RediLink
Edge-of-Network Gateway

User Manual

elecsys
REDILINK

Product Information

Full information about other Elecsys products is available on our website at www.elecsyscorp.com

Useful Contact Information

Product Support
Tel: +1-913-890-8905
Toll free: +1-800-338-8969
Fax: +1-913-982-5766
Email: idc-support@elecsyscorp.com

Headquarters, Sales, Support & Manufacturing
Elecsys Corporation
846 N Mart-Way Court
Olathe, KS 66061
Tel: +1-913-647-0158
Fax: +1-913-982-5766
Email: info@elecsyscorp.com

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Contents

1 Revision History

Revision	Comments
A	Initial release of RediLink User Manual

2 Preface

2.1 Scope of this Manual

This manual describes the standard features and hardware of the Elecsys RediLink Gateway products and the RediLink Manager configuration software.

2.2 Name Conventions

All numbers are in decimal unless otherwise indicated. Where a number is prefixed by '0x', the value is in hexadecimal format.

2.3 Electrostatic Discharge (ESD) Protection

These units contain devices that could be damaged by the discharge of static electricity. At all times, please observe industry standard ESD precautions when handling the unit.

2.4 Electromagnetic Compatibility (EMC)

The RediLink is classified as a component with regard to FCC EMC regulations, and it is the user's responsibility to ensure that systems using the product are compliant with the appropriate EMC standards.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2.4.1 Radio Frequency Requirements

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.
3. To comply with RF safety requirements, you must maintain a distance of 20 cm from the antenna when operating the device.
4. Each antenna of this device must not be co-located within 20 cm of any other antenna or transmitter. Antenna requirements are listed in Cellular Antenna on page 24.

The RediLink may be supplied with an EVDO cellular module (FCC ID: RI7DE910-DUAL), or with a GSM cellular module (FCC ID: RI7HE910).

Changes or modifications to the product not expressly approved by Elecsys Corporation could void the user's authority to operate the equipment.

2.5 Disclaimers

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3 Introduction

The RediLink series Edge-of-Network gateways are rugged, field proven, and designed for remote data communication applications. A single RediLink device creates a seamless path from a remote site to an enterprise data host system and enables efficient real-time data acquisition, protocol conversion, field data security, and bandwidth management throughout an enterprise data communication network.

Features:

- Built-in support for numerous communication protocols
- Remote “on the fly” programmability and configuration over secure connection
- Compatible with Report-by-Exception, Publish/Subscribe, and Poll/Response data architectures
- Optional integrated cellular data modem
- Data security (TLS, Firewall)
- Terminal Server – serial to IP conversion
- MQTT for message oriented middleware

The RediLink features a selection of industry standard and legacy communication protocols. RediLink gateways interface with both serial and Ethernet-based field devices to route real-time data through enterprise data systems by utilizing either an Ethernet or cellular data connection. The user-friendly configuration utility enables easy configuration of RediLink devices for a wide variety of applications.

Utilizing its native MQTT communications protocol, the RediLink interfaces directly with message oriented middleware, data brokers, new and legacy host systems, cloud hosted applications, and many other enterprise applications. In addition, Elecsys offers an optional OPC Server middleware application that greatly expands the capabilities of existing enterprise systems.

This manual describes the hardware, technical specifications and installation instructions for the Elecsys RediLink Gateway, and the installation and use of the RediLink Manager software.

3.1 RediLink Model Options

RediLink Gateways have a variety of hardware and software options, depending on the interface required for the device or host connection. Some of these optional features are described below:

Device port	RS-232/485/422 serial, or Ethernet
Host port	Ethernet, or cellular modem (EVDO or GSM/HSPA)

Please contact Elecsys to obtain pricing for a particular configuration of optional equipment or software. The table below gives model numbers for several standard part numbers of the RediLink family of products.

