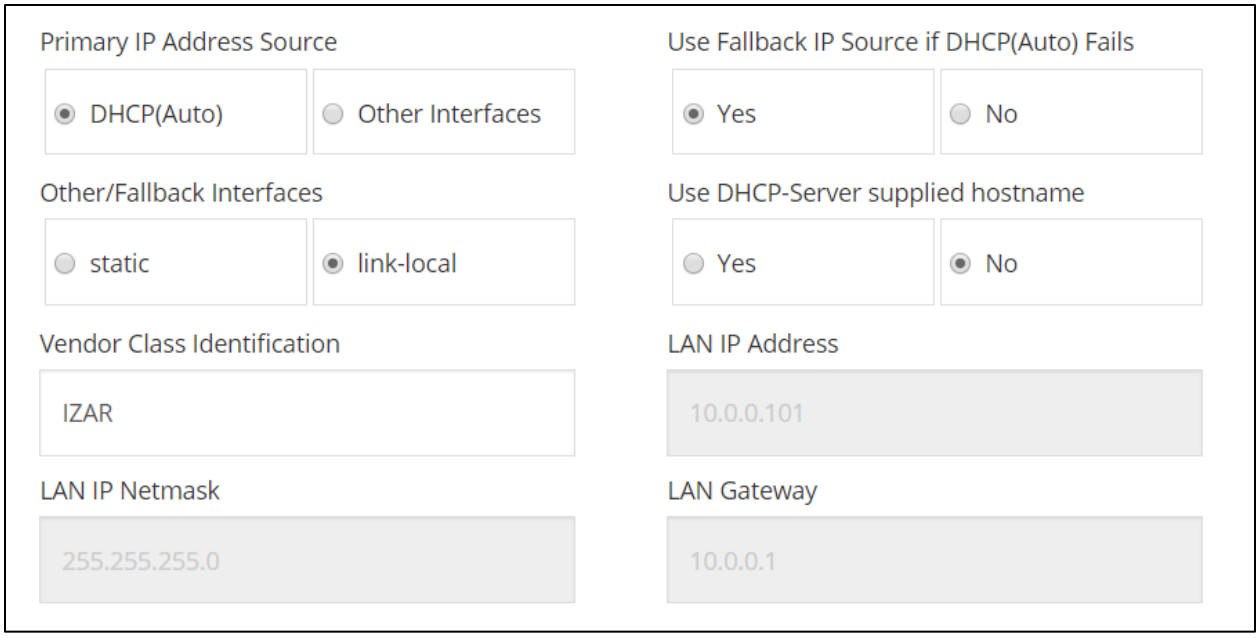


Figure 19: Network Settings

WARNING – No changes take effect until you click on the "Save Settings" button at the bottom of any configuration screen or "Save All Settings" at the upper right of the screen.

7.2.1.2 PC Setup

To use DHCP to automatically assign your PC's IP address to insure common configuration with the IZAR, do the following:

1. Select Start from the Start bar, and then select Control Panel.
2. Double click the Network Connections icon.
3. Disable your PC's wireless connection, if one exists.
4. Double click the Local Area Connection icon. The local area Connection Status window appears, as shown in Figure 12.
5. Click the Properties button. The Local Area Connection Properties window appears, as shown in Figure 13.
6. Scroll down to the bottom of the list and select Internet Protocol (TCP/IP).
7. Click on the Properties button. The Internet Protocol (TCP/IP) Properties window appears, as shown in Figure 17.

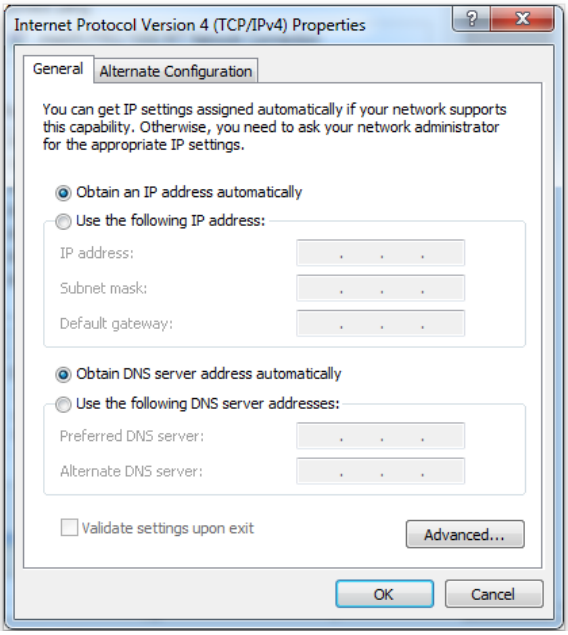
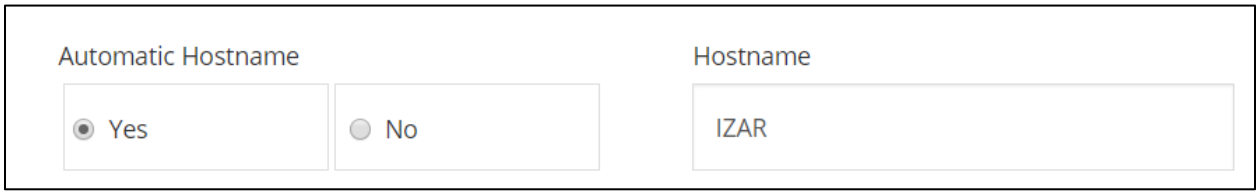


Figure 20: Internet Protocol (TCP/IP) Properties Window

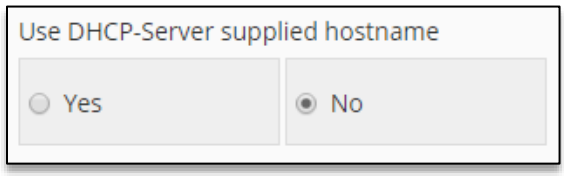
8. Select the Obtain an IP address automatically button.
9. Click OK to save and exit the window.
10. Click OK, in the Local Area Connection Properties window.
11. Click OK, in the Local Area Connection Status window. The PC may take few minutes to save the new network settings.

Automatic Hostname: IZAR-xxxxxx

At startup, the Reader, by default, generates an 'automatic hostname' by appending the last three bytes of its MAC address to its hostname, such as IZAR-210027. (A label on the IZAR Reader will also provide this default hostname.)



(From Ethernet Interface page)



Your network must have properly configured DNS servers if you are accessing the reader via its hostname. When using DHCP, the DHCP server automatically adds the hostname to the DNS server's database.

NOTE: The hostname can also become known to your PC via MDNS. If you cannot reach the reader via the hostname alone, append ".local" to the end for the connection to succeed. i.e. IZAR-21071f.local. This is typical when Link Local addressing is being used.

7.2.1.3 Accessing the Reader via Hostname

The first six characters of the MAC address are the manufacturer's code. The last six characters of the MAC address are specific to the Reader and are used for automatic hostname addressing.

To log on to the Reader using the Hostname:

Obtain the Reader's hostname, launch your web browser, and then log on to the Reader by entering its hostname in the address bar, such as http://IZAR-xxxxxx (the last six characters of the Reader's MAC address).

1. Press Enter. The Reader's Login dialog box appears.
2. Enter the following:
   User name: web
   Password: radio
3. Click OK. The Reader displays the IZAR Status Page.

8 Connecting to the USB Console Port

IZAR supports communication over its USB Console as a serial TTY port to enable you to accomplish the following:

- Access the boot logs as files
- Access the console for emergency recovery
- Learn the IP addresses of all LAN interfaces

Unlike previous generations of ThingMagic readers, the IZAR console is not active from the beginning of boot-up. It is only active after boot-up. The boot-up messages may be obtained from log files at that time.

Before you connect to the USB Console port, ensure that you have:

- A PC with a USB port
- A serial terminal program (such as PuTTY for Windows or CoolTerm for the Mac)
- A USB cable (with USB Mini-B plug)
- USB Serial Driver. See Section 8.1.1 USB Serial Driver

To address the port correctly, you must determine the port name used by the host OS. On Windows it will be assigned “COM” followed by a number. For a MacOSX system, the port name will be “/dev/tty.usbmodem1a123” or similar. For Linux based systems will see it as “/dev/ttyACM0” or similar.

When you have completed setting up the serial port, you must set the following four parameters to allow the terminal program to talk to the Reader:

- Data Rate: 115200
- Parity: None
- Data Bits: 8
- Stop Bits: 1

The procedure for connecting to a specific port is different for each terminal emulation program. Check the documentation for your program for information on setting these parameters.

Once you have set up the USB connection, press <Enter> to send a carriage return character to the reader. You should see a printout of the IP addresses, followed by a login prompt.