Part Number	Description
RL-10E-00-00	RediLink 10E – serial device to Ethernet host
RL-10C-00-00	RediLink 10C – serial device to cellular host (EVDO)
RL-10C-22-00	RediLink 10C – serial device to cellular host (GSM/HSPA)
RL-20E-00-00	RediLink 20E – Ethernet device to Ethernet host
RL-20C-00-00	RediLink 20C – Ethernet device to cellular host (EVDO)
RL-20C-22-00	RediLink 20C – Ethernet device to cellular host (GSM/HSPA)

3.2 Accessory Options

Elecsys provides several accessories for use with the RediLink. Please contact Elecsys to obtain pricing and model numbers for accessory equipment.

RediLink Accessories	
Power Cable	6.5 foot cable for connection from RediLink to power source (supplied with RediLink)
DIN Rail Mounting Kit	Kit for mounting enclosure to a standard DIN rail (supplied with RediLink)
DB-9 Screw Terminal Adapter	DB-9 to 10-way screw termination for external wiring to RediLink serial port (P/N 15-0429-09, supplied with RediLink 10E and 10C)

4 Specifications

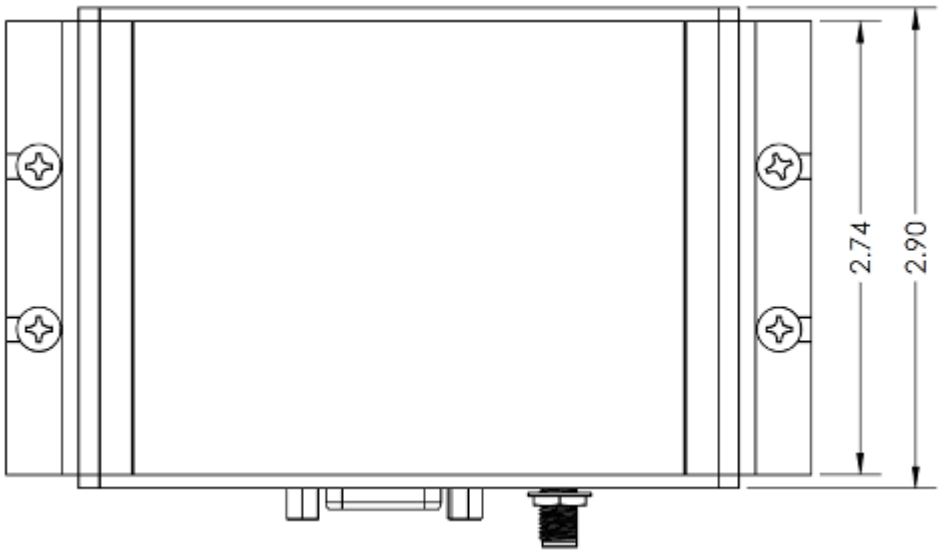
4.1 Enclosure / Dimensions

Model	RediLink
Width	4.88” (12.40 cm)
Length	2.90“ (7.85 cm) (excluding connectors)
Height	1.35” (3.43 cm) (excluding DIN rail mount feet)
Weight	0.5 lbs (0.23 kg)

4.1.1 Dimensions

The mechanical and mounting dimensions of the RediLink are shown below (all dimensions in inches).

Top



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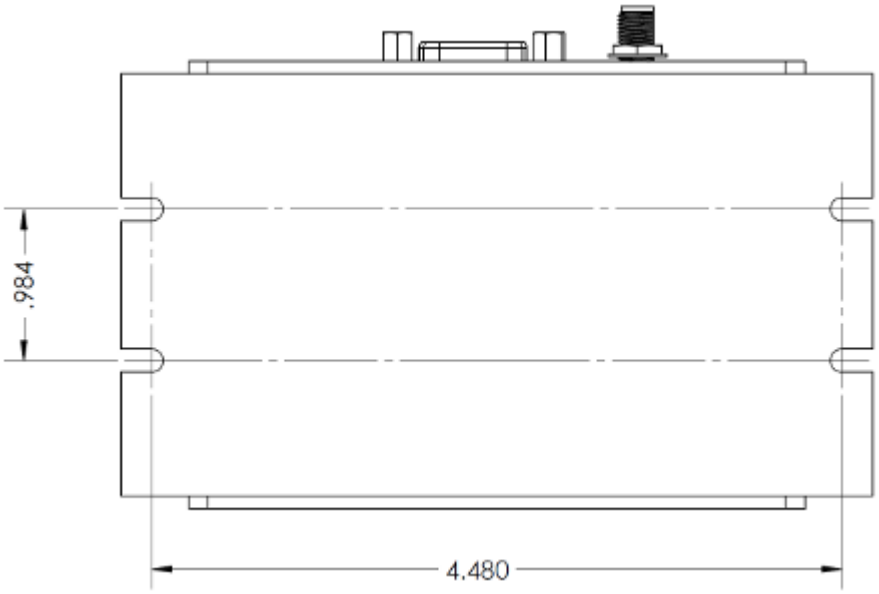
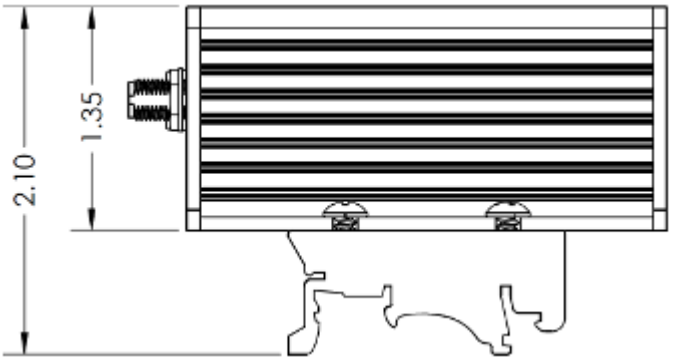
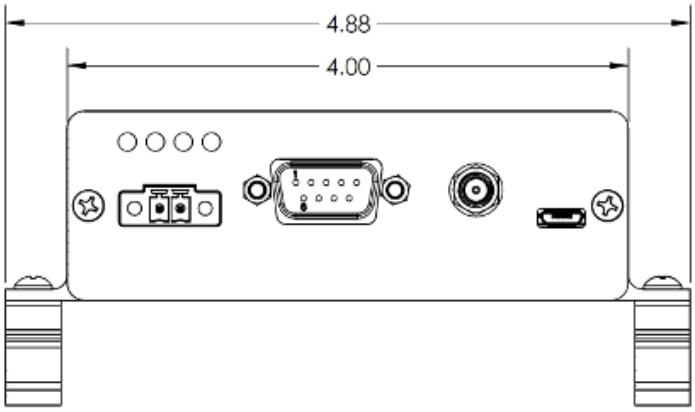