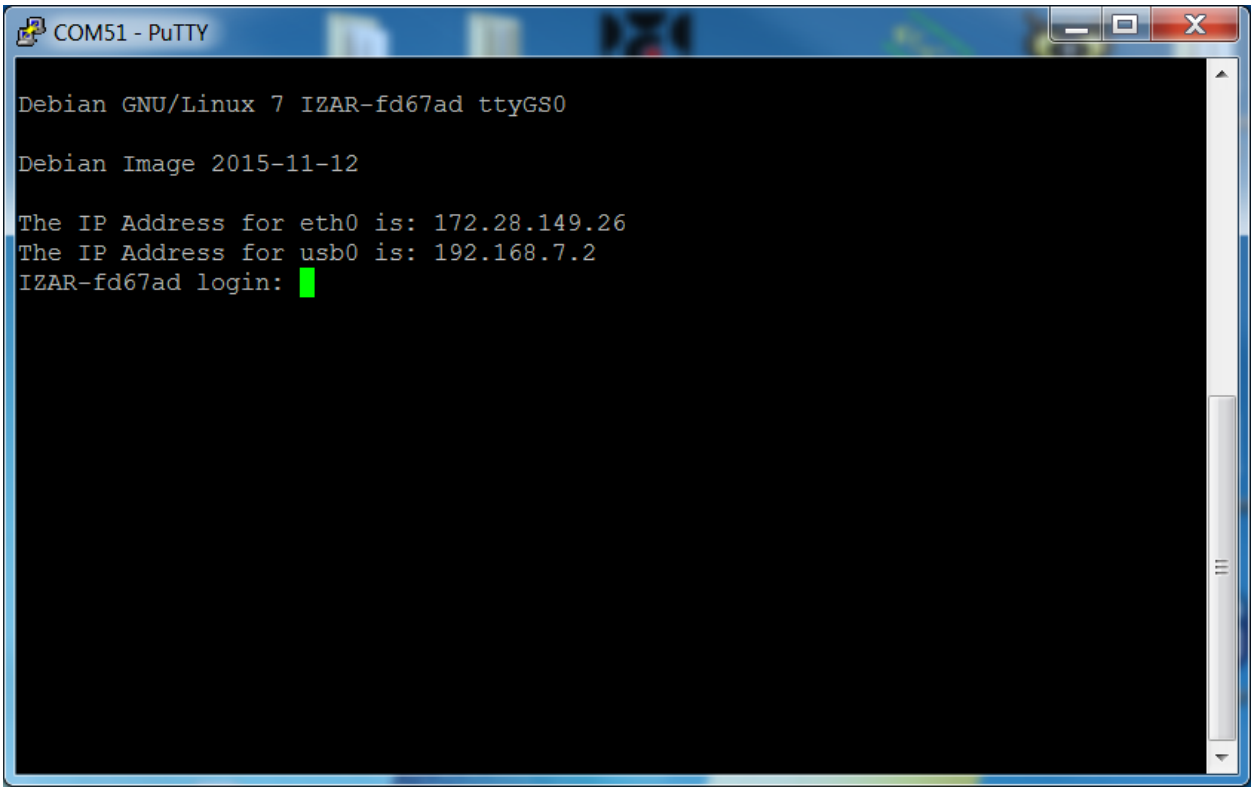
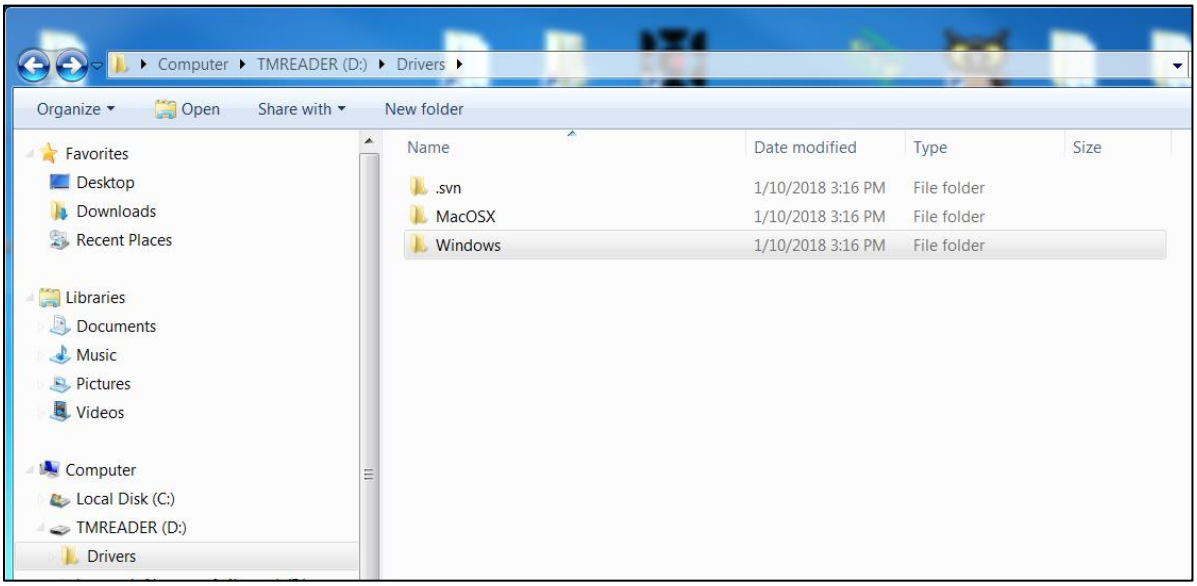


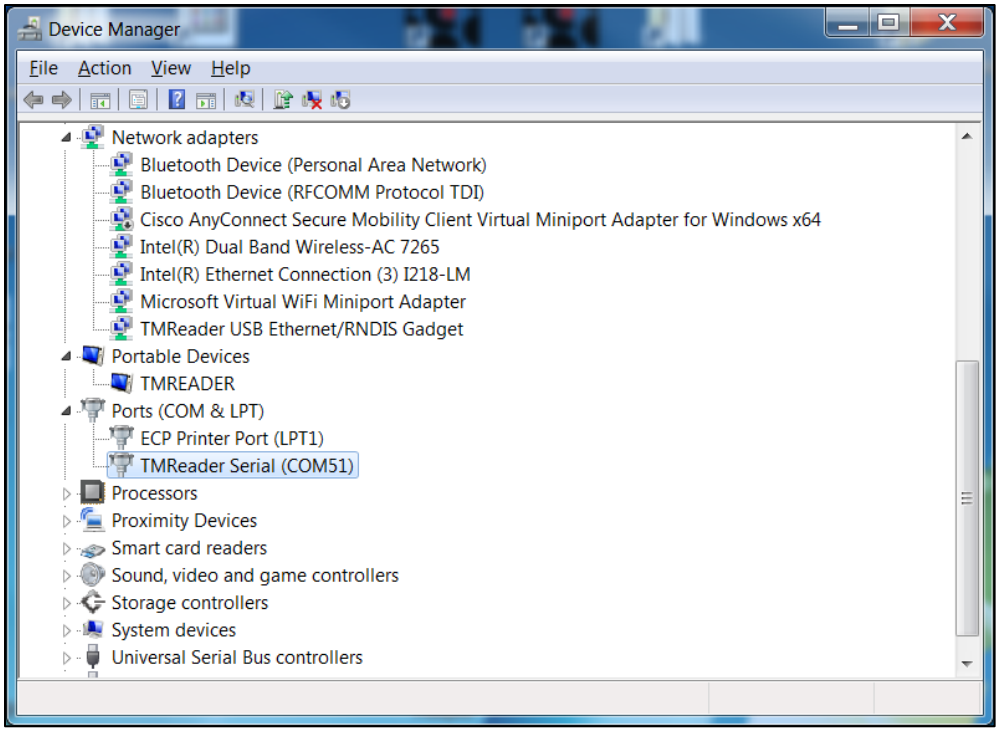
Figure 21: IZAR Console Login Prompt

8.1.1 USB Serial Driver

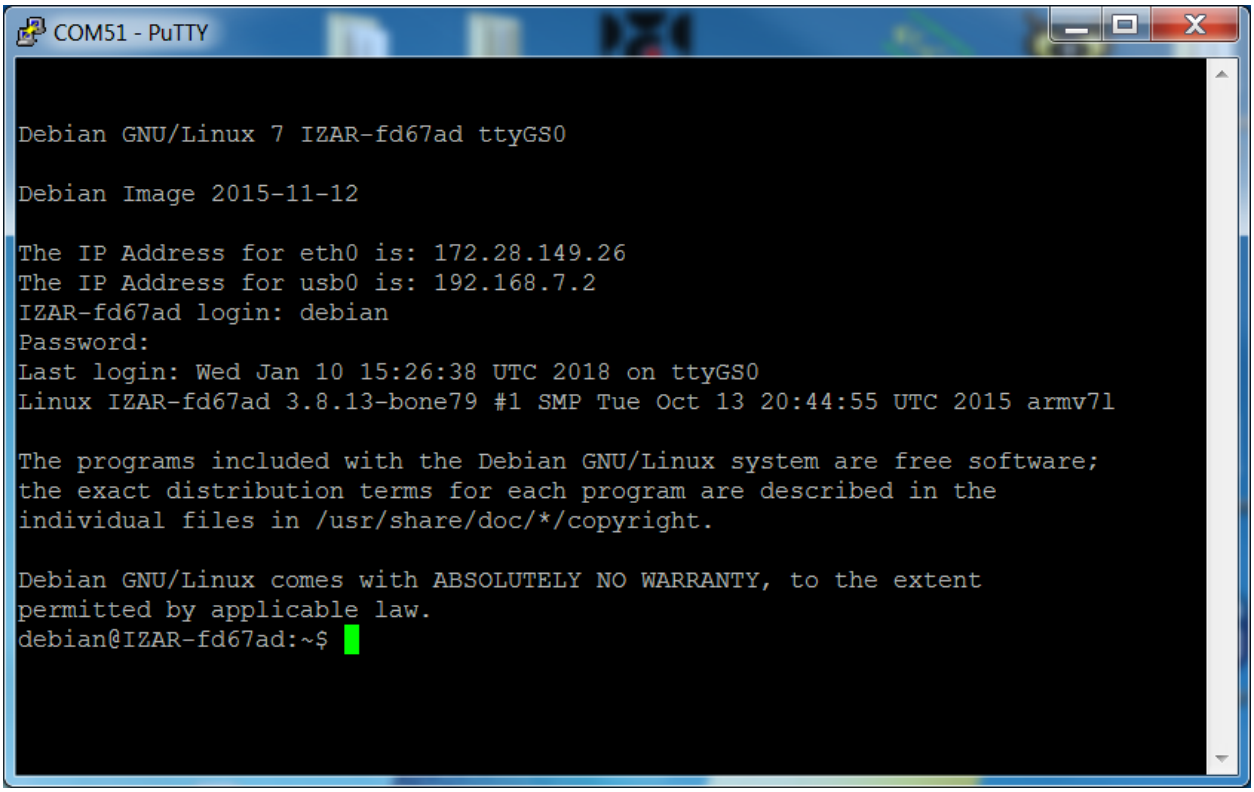
The console port requires the host have a Gadget serial virtual COM port drivers installed. When the USB port is connected to a PC, it appears to the PC as a USB memory device with the name, “TMREADER”.



The Gadget serial virtual COM port drivers are in this directory. If signed drivers are needed, they will be in the new “Windows 10_1607” directory. When the Gadget driver is installed, the USB port will appear



Please follow the instructions in the installation guide appropriate for your operating system. Once you have accessed the console port with a terminal program, enter the default username ("debian") and the default password ("rootsecure").



NOTE: Typing “help” will show you many of the supported Linux commands. One useful command not listed is “ifconfig”. It will display the current network settings for all interfaces and is very useful for determining the reader’s IP address if you cannot access it by host name.

9 Using GPIO

The IZAR Reader includes a 12-pin terminal block connector for GPIO access.

GPIO Connector on the reader:

- Molex 0039301120

Mating Connector

- Molex 0039012125

Crimp Pins

The crimp pins you wll need for the mating connector are Molex 0039000073 (for 18-24AWG wire), or equivalent that is appropriate for your wire size.

The GPIO consists of 4 lines of general purpose output, and 4 lines of general purpose input. These lines are writeable and readable by user programs running on the IZAR. This is a 12-pin connector. The values of the GPIO lines can be Get and Set using the MercuryAPI. See the respective guide for more details on software control of these signals.

9.1 Connector Pinout

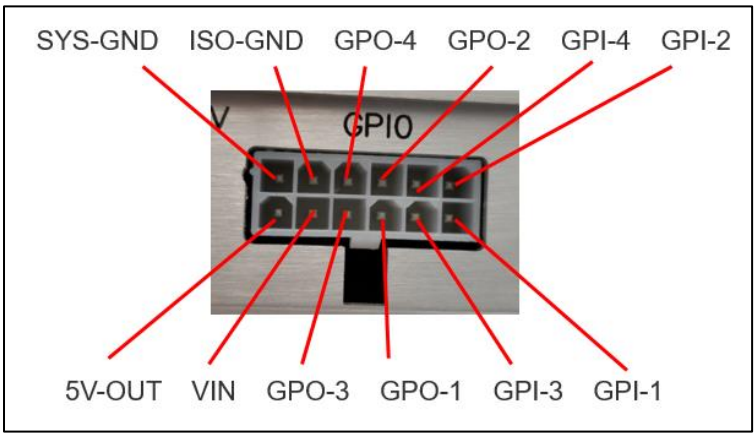


Figure 22: IZAR connector

The diagram (Figure 22: IZAR connector) shows the pinout of the connector.

The table below gives the characteristics of the pins

Table 1: Connector Pin Characteristics

I/O Name	I/O Function
+5V Supply	Reader supplied (not isolated) power source
VIN	Power input for isolated outputs
GPO-x	Isolated output (active pull down to V-)
GPI-x	Isolated input
ISO-GND	Return for isolated inputs and outputs
SYS-GND	System (Reader) ground, not isolated

9.2 Electrical Specifications

The electrical specifications are as follows:

Pin	Parameter	Description	Min	Max	Unit	Conditions
+5V Supply	IO	Output current		200	mA	
GPI	VIH	HIGH level input voltage	3	30	V	
GPI	VIL	LOW level input voltage	0	0.8	V	
GPI	ILI	Input current		5	mA	24V input
GPI	VI	Input voltage range	0	30	V	No damage
GPO	VOH	Output high voltage		V+*	V	10k pull up
GPO	VOL	Output low voltage		(V-)+0.5	V	100mA load
GPO	VI	Supply voltage range (V+) - (V-)		30	V	

*User-supplied voltage

9.3 Inputs

The four opto-isolated inputs support the following input levels:

- V-low (Logic 0) = 0-0.8V
- V-high (Logic 1) = 3-30V
- 5mA max current with 24V input

It is recommended that external devices guarantee a minimum pulse width of at least 100ms.

9.4 Outputs

The four opto-isolated outputs support power sourcing, up to +30V with current sink up to 200mA, through an external power supply connected between V-GPO and ISO-GND (pins 2 and 7).

Using the MercuryAPI the output signals (see note under Connector Pinout for enumeration values) can be set as follows:

1) gpoSet(GPIO_#, 1) sets the pin corresponding to the GPIO enumeration to Vhigh (relative to ISO-GND) by allowing an internal or external voltage to pull the signal up through internal or external resistors.

If the 5 V internal source is used with internal 10KOhm resistors, (5V-OUT connected to V-GPO), ISO-GND must be connected to SYS-GND. If an external voltage source is used at V-GPO in place of the internal 5V source, make sure its negative side is connected to ISO-GND. If an external voltage is used with an external

resistor, make sure its negative side is connected to ISO-GND and connect V-GPO to ISO-GND (to prevent the output lines from driving each other through a floating V-GPO pin).

2) gpoSet(GPIO_#, 0) sets the pin corresponding to the GPIO enumeration to Vlow by "shorting" the output level to ISO-GND.

NOTE: For non-isolated applications connect grounds together (pin 7 and 8) and V -GPO to IZAR +5V (pins 2 and 1). With this configuration the reader provides the +5V supply and can sink up to 200mA, total.

For convenience, the schematic diagram of the GPIO circuits of the IZAR Reader are shown in Figure 23 through Figure 25 so you can more easily determine the external connections that will work for your application.

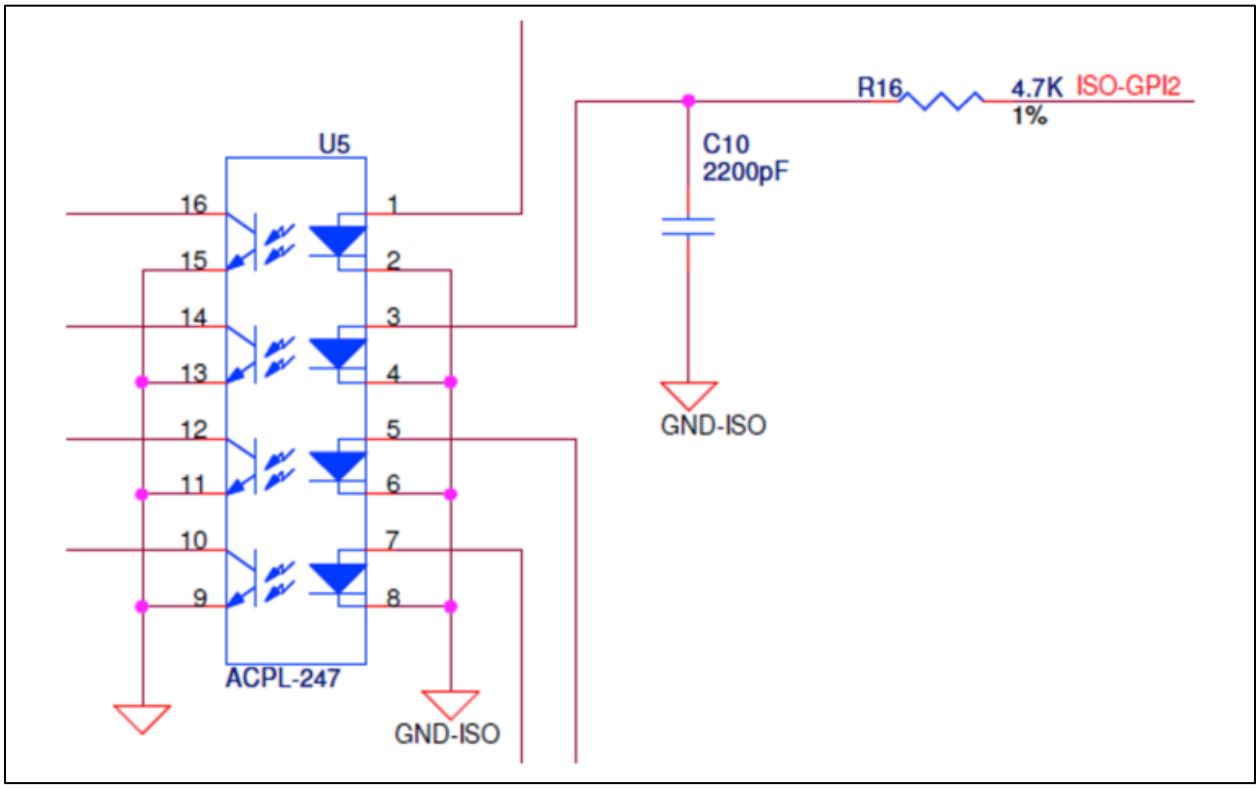


Figure 23: Schematic Diagram of GPI Circuitry (only 1 input shown)

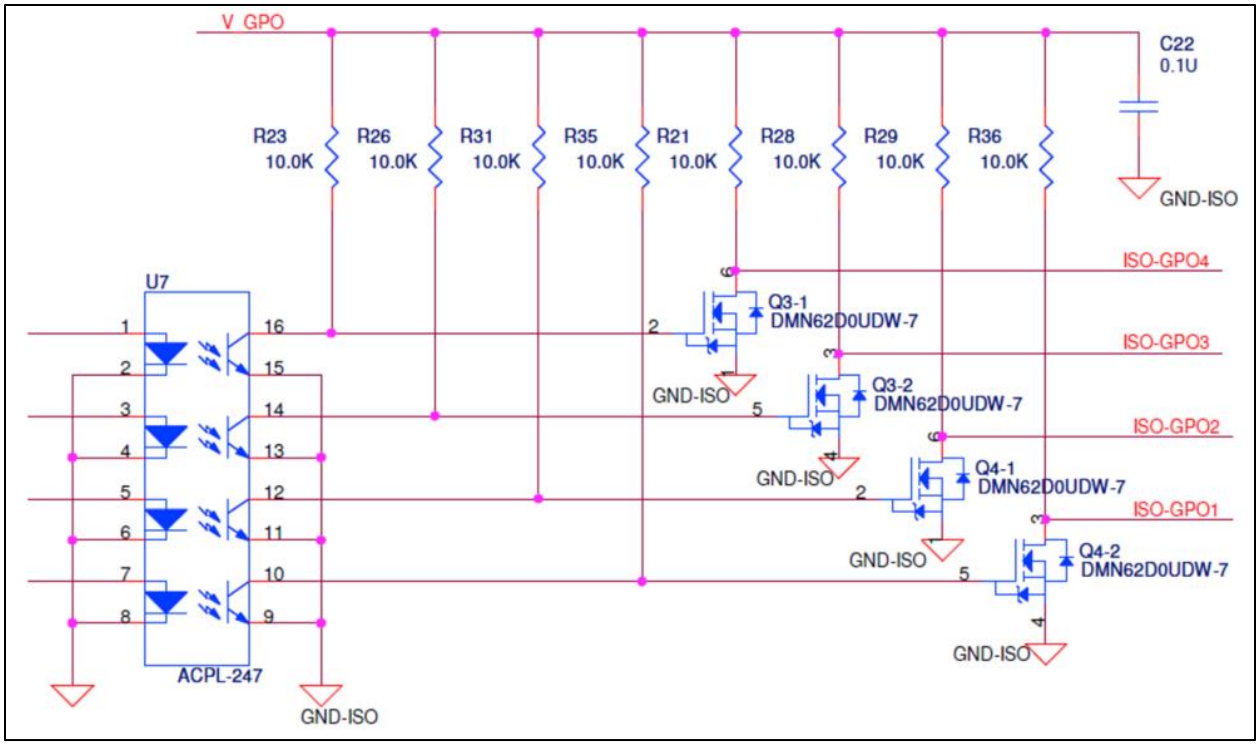


Figure 24: Schematic Diagram of GPO Circuitry

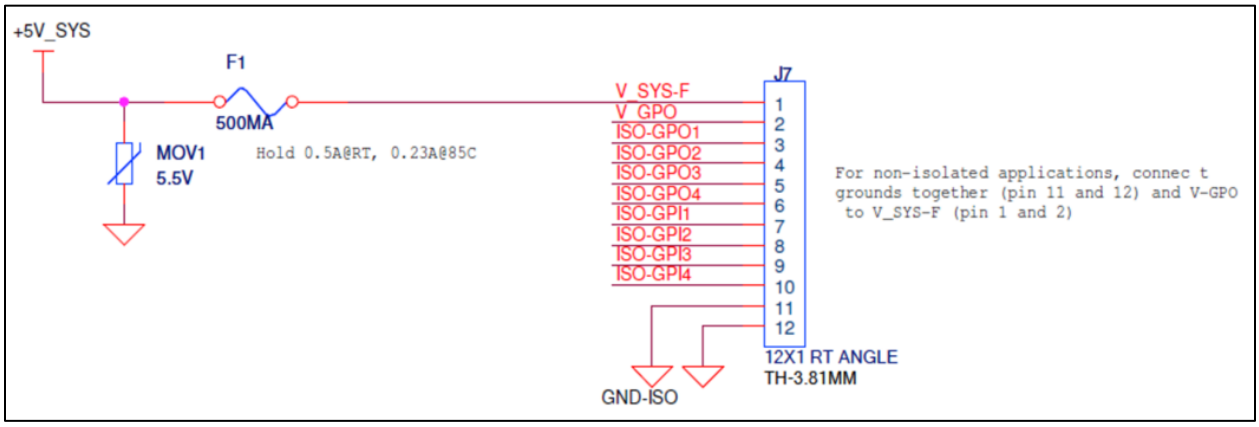


Figure 25: Schematic Diagram of Connector and 5V source

10 Controlling the Reader

The Reader uses RFID (Radio Frequency Identification) technology to read and write data stored on RFID Tag(s). The IZAR Reader provides three levels of access to control read/write operations of RFID tag(s):

1. Using the Browser-Based Interface:

   A web browser controls high-level Reader operations. See Status Page for information about how to access the browser-based interface.