Side

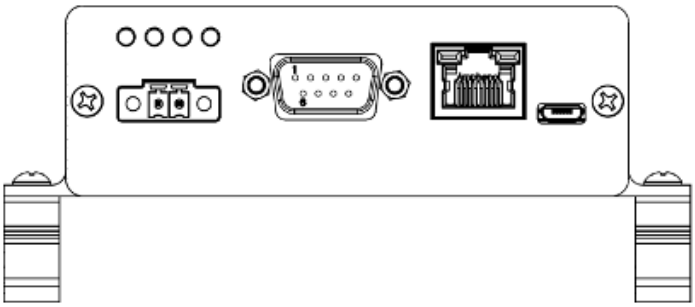


Front

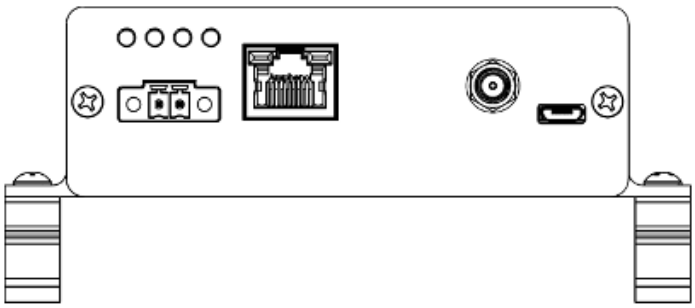
RediLink 10C



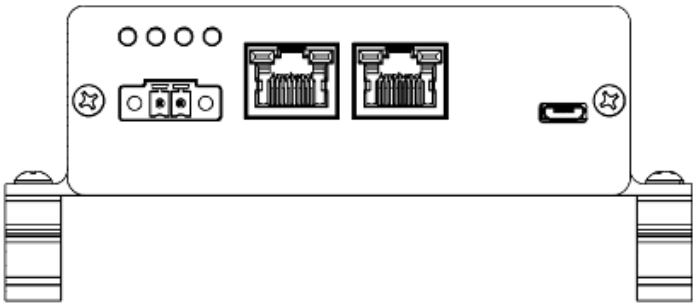
RediLink 10E



RediLink 20C



RediLink 20E



4.1.2 Mounting Instructions

The RediLink is intended to be installed in a Restricted Access Location, defined as a location for equipment where both of the following apply:

1. Access can only be gained by service persons or by users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and
2. Access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

When mounting the RediLink, allow sufficient space to connect the cables to the enclosure. There are two recommended means of mounting the device: panel mount, or DIN rail mount.

For panel mounting the RediLink, use four screws of an appropriate size and type to securely attach the device to a customer-supplied panel or enclosure, using the four keyhole slots on the sides of the RediLink, as shown in the dimensional diagrams in the previous section. Connect all the I/O cables, and lastly attach the power connector to the RediLink.

The RediLink is supplied with two (2) optional DIN rail clamps (shown on the bottom view dimensional drawing in the previous section). To mount the RediLink to DIN rail, use the following instructions:

1. Determine the correct location and orientation of the RediLink that will accommodate all attached cables and connectors.
2. Install a piece of DIN rail (35mm top hat rail) to the mounting location using appropriate screws or bolts. DIN rail should be installed horizontally or vertically, and should be a minimum of 5 in. (127mm) in length.
3. Using the four supplied DIN rail clamp screws (No. 6, 3/8”), attach the two DIN rail clamps to the keyhole slots on the sides of the RediLink housing (see pictures under Dimensions beginning on page 10).
4. Hang the spring side of the RediLink’s DIN rail clamps on the DIN rail and snap into place.
5. Ensure that the mounting is secure, then connect all the I/O cables, and lastly attach the power connector to the RediLink.

4.1.3 Compliance with Hazardous Area Standards

The RediLink has approval for installation in Class I Division 2 Groups A, B, C and D Classified Hazardous Locations, temperature class T4. Class, Division, and Group are defined as:

- Class defines the general nature of the hazardous material in the surrounding atmosphere. Class I is for locations where flammable gases or vapors may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

- Division defines the probability of hazardous material being present in an ignitable concentration in the surrounding atmosphere. Division 1 locations are presumed to be hazardous. Division 2 locations are areas where gas, dust, or vapors can exist under abnormal conditions.
- Group defines the hazardous material in the surrounding atmosphere. Groups A to D are defined as follows:
  - Group A – Atmosphere containing acetylene, gases or vapors of equivalent hazards.
  - Group B – Atmosphere containing hydrogen, gases, or vapors of equivalent hazards.
  - Group C – Atmosphere containing ethylene, gases, or vapors of equivalent hazards.
  - Group D – Atmosphere containing propane, gases, or vapors of equivalent hazards.

For the RediLink to be approved for hazardous locations, it must be installed according to the National Electrical Code (NEC) Article 501 (or Canadian Electrical Code, Section 18), and any local code requirements, if applicable.