2. An application accessing the reader via MercuryAPI on a host, such as Universal Reader Assistant for Windows PCs:

   See the MercuryAPI Programmers Guide and the Universal Reader Assistant User Guide at www.jadaktech.com.

3. Directly address the reader from a host application via its LLRP protocol.

   EPC global ratified protocol used for communication between the IZAR and a client application. The IZAR should be "drop-in compatible" with systems supporting the standard LLRP protocol.

10.1 Using the Browser-Based Interface

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

You can run the browser-based interface from any PC on the network. Carefully configure the PC with an IP address and subnet mask compatible with the current operational settings of the Reader.

The Reader navigation menu provides access to the following pages:

- **Status Page** – Displays the current operational settings
- **Settings Page** – Allows the user to modify Reader configuration and network settings
- **Read Page** – Allows the user to read on all configured antennas using the configured setting
- **Firmware Upgrade Utility** – Upgrades the tag Reader with new firmware images provided by JADAK
- **Diagnostics Page** – Provides current operating settings and access to the log files kept by the Reader

To start the browser-based interface:

1. Exit all Reader applications on the network.

   WARNING – Only one application may actively control the reader at any time. If a host is already connected to the reader, you may view status and change configurations values, but not read tags. Configuration changes made through one interface may not be displayed on the other interface. A good rule of thumb is that the saved web interface changes become default values that are used on start-up and, at the time the change is made, the current value. Changes made through the LLRP interface override the values in current use, but are temporary and only last until the reader is rebooted.

2. Type the host name or IP address of the Reader to which you want to communicate in the address field of the browser. The log-in dialog appears.

3. Enter the following:
   User name: "web"
   Password: "radio" (all lower-case).

4. Click OK. A navigation menu and the Status page appear in the browser, as shown in the Figure 16.

10.1.1.1 Status Page

The IZAR Status Page, as shown in Figure 26: Status Page, indicates the reader status, reader version and current LAN configuration parameters.

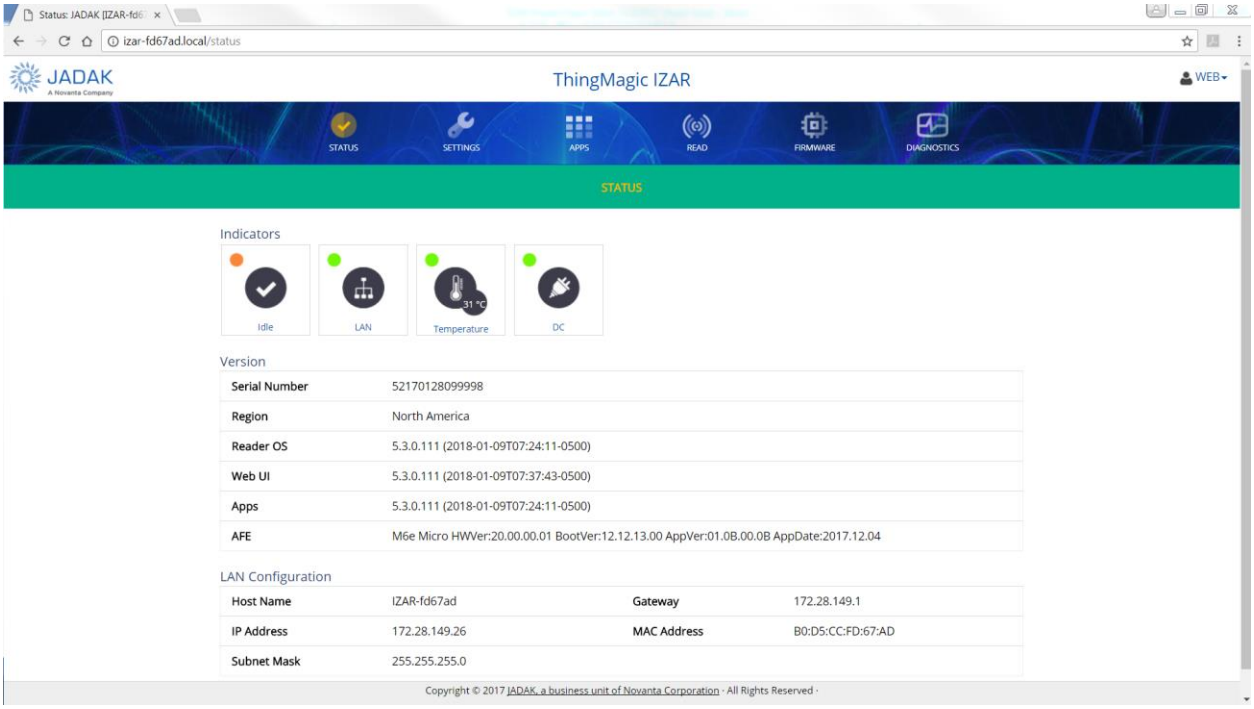


Figure 26: Status Page

10.1.1.2 Settings Page

The IZAR Settings Page (Figure 27: Settings Page) enables you to change network, performance and security settings. The page is divided into four main sections:

- Reader (Power) Settings
- (Gen2) Protocol Settings
- Network Settings
- Miscellaneous Settings

Changing these parameters may change the settings the Reader uses on startup. Be careful to use correct values or you may not be able to connect to the Reader without reconfiguring the reader via the console interface.

NOTE: All settings set through the Web UI | Settings pages are persistent, they are retained across reboots and become the default settings of the reader for client applications. The values shown on these pages do not necessarily reflect the active settings of the Reader if configuration parameters are transiently changed through the MercuryAPI or LLRP. All changes made through MercuryAPI or LLRP client applications are transient. The reader will return to its last saved persistent settings (“default settings”) if rebooted.

NOTE: Do not disconnect power until the save process is complete. Unless stated otherwise in the release notes, all new RFID, network and security settings take effect after saving.

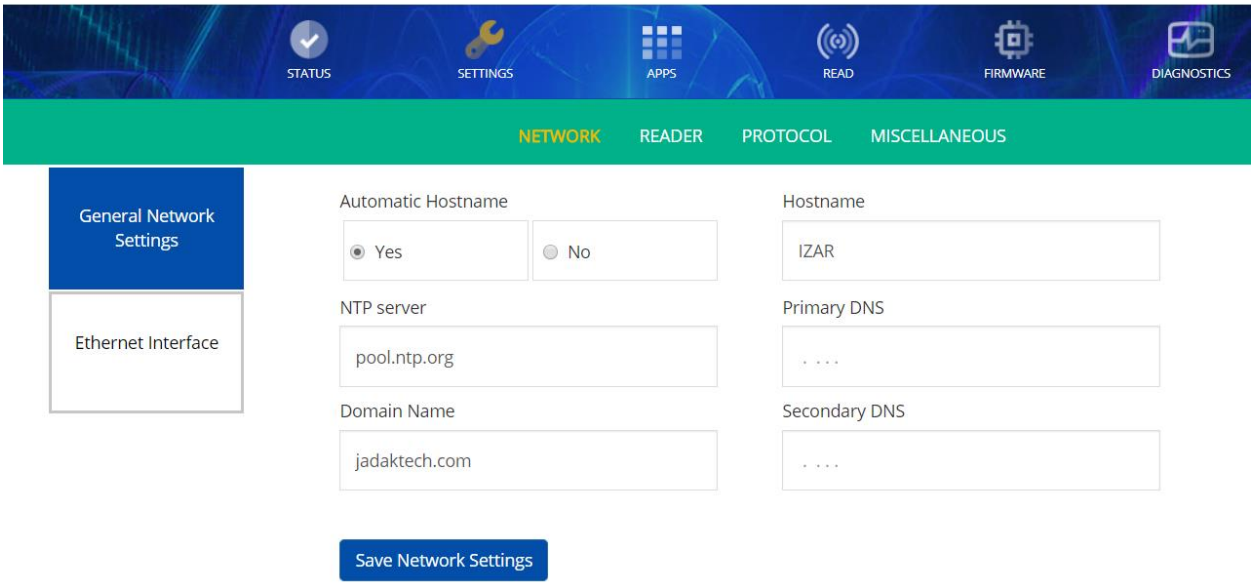


Figure 27: Settings Page

10.1.1.3 Reader (Power) Settings

The Reader Power Settings (Figure 28: Reader Power, Antenna, and Protocol Settings) are used to control the amount of RF Power transmitted by the reader when active. The RF power directly relates to the range at which the reader can "see" tags, the higher the power, the longer the range.

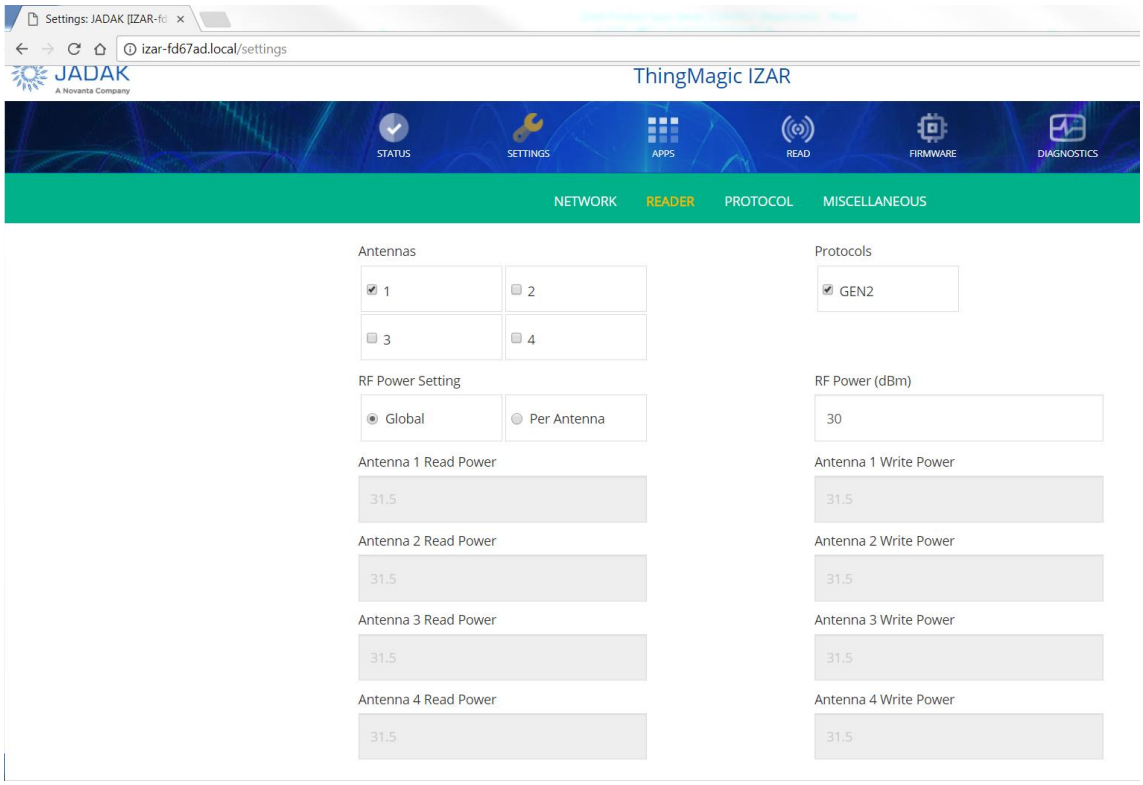


Figure 28: Reader Power, Antenna, and Protocol Settings

Table 2: Reader Power Settings

Setting	Description
Antennas	Select the antennas over which you would like to read. There is currently no automatic antenna detection support in IZAR Readers.
RF Power Setting	Controls the method used for setting power: • **Global** - all antennas will use the same power setting, the value of RF Power. • **Per Antenna** - power for each antenna must be set individually for each and antenna and both read and write power settings, the value of Antenna # Read Write Power.
Antenna # Read Power (dBm)	The power setting used for Read operations on antenna #. This setting is only used when RF Power Setting is set to *Per Antenna*.
Antenna # Write Power (dBm)	The power setting used for Write operations on antenna #. This setting is only used when RF Power Setting is set to *Per Antenna*.

WARNING: Antenna detection is currently not supported in IZAR. If no antennas are selected in the "Settings → Reader screen", no tags will be read.

10.1.1.4 (Gen2) Protocol Settings

The Gen2 Protocol Settings allow for optimization of the Reader's performance based on real world use case requirements. In addition, for advanced users, direct setting of low level Gen2 protocol parameters are available using the Customize option of each section.

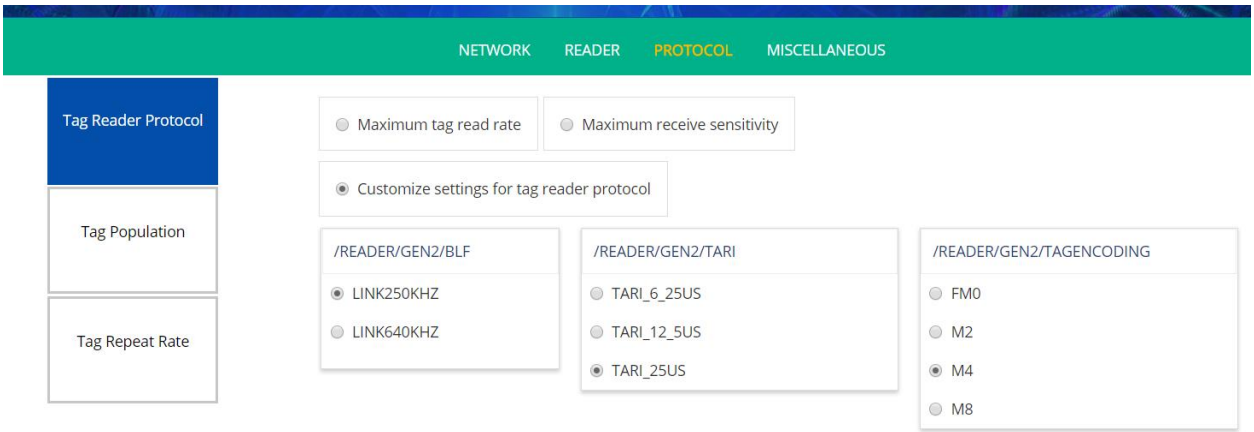
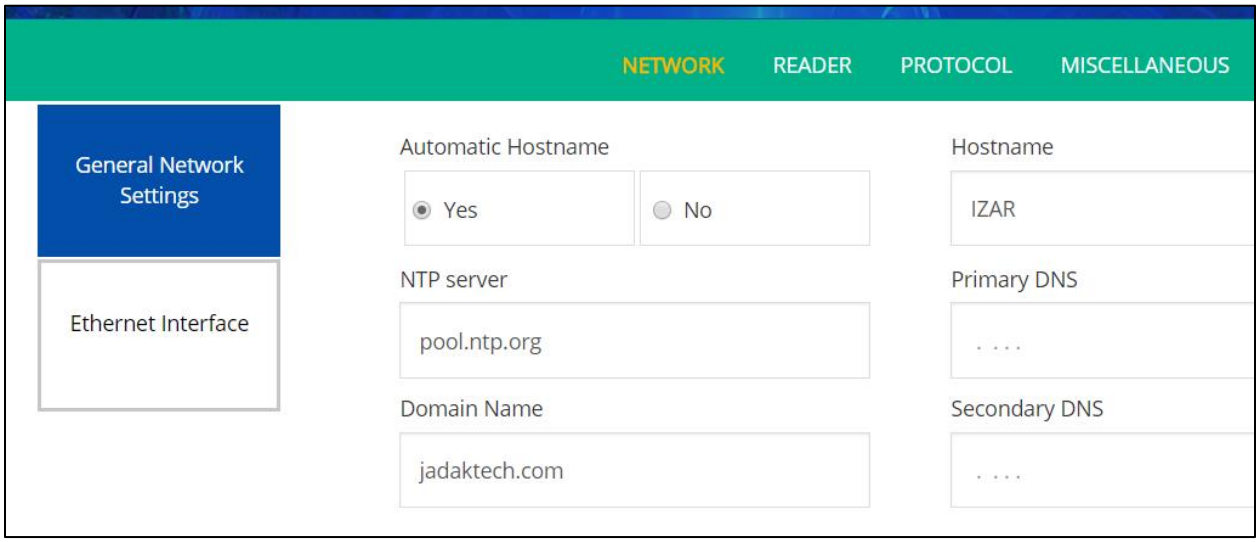


Table 3: Gen2 Protocol Settings

Setting	Description
Tag Reader Protocol Setting	• **Maximum tag read rate** - Performance is optimized for maximizing the speed of communications between the tag and reader, which results in more tags being read faster. • **Maximum receive sensitivity** - Performance is optimized for reading weaker, harder to read tags. Note: Maximum receive sensitivity is only relevant when using Battery Assisted Passive Tags. Most Passive Tag applications are range limited by the tag's ability to power up, not the reader's ability to hear a tag's response. • **Customize** - Set low level Gen2 parameters related to tag to reader communication speed vs sensitivity. See the *Mercury API Programmers Guide* | *Performance Tuning* section for more details on these setting
Tag Population Size Settings	• **Automatically adjust settings as tag population changes** – Reader dynamically adjusts optimization setting depending on the tag population it detects in the field. • **Adjust settings for an approximate population of X** - If the tag population size is relatively well known and consistent, performance can be increased by optimizing for that size. In this case enter the approximate population size for increased performance. NOT IMPLEMENTED IN FIRST RELEASE • **Customize** - Set low level Gen2 parameters related to tag population size. See the *MercuryAPI Programmers Guide* | *Performance Tuning* section for more details on these settings.
Tag Repeat Rate	• **Best Choice for Tag Population** • **Tags repeat as often as possible** - Tags will re-respond to an on-going inventory operation as quickly as possible. • **Tags wait 0.5 seconds to repeat** - Tags will sleep for their "flag persistence" period, typically 0.5 to 2.0 seconds. This is preferred when trying to inventory large populations of tags as it allows "weaker" tags a chance to respond. • **Customize** - Set low level Gen2 parameters related to tag response rate and session usage. See the *MercuryAPI Programmers Guide* | *Performance Tuning* section for more details on these settings.

10.1.1.5 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, to connect to the Reader through its hostname. Typically, when using DHCP, the DHCP server will add the hostname to the DNS server's database.



10.1.1.6 Network Settings: General Network Settings

Table 4: General Network Settings

Setting	Description
Automatic Hostname	Turning on automatic hostname will append the last six numbers (3 bytes) of the Readers address to the text in the hostname field. For example, given a hostname of IZAR and a MAC Address of 00:12:A4:13:47:AC, the automatic hostname would be IZAR-1347ac.
Hostname	This field contains the name of the Reader.
NTP Server	This field contains the address of any network time protocol server(s) (Optional).
Domain Name	This field contains the network domain name.
Primary DNS Server	This field allows the IZAR Reader to resolve host names to IP addresses.
Secondary DNS Server	This field allows the IZAR Reader to resolve host names to IP addresses.

10.1.1.7 Ethernet Interface Settings

Table 5: Ethernet Interface Settings

Setting	Description
Primary IP Address Source	If set to “DHCP”, the Reader will automatically obtain its LAN IP, Netmask, and Gateway addresses from a DHCP Server.
Use Fallback IPsource if DHCP Fails	If set to Yes, the reader will use either a static or link-local address if the IP address cannot be obtained through DHCP.
Other/FallbackInterface	Selects whether a static address or link-local address is used either as a primary IP address source or if DHCP fails.
Use DHCP-Server supplied hostname	If set to Yes, the manually supplied hostname (see Hostname) will be overridden by the hostname supplied by the DHCP Server.
Vendor Class Identification	Fill this in if your DHCP server needs this information to select which IP address to assign the reader.
LAN IP Address	If a static IP address is configured as either a primary or fallback method, you should manually enter the LAN address.
LAN Gateway	Unless all devices are on a local network, you must enter the IP address of an IP router on your local network (is address must be within the same network as all other local devices.
LAN IP Netmask	This is the subnet mask IP address used to determine to which TCP/IP subnet the Reader belongs. Devices in the same subnet can communicate locally without going through a router. Conversely, if two devices are configured for different subnets, they will seek a router even if on the same physical network.

10.1.1.8 Miscellaneous Settings

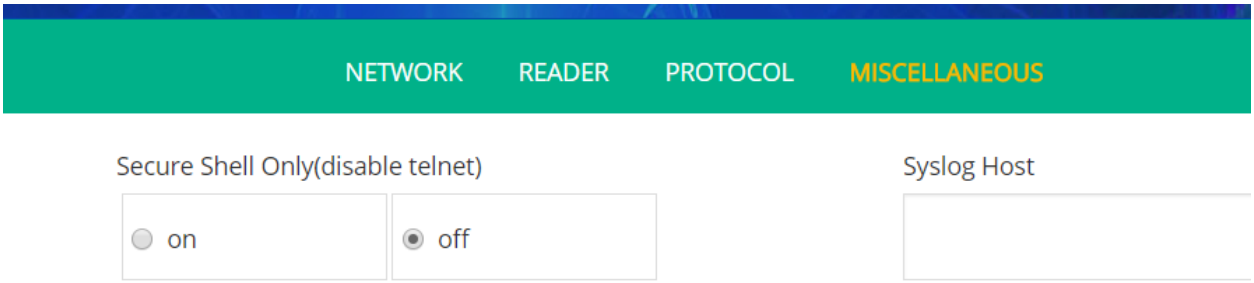


Figure 29: Miscellaneous Screen

10.1.1.9 Security Settings

The security settings specify whether insecure protocols may be used to access the console and specifies the location of a syslog server to which all Reader events may be sent.

Table 6: Boot Option Settings

Setting	Description
Secure Shell Only	Turn on if you want remote console access over the network to only be done over a secure link provided by the SSH protocol. (Rather than telnet).
Syslog Host	This is the hostname of the server used for remote logging. All log levels in syslog are sent to this host.

10.1.1.10 Diagnostics Page

The Diagnostics page (Figure 24) provides information that is most beneficial for troubleshooting. The Log files may be viewed (which allows them to be copied) or cleared via this screen. There is also a button which allows the user to reboot the module. The web link will be broken while the reader reboots, but will automatically get reestablished unless the IP address of the reader changes with the reboot.