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When installing units in a hazardous area, make sure all installation components selected are labeled for use in such areas. Installation and maintenance must be performed only when the area is known to be non-hazardous. Installation or maintenance in a hazardous area could result in personal injury or property damage.

The certificate for this equipment includes the following special conditions for safe use:

1. Install the equipment in an IP54 or better enclosure or equivalent location. Any enclosure shall be suitably certified or otherwise approved for Class 1 Division 2 hazardous locations. This may include an instrumentation tray cable (Type ITC) or similar means of limiting access to connect or disconnect cables under hazardous conditions.
2. Ensure that the rated input voltage is not exceeded in service.
3. The USB ports should not be used in a hazardous location.

4.2 System Specifications

4.2.1 General Features:

Feature	Description
Model(s)	RediLink 10E, 10C, 20E, & 20C
Memory	RAM: 256MB Flash: 64MB
Serial Ports	*All models:* (1) USB serial (user configuration) *Models 10E and 10C:* (1) RS-232/485/422 (device communication)
LAN Port	*Models 20E and 20C:* (1) RJ45 10/100baseT Ethernet
WAN Port	*Models 10E and 20E:* (1) RJ45 10/100baseT Ethernet
Cellular	*Models 10C and 20C:* (1) EVDO or GSM/HSPA+ modem

4.2.2 Power

– The device is intended to be powered from a Certified Limited Power Source (LPS, as defined in standard 60950-1) or a Certified "Class 2" Power Source (as defined in NEC and CEC).

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Connect power to the RediLink using a two-position Phoenix Contact plug (Phoenix part# 1827703 or compatible). The orientation of positive and neutral wires as viewed from the front side of the RediLink is illustrated using the following symbol located on the product overlay: 

Feature	Description
Operational Voltage	+9.5 to +28 V ⎓, 1.5 A max.
Overvoltage Protection	+50 V ⎓ maximum
Reverse Voltage Protection	-28 V ⎓ maximum
Operating Current @24V	110 mA ⎓ nominal
Power Consumption (power excludes USB, normally unused)	2.5 W nominal 3 W maximum

4.2.3 Environmental Characteristics

Feature	Description
Operating	-40 to +75 °C
Storage	-40 to +125 °C
Humidity	0% to 95% relative humidity (non-condensing)

5 RediLink Hardware

The RediLink is supplied with a rugged metal housing, with hardware options that vary depending on the model and are indicated by symbols located on the product overlay. The front panel of the RediLink contains (in order from left to right):

- Power input connector and status LEDs
- One Device Port for communicating with a local device
- One Host Port for connection to the enterprise data host system
- Micro-USB port for local configuration

The following sections describe the operation of the status LEDs and each of the hardware options and connector pinouts.

5.1 Status LEDs and Device Ports

There are four status lights that indicate the operational state and communication of the RediLink. The LEDs are located above the power input connector and are indicated with symbols on the product overlay. The normal operation of the Device and Host LEDs depends on a correct configuration of the RediLink to communicate with a local device and a host system, and a correct serial or network connection to the device and host. The normal operation of the Cellular LED is only valid for a RediLink with cellular modem and depends on a correct configuration and an active cellular account and/or SIM card associated with this RediLink.

Symbol	Color	Indicates	Explanation
	Green	**Run**	**Startup**: On solid during initial stage of boot-up, followed by a fast blink until beginning normal operation. **Slow blink**: Software is in normal operational mode (one blink every 2 seconds). **Fast blink**: Unit is in process of being reconfigured (2 blinks/second).