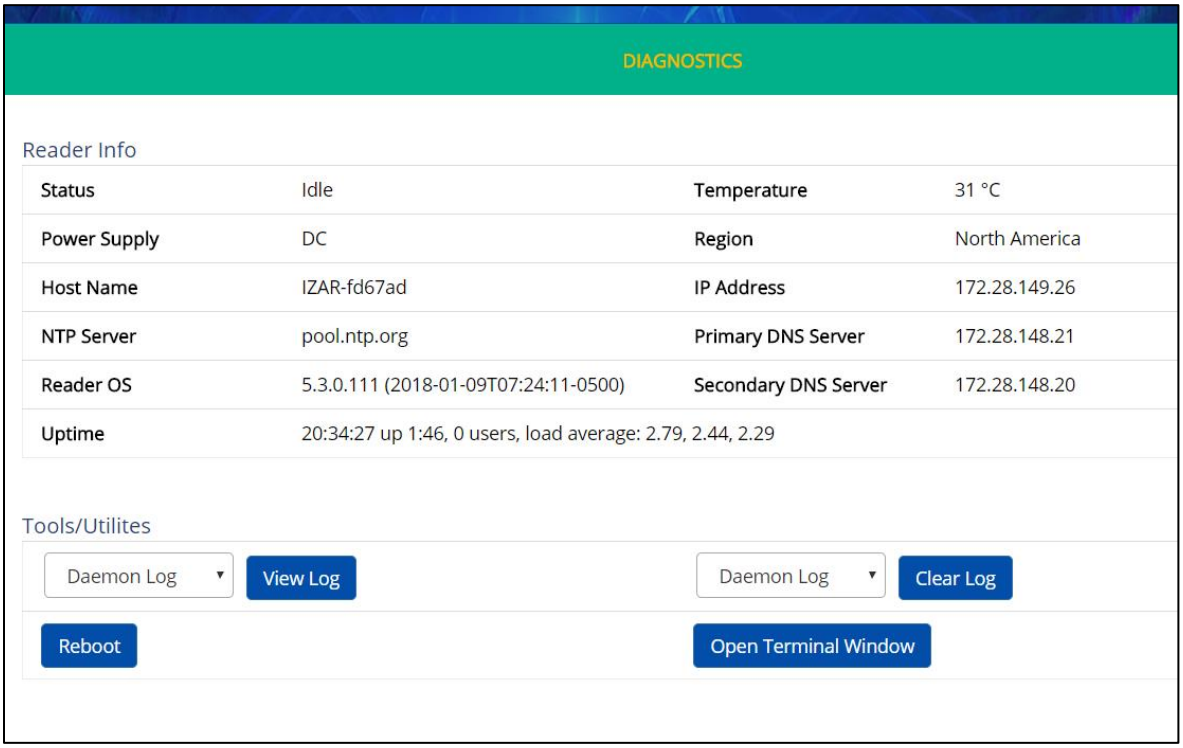


Figure 30: Diagnostics Page

10.1.1.11 Firmware Upgrade Utility

IZAR provides the Firmware Upgrade Utility for loading new firmware onto the reader. A single ".tmfw" upload file will have name such as:

tmreader-5.3.0.126.tmfw

Reboot the reader after installing this file. (Your previous firmware will remain active until you do.)

In some cases, firmware might be distributed as several ".deb" files. Here are the typical files that comprise a complete set:

tmapp-5.3.0.126.deb
tmreader-core-5.3.0.126.deb
tmrfid-5.3.0.126.deb
tmsafe-5.3.0.126.deb
tmweb-5.3.0.126.deb

Usually order of installation of the individual files does not matter and the reader need only be rebooted after all files are uploaded. (Not all individually updated file versions will appear in the Status screen until the reader is rebooted.)

NOTE – The "Revert to default settings" button on this browser page can also be used to reset the reader without upgrading firmware

To upgrade firmware:

1. Click the Firmware link on the navigation menu. The Firmware Update page appears, as shown in Figure 25.

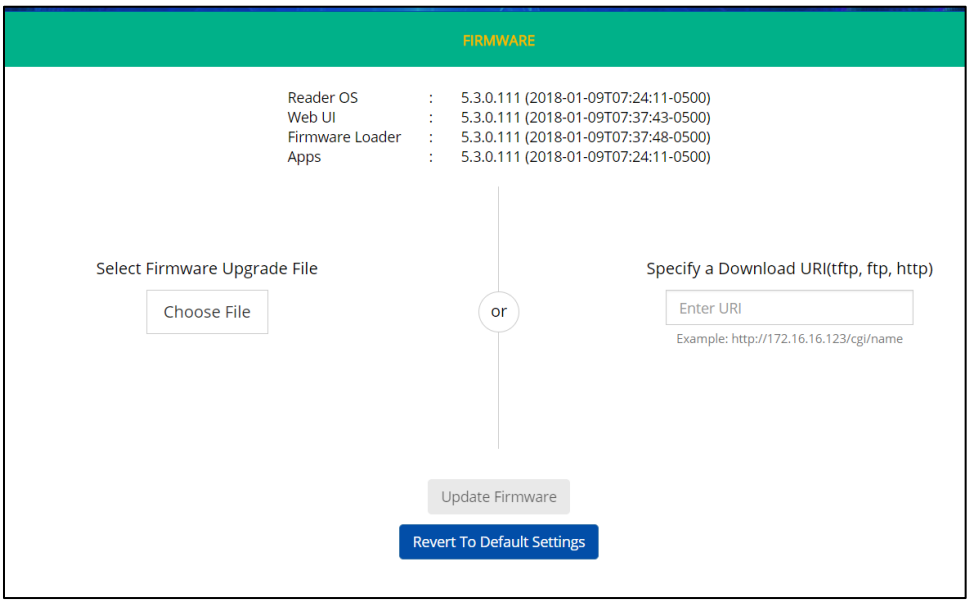


Figure 31: IZAR Firmware Update Page

2. Do one of the following:
   a. In the File upload field, enter the complete URL network pathname of the firmware file, or
   b. Click Browse to locate the firmware file.

CAUTION: If you select "Revert to default settings", 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. 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.

4. Restart the reader to activate the new firmware.
   The old firmware remains active until the Reader is restarted.

10.2 Protocol Support

Using the MercuryAPI ReadPlan classes the IZAR can be configured to perform various Read operations. The following describes protocol specific configuration options supported on the IZAR. See the *MercuryAPI Programmers Guide* and language specific reference guides for details on supported Gen2 command functionality.

ISO 18000-6C (Gen2)

Protocol Configuration Options

The IZAR supports multiple ISO-18000-6C profiles including the ability to specify the Link Frequency, encoding schemes, Tari value and modulation scheme. The protocol options are set in the MercuryAPI Reader Configuration Parameters (/reader/gen2/*). The following table shows the supported combinations:

ISO-18000-6C Protocol Options

Backscatter Link Frequency (kHz)	Encoding	Tari (usec)	Modulation Scheme
250	Miller (M=8)	12.5	PR-ASK
250	Miller (M=4)	12.5	PR-ASK
250	Miller (M=2)	12.5	PR-ASK
250	FM0	12.5	PR-ASK
250	Miller (M=8)	25	PR-ASK
250	Miller (M=4)	25	PR-ASK
250	Miller (M=2)	25	PR-ASK

250	FM0	25	PR-ASK
250	Miller (M=8)	25	PR-ASK
640	FM0	6.25	PR-ASK

10.3 ISO 18000-6B

10.3.1.1 Protocol Configuration Options

The IZAR, with appropriate license purchase, supports multiple ISO-18000-63 (Gen2v2) profiles including the ability to specify the Return Link Frequency, encoding, Forward Link Rate and modulation scheme. The protocol options are set in the MercuryAPI Reader Configuration Parameters (/reader/iso18000-6b/*). The following table shows the supported combinations:

ISO-18000-6B Protocol Options

Return Link Freq (kHz)	Return Encoding	Forward Link Freq (kHz)	Forward Encoding
40	FM0	10	Manchester
40	FM0	10	Manchester
160	FM0	40	Manchester
160	FM0	40	Manchester

10.3.1.2 AEI ATA

Support for AEI ATA protocol is enabled by installing an optional license key. There are currently no unique settings associated with AEI ATA protocol. Licenses may be installed using the Universal Reader Assistant utility. This is available on the JADAK support web site.
https://www.jadaktech.com/documentation/rfid/universal-reader-assistant-utility/

10.4 Tag Read Meta Data

When tags are being inventoried by the IZAR, the tag read results may incorporate information other than the Tag ID. This information can be the data contained in another tag memory location or information about the conditions at the time the tag was read. The specific meta data available for each tag ID is given in the following table.

Tag Read Meta Data

Meta Data Field	Description
Antenna ID	The antenna on which the tag was read. If the same tag is read on more than one antenna there will be a tag object returned for each antenna on which the tag was read.

Read Count	The number of times the tag was read on [Antenna ID].
Timestamp	The time the tag was read. For accurate time an NTP server should be configured.
Tag Data	When reading an embedded TagOp is specified for a Read- Plan the TagReadData can contain up to 128 bytes of data returned for each tag. Note: Tags with the same TagID but different Tag Data can be considered unique and each get a Tag Buffer entry if set in the reader configuration parameter /reader/tagReadData/ uniqueByData. By default it is not.
Frequency	The frequency on which the tag was read
Tag Phase	Average phase of tag response in degrees (0°-180°)
LQI/RSSI	The receive signal strength of the tag response in dBm.

For timed (synchronous or pseudo-asynchronous) reads, the information will apply to the first time this tag was read (or optionally, for the read with the highest RSSI) with a tag count that represents the number of times this tag responded during the read cycle.

For asynchronous (continuous) reading, a new record with appropriate meta data will be generated each time the tag responds so the read count will always be ‘1”.

11 Reader RF Power

During initial installation, the reader must be properly configured to use the correct RF power to comply with FCC or other regional regulations. DO NOT increase the power beyond this level.

The IZAR supports separate read and write power level which are command adjustable via the MercuryAPI. Power levels must be between:

- Minimum RF Power = 0 dBm
- Maximum RF Power = +31.5 dBm

Power Settings for Authorized Antennas and Cables

This device has been designed to operate with the antennas listed in Authorized Antennas list using the cables in the Authorized Cables list. For any combination of antenna and cable the maximum RF power is determined from antenna gain (Max Linear Gain value from antenna list) and antenna cable loss (Insertion Loss value from cable list) using the formula:

Pmax = 36 dBm - Antenna Gain + Cable Loss

For more information about setting the RF power, refer to Setting the Reader RF Power.

NOTE: Be sure to read Compliance and IP Notices to maintain compliance with FCC or other applicable regional regulations.

11.1 Setting the Reader RF Power

To set the Reader RF power:

1. Log on to the Reader using your browser.
2. The IZAR Status Page appears, as shown in the *Figure 16*.
3. Click on the Settings icon. Click on the “Reader” header. By default, the value for RF output power is 31.5 dBm for all functions, on all antennas.
4. Enter the maximum setting based on your cable type, length, and antenna type.
5. Scroll down to the bottom of the screen and click Save changes button.
   The Settings Page will reload automatically after the settings have been saved.

Optionally, the RF power may be set at a different level for read operations than for write operations or at a different level per antenna.

12 Thermal Considerations

When transmitting at its highest RF power levels, the enclosure temperature of the IZAR Reader will rise. Industry guidelines do not consider any surfaces whose temperature is above 70 C to be safe to touch. If the IZAR Reader is operated at elevated ambient temperatures, care should be taken that it is mounted to conductive material to limit how high the temperature of the enclosure rises.

13 Mounting the Reader

See Appendix B: IZAR Dimensions for mounting hole locations and dimensions.

CAUTION!

If there is any chance of dust or water exposure, the IZAR should be mounted in an appropriate water-tight enclosure.

13.1 Ceiling or Wall

Follow these steps to mount the reader on a ceiling or wall:

1. Hold the reader in its mounting location and mark the position of the four mounting screws.
2. Drill holes for the screws and install wall or ceiling anchors if required. For ceiling mount, use only anchors specifically designed for ceilings.
3. Hold reader over holes and insert the screws and tighten until almost flush with the wall.
4. Tighten the screws.

13.2 Variables Affecting Performance

Reader performance may be affected by the following variables, depending on the site where your Reader is being deployed:

- Environmental
- Tag Considerations
- Multiple Readers

13.3 Environmental

Reader performance may be affected by the following environmental conditions:

- Metal surfaces such as desks, filing cabinets, bookshelves, and wastebaskets may enhance or degrade Reader performance.
- Antennas should be mounted far away from metal surfaces that may adversely affect the system performance.
- Devices that operate at 900 MHz, such as cordless phones and wireless LANs, can degrade Reader performance. The Reader may also adversely affect the performance of these 900 MHz devices.

- Moving machinery can interfere the Reader performance. Test Reader performance with moving machinery turned off.
- Fluorescent lighting fixtures are a source of strong electromagnetic interference and if possible should be replaced. If fluorescent lights cannot be replaced, then keep the Reader cables and antennas away from them.
- Coaxial cables leading from the Reader to antennas can be a strong source of electromagnetic radiation. These cables should be laid flat and not coiled up.

WARNING!

The IZAR antenna ports may be susceptible to damage from Electrostatic Discharge (ESD). Equipment failure can result if the antenna or communication ports are subjected to ESD. Standard ESD precautions should be taken during installation to avoid static discharge when handling or making connections to the IZAR Reader antenna or communication ports. Environmental analysis should also be performed to ensure static is not building up on and around the antennas, possibly causing discharges during operation.

13.4 Tag Considerations

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

- Application Surface: Some materials, including metal and moisture, interfere with tag performance. 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. The antenna is circularly polarized, so it reads face-to but not edge-to.
- Tag Model: Many tag models are available. Each model has its own performance characteristics.

13.5 Multiple Readers

The Reader adversely affect performance of 900 MHz devices. These devices also may degrade performance of the Reader.

Antennas on other Readers operating in close proximity may interfere with one another, thus degrading performance of the Readers.

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.

Low read rate settings (high Tari value, low BLF value, high “M” value) will reduce channel-to-channel interference

NOTE: Performance tests conducted under typical operating conditions at your site are recommended to help optimize system performance.

14 IZAR Specifications

The following are the specifications for the IZAR Reader.

14.1 UHF RFID Antenna Interface

Interface: Four RP-TNC Connectors

RF Power Output: Separate read and write levels, adjustable from 0 dBm to 31.5 dBm (1.4 W)

Frequency: Hop table with up to 62 entries, configurable in 50KHz steps, accommodating the following ranges (hardware dependent):

– 902-928 MHz (FCC; NA, SA)
– 865.6-867.6 MHz (ETSI; EU)
– 865-867 MHz (MCIT; India)

14.2 Power

If designing a power source for the IZAR Reader, use the worst-case maximum power consumption figures. If estimating battery life for a power source connected to the IZAR Reader, use the typical figures. Both are provided below. Note that external devices connected to the IZAR Reader can impact the power consumption

External DC Power: 9 to 30 VDC supply voltage. Maximum DC power under all worst case conditions: 17 W. This is based on 13 W being consumed by the IZAR Reader itself and 5 W being supplied to external peripherals that are connected to the IZAR Reader. It is recommended that DC supplies connected to the IZAR Reader be capable of supplying 17 W to avoid a brown-out condition under any circumstances.

Neglecting external peripheral circuitry being powered by the IZAR Reader, typical maximum DC power consumption when transmitting at +31.5 dBm is 13.0 W into an approved antenna.

If power is being drawn from the host USB port, add as much as 2.5 W to the typical power consumption when transmitting or at idle. If power is being supplied by the 5V GPIO power source, add as much as 2.5 W to the typical power consumption to account for this. Therefore, the typical power consumption when transmitting will vary between 13 and 17 W depending on how the IZAR Reader is used.

NOTE: If a third-party DC Power supply is used it must meet the following criteria:

- Be UL Listed
- Meet the above operating specs
- The output must comply with SELV and LPS characteristics

Have a maximum operating ambient temperature that meets or exceeds the intended IZAR operating temperatures as covered under the UL Listing of the power supply.

14.3 Environmental

Operating Temperature: -40°C to +60°C

NOTE: If an external DC power supply with a lower operating ambient temperature, as covered under the UL Listing of the power supply, is used then the operating ambient temperature of the IZAR would be reduced accordingly.

Storage Temperature: -40°C to +85°C

Altitude: Less than 200 meters

14.4 Physical Dimensions

194 mm L x 138 mm W x 33 mm H

(7.6 in L x 5.5 in W x 1.3 in H)

0.7 kg (1.51 lbs)

See Appendix B: IZAR Dimensions for exact dimensions.

14.5 Supported UHF Tag Protocols

EPC Class 1 GEN2v2 (ISO 18000-63) with DRM

ISO 18000-6B (Optional)

IP-X (Optional)

AEI ATA (Optional)

14.6 Data/Control Interfaces

Connectors:

- RJ45 (10/100 Base-T Ethernet)
- USB Type B (console port)
- USB Type A (accessory port)
- 12-pin terminal block (GPIO interface)
- 2-pin terminal block (DC power)
- Micro SD card interface (has been tested with cards of up to 128 GB capacity)
- HDMI video port

Indicators, switches, and GPIOs:

- One two-color status LED
- Four antenna status LEDs
- Two LAN status LEDs
- Isolated GPIOs: 4 Inputs & 4 Outputs plus +5 VDC and ground references

14.7 Performance

Read Rate: Over 750 tags/second

Read Distance: Over 30 ft (9m) read distance with a 6dBi antenna (emitting 36 dBm EIRP) with a tag which has at least -15 dBm receive sensitivity. Typically, antenna can be up to 4 meters from the reader as well if the RF output power is set to +31.5 dBm.

14.8 Regulatory & Safety

FCC 47 CFR Ch. 1 Part 15

Industrie Canada RSS-21 0

ETSI EN 302 208 V1.1.1 and V1.2.1 (with corresponding PLT-RFID-IZ6-EU hardware)

ROHS Compliant, UL Listed

14.9 Processor

1 GHz TI ARM Cortex AB (AM335x)

14.10 User Memory

4GB Flash

512MB DD RAM

14.11 Real Time Clock

Backup time: 1 week at room temperature

14.12 Operating System

Debian Linux kernel version 7.9

15 Compliance and IP Notices

15.1 Regulatory Compliance

EMC FCC 47 CFR, Part 15

Industrie Canada RSS-210

15.1.1.1 Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

W A R N I N G !

Operation of the IZAR reader requires professional installation to correctly set the transmit power for the RF cable and antenna selected.

15.1.1.2 Industrie Canada (IC)

Under Industrie Canada (IC) regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by IC. 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 necessary for successful communication.

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by IC to operate with the antenna types listed in Authorized Antennas and Authorized Cables tables with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device

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.

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.

This device has been designed to operate with the antennas and cables listed in Authorized Antennas and Authorized Cables tables. Antennas or cables not included in these lists are strictly prohibited for use with this device.

To comply with IC's RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 34 cm is maintained between the radiator (antenna) & people in front of the antenna at all times and must not be co-located or operating in conjunction with any other antenna or transmitter unless appropriate additional proximity restrictions are imposed.

15.1.1.3 Industrie Canada

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

Le fonctionnement de l' appareil est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas perturber les communications radio, et

2. Cet appareil doit supporter toute perturbation, y compris les perturbations qui pourraient provoquer son dysfonctionnement.
   Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de façon que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pas celle nécessaire pour une communication réussie.
   Au but de conformer aux limites d'exposition RF pour la population générale (exposition non-contrôlée), les antennes utilisés doivent être installés à une distance d'au moins 34 cm de toute personne et ne doivent pas être installé en proximité ou utilisé en conjonction avec un autre antenne ou transmetteur.

15.2 EU RED Declaration of Conformity

Novanta
The Innovation Advantage

European Union Declaration of Conformity for IZAR IZ6-EU RFID Reader

Manufacturer:	Novanta Corporation
Address:	125 Middlesex Turnpike, Bedford, MA 01730
Object of the declaration: Product Model Numbers:	IZAR, IZ6-EU
Product Description:	865-869 MHz Radio Frequency Identification (RFID) Reader / Interrogator with four RF ports, for network applications.

This declaration of conformity is issued, under the sole responsibility of the manufacturer.

The object of the declaration described above is in conformity with the following relevant European Union harmonization Legislation.

Directives:	
Identifier	Date
2014/53/EU	16 April 2014
2011/65/EU w/ Amendments M1-M30	19 April 2016

The object described above conforms to the requirements of EU directives through full compliance with the following standards:
Harmonized European Standards

Standard	Amendments
ETSI EN 302 208 V3.1.1 (2016-11)	None
ETSI EN 301 489-3 V2.1.0 (2016-09)	None
CENELEC EN 50581:2012	None

It is required that IZ6-EU radio frequency power be set to not more than +33 dBm, plus antenna cable loss in dB, minus antenna gain in dBdL, to allow the object to operate as intended, and to be covered by this EU declaration of conformity.

Authorised on Behalf of NOVANTA Corporation:	
Name	Eva Gravius
Function	VP Engineering
Address	North Syracuse, New York
Date	February 12, 2018
Signature	

Document No. CONF-10002- Rev A

Novanta Corporation
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16 Appendix A: IZAR Antenna and Cable Information

16.1 Authorized Antennas

To comply with FCC's RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 23 cm is maintained between the radiator (antenna) & people in front of the antenna at all times and must not be co-located or operating in conjunction with any other antenna or transmitter unless appropriate additional proximity restrictions are imposed. You must also provide strain relief for all Reader connections.

IZAR is capable of up to +31.5 dBm conducted power on the housing RF connector and requires professional installation. IZAR can only be operated with JADAK-approved antennas and can radiate no more than 36 dBm EIRP per FCC Part 15.247 regulations. The IZAR output power can be increased to provide the maximum allowable EIRP subject to a maximum conducted power allowance of 30 dBm at the antenna connector. The maximum allowable output power of the Reader can be set to satisfy both the conductor and radiated maximum criteria.