Symbol	Color	Indicates	Explanation
	Amber	**Host**	**Startup**: Turns on after the Device light, then goes off when operating system begins to load. **Off/Single Blink**: Attempting to connect to MQTT host (one blink every ~2 seconds). **Off/Double Blink**: Connected to a host system and communication is occurring (every 3 seconds, blink 2-3 times). **Slow Blink**: (*MQTT only*) Attempting to connect to a server (one blink/second). **Off**: Host not configured.
	Red	**Device**	**Startup**: Turns on after the Run light, then goes off when operating system begins to load. **Solid**: Successfully connected to device but no communication is occurring. **Solid/Fast blink**: Connected to device and successful polls are occurring (every 5 seconds blink 3 times). **Solid/Slow blink**: Not connected to device and/or polls are failing (every 5 seconds, blink 2 times) **Off**: Not connected to or not successfully polling the device.
	Blue	**Cellular** (10C and 20C only)	**Startup**: Turns on after the Host light, then goes off when operating system begins to load. **Solid**: Successfully connected to cellular IP network. **Solid/Fast blink**: Every 3 seconds, fast blink off/on to indicate number of bars of cellular signal strength: 1 bar: -111 to -96 dBm 2 bars: -95 to -81 dBm 3 bars: -80 to -64 dBm 4 bars: -63 dBm or better **Off**: Not connected to cellular IP network.

5.2 Ethernet Ports

The RediLink 10E and 20E provide Ethernet for the Host Port network communication. The RediLink 20E and 20C provide Ethernet for the Device Port network communication.

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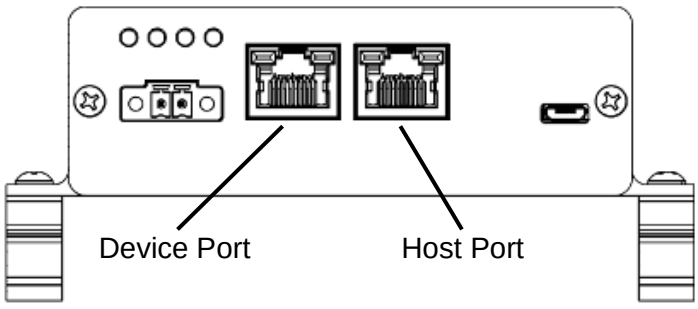
Ethernet ports do not provide Power over Ethernet (PoE) and should not be connected to an unregulated PoE device.

Ethernet ports are not suitable for direct connection to WAN unless an appropriate interface is provided, to ensure lightning surge protection.

Ethernet ports are 10/100 Mbps and are configured via the RediLink Manager for either a fixed IP address or dynamically assigned DHCP addressing. The ports should be configured to operate on different, non-overlapping IP addresses/subnets. Icons on the product overlay identify the Host and the Device ports. Ethernet ports are identified with the icon:

On the RediLink 20E, the Device Ethernet port is located on the left, and the Host Ethernet port is located on the right, as facing the front side of the RediLink.

RediLink 20E



5.3 USB Configuration Port

The RediLink provides a Micro-USB port on the front for configuration with the RediLink Manager software. A USB to Micro-USB cable should be connected from a computer to the USB port on the RediLink, which is marked on the label with the icon:

See RediLink Manager Software starting on page 26 for information on using the RediLink configuration utility through the USB port.

5.4 Device Serial Port

The RediLink 10E and 10C provide one DB-9 serial port for the local device communication. The port is software-configurable using the RediLink Manager as either RS-232, RS-485, or RS-422, and its location is indicated on the RediLink label with the serial icon:

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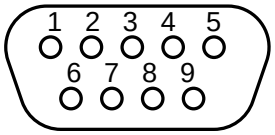
5.4.1 RS-232 Serial Interface

The direction of data with respect to the RediLink serial interface is such that the RediLink acts as a DTE (Data Terminal Equipment) device. The pin-out of the DB-9 serial interface in RS-232 mode is as follows:

DB-9 Male



Pin	RS-232 Name	Type	Description
1	DCD	Input	Data Carrier Detect
2	RXD	Input	Receive data
3	TXD	Output	Transmit data
4	DTR	Output	Data Terminal Ready
5	GND	Common	Ground
6	DSR	Input	Data Set Ready
7	RTS	Output	Request To Send
8	CTS	Input	Clear To Send
9	RI	Input	Ring Indicate

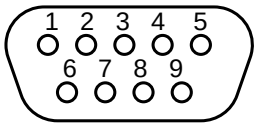
When configuring the RS-232 ports using the RediLink Manager, the **Flow Control** setting allows for hardware flow control ("RTS/CTS" setting), which may be required to control sending and/or receiving data through certain external devices, such as modems. If hardware flow control is not required, set the **Flow Control** to "None".