The only antennas authorized by the FCC for use with the IZAR Reader are listed in the table below. FCC permits using antennas of a similar type as long as their maximum linear gain in any orientation is equal to or less than that given for the authorized antennas in the chart below. Detailed information on each antenna is available from their respective manufacturers. Antennas having a linear gain greater than 6 dBiL are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

16.1.1 Authorized Antennas

Table 7: Authorized Antennas

Manufacturer	Type	Manufacturer Part Number	Max. Linear Gain (dBiL)
Laird	Patch	S9025P	4.3
Laird	Patch	S8658WPL	6.0
MTI	Patch	MT-262013	6.0
MTI	Patch	MT-242043	6.0
MTI	Patch	MT-242025	5.1
Axiom Wireless Tech	Ceramic Patch	MPAC29SE921P-TA	-3.0
Laird	Dipole	FG9026	6.0

NOTE: Only similar antennas with the same or lower gain may be used with the IZAR Reader without violating FCC regulations. It is the responsibility of the user to comply with this requirement.

16.2 Authorized Cables

The following table contains the cable loss values for authorized shielded coaxial cables provided by JADAK.

Cable Description	ThingMagic Part Number	Insertion Loss
6' RTNC to RTNC Cable	CBL-P6	0.8 dB

12' RTNC to RTNC Cable	CBL-P12	1.5 dB
20' RTNC to RTNC Cable	CBL-P20	2.4 dB
25' RTNC to RTNC Cable	CBL-P25	3.0 dB

17 Appendix B: IZAR Dimensions

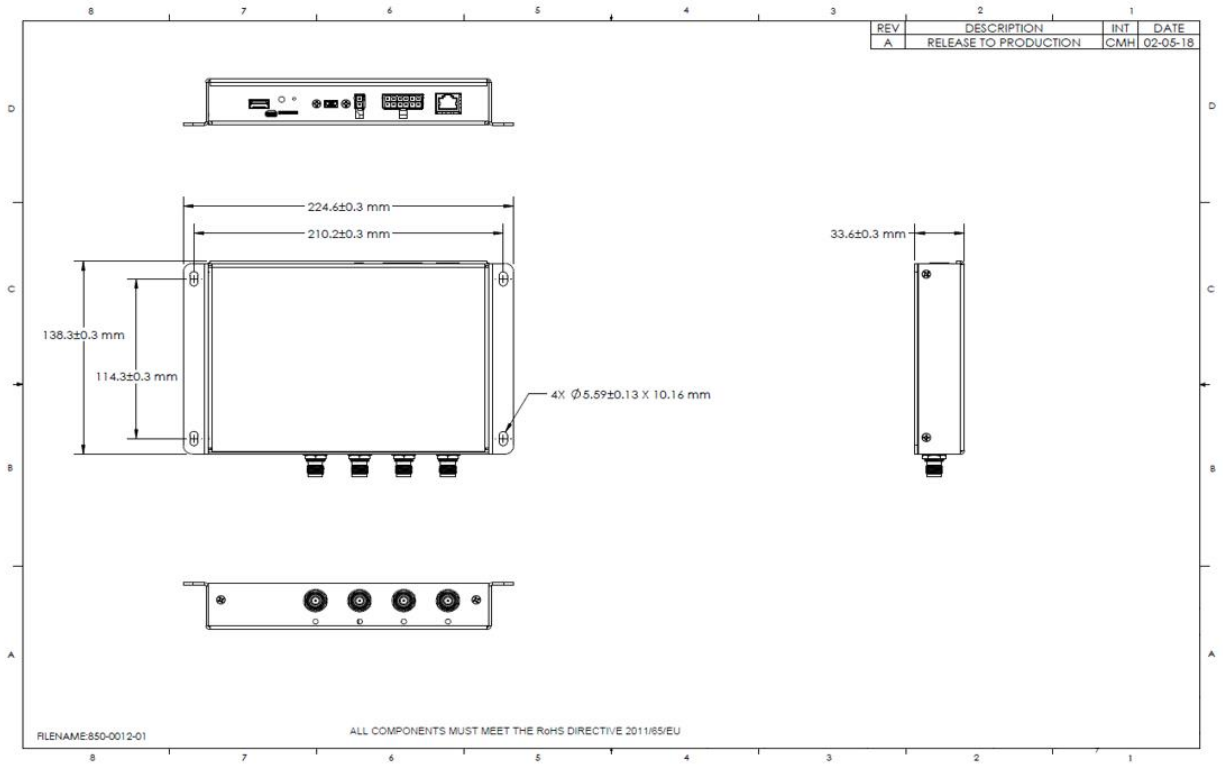


Figure 32: IZAR Product Dimensions

18 Appendix C: Advanced Administration

18.1 Changing console/root password:

To change the root password, used by the command-line interface and console access, use standard Linux "passwd [userid]" command.

```
debian@IZAR-c8b641:~$ passwd
Changing password for debian.
(current) UNIX password:
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
```

19 Appendix D: Troubleshooting

19.1 Troubleshooting Table

Table 8: Common Problems and Solutions

Problem	Path to Solution
Cannot connect to reader over network	• Check your network settings to make sure you're trying the correct IP address. The easiest way to do this is to connect to the console port with a USB cable. The login prompt is preceded by the current IP addresses that the reader recognizes, for convenience. • If the settings are wrong, try to Using Safe Mode to get a known network configuration, or Reset to the Default Configuration and start the configuration over. • The MercuryAPI and Query applet communicate using the LLRP interface which uses network port 5084. Verify 5084 is not being blocked by the network fire wall.
Reader is not reading tags	• Verify LEDs are blinking according to Interpreting the Reader Indicator LEDs If they are, indicating active RF, make sure tags are in range. • Check antenna cables • Try known good Gen2 tags • Increase Reader RF Power
Reader error LED stays on	Following Collecting Diagnostic Data for Support and send to support.
Read "Performance" is slow	Performance, as it relates to tag reading, is very use case dependent. Typically, it comes down to whether you are trying to read lots of tags once or a few tags repeatedly. If the reader settings aren't correct for your use case the performance will appear poor. • See the *MercuryAPI Programmer's Guide* | *Performance Tuning* section for details about settings. • Use the *Universal Reader Assistant* | *Options* | *Advanced...* | *Gen2 Settings* to modify the settings for your use case.
Errors after a Firmware Upgrade	Try reinstalling the firmware with "Revert to default settings" Selected.

19.2 Reset to the Default Configuration

If you are experiencing a problem with the reader and are having difficulty pinpointing the cause, it is useful to return the reader to a known state. The easiest method of doing this is to navigate to the Firmware screen and press the button labeled, “Revert to default settings”, shown in *Figure 25*.

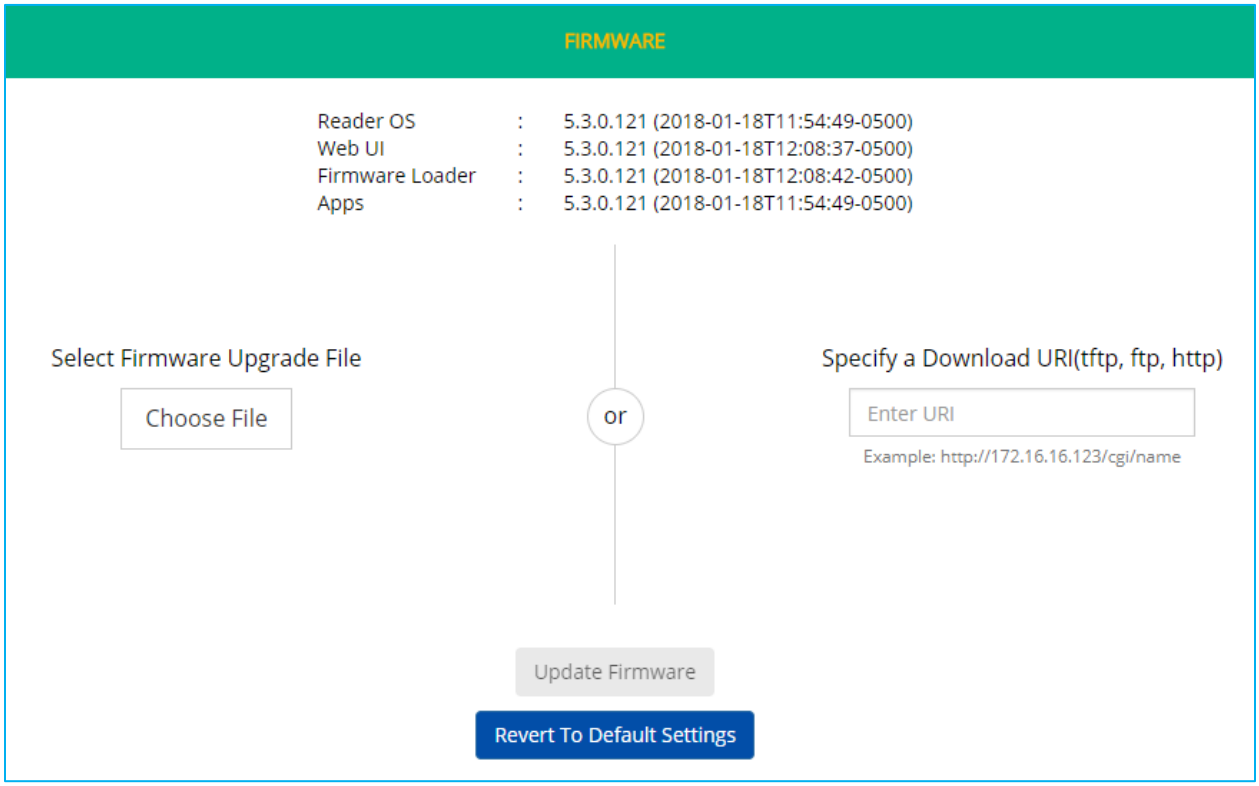
- To reboot, hold for ~1 second, then release
- To reboot to safe mode, hold for ~5 seconds, then release

Note on SafeMode:

- The IZAR status LED also toggles red/green every 250ms while in safe mode
- IZAR safe mode causes the “safe web page” to run on the normal web port (80), as well as its usual 8888. The idea is that if the regular web interface is damaged, this allows the “safe” one to take over.

19.3 Safe Mode

If the standard web interface should become corrupted such that the reader firmware cannot be updated, a backup web page is available. It is accessed the same as the standard web page, but with a port number of “8888”. To do this, you add “:8888” after the IZAR host name or IP address of the URL you are accessing. For example, *http://10.8.80.61:8888/firmware* or *http://IZAR-b65b2f:8888/firmware*. You will be presented with the login prompt again. The only screen available will be the one for updating firmware.



Collecting Diagnostic Data for Support

When experiencing problems connecting to the IZAR or performing RF (reading, writing) operations, it will be necessary to gather the following information to help diagnose the problem. This information will often be the first thing requested when reporting a problem to technical support.

Collect the following:

1. **Diagnostics Status and Logs**: Save the contents of the Diagnostics Page and the output from the Diagnostics Page | *View Log* button.

2. **IZAR Serial Number**: See the 2d barcode label.

3. **Controlling software**: any details about the software used to control the reader. LLRP based middleware, MercuryAPI app (what version and language), platform, etc.

4. **Physical Configuration**: any details available about the number and types of antennas connected, cables used, power supply, etc.

5. **Environment**: any details about the physical environment the IZAR is being used/tested in. Temperature, humidity, vehicle mounted, office, etc.