5.4.2 RS-485/RS-422 Serial Interface

RS-485/422 uses an optically isolated, balanced differential system, in which the voltage produced by the driver appears across a pair of signal lines that transmit a single signal. A balanced line driver produces a voltage from 2 to 6 volts across its positive and negative output terminals. A balanced differential line receiver senses the voltage state of the transmission line across the two signal input lines. Up to 32 RS-485 devices or 10 RS-422 devices can be connected together in a multi-drop configuration.

The pin-out of the DB-9 serial interface in RS-485 and RS-422 modes is identified as follows (all pins not listed are unused):

DB-9 Male



4-wire Pinout:

Pin	4-wire RS-485/ RS-422 Name	Type	Description
1	TX-	Output	Transmit Data -
2	TX+	Output	Transmit Data +
3	RX+	Input	Receive Data +
4	RX-	Input	Receive Data -
5	GND	Common	Ground

2-wire Pinout:

Pin	2-wire RS-485 Name	Type	Description
1	Data-	Input/Output	Transmit/Receive Data -
2	Data+	Input/Output	Transmit/Receive Data +
5	GND	Common	Ground

5.4.3 RS-485/422 Wiring Diagrams

The RS-422 interface provides full-duplex communication. It supports one transmitter and up to 10 receivers.

The RS-485 interface can provide either half-duplex or full-duplex communication. The interface supports up to 32 transmitters and receivers on a single network. Only one transmitter should be switched on at a time.

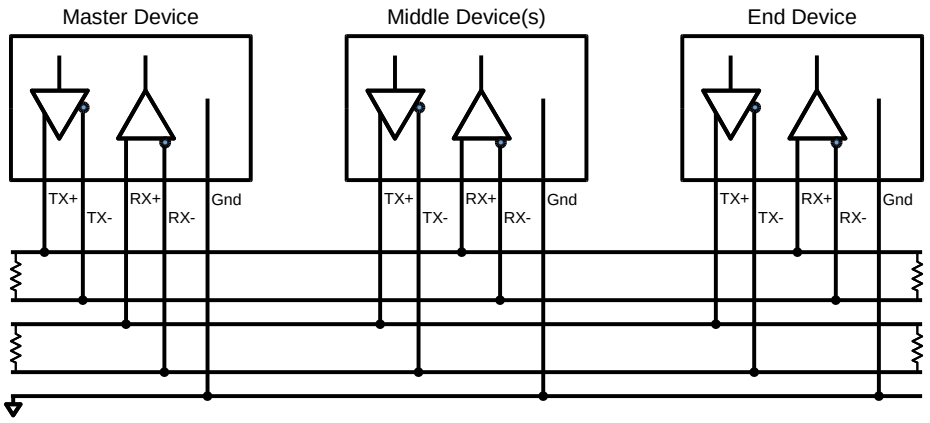
RS-485 and RS-422 generally use a 120Ω terminating register on both ends of the connection to match the cable impedance of a long transmission line. The installer should confirm that the termination resistors match the rated impedance of the serial cable. When connecting RS-485 or RS-422 devices in a multi-drop configuration, the termination resistor should be used for the devices located at both ends of the network, but not on devices located in the middle.

In RS-485 or RS-422 systems, the ground connection is typically required to properly establish the voltage reference for the differential voltages of the transmit and receive lines. The maximum end-to-end cable length for an RS-485/422 network is rated at 1200 m (4000 ft.). Care should be taken in long runs to use twisted, shielded pair wiring to avoid the introduction of electromagnetic noise on the communication lines.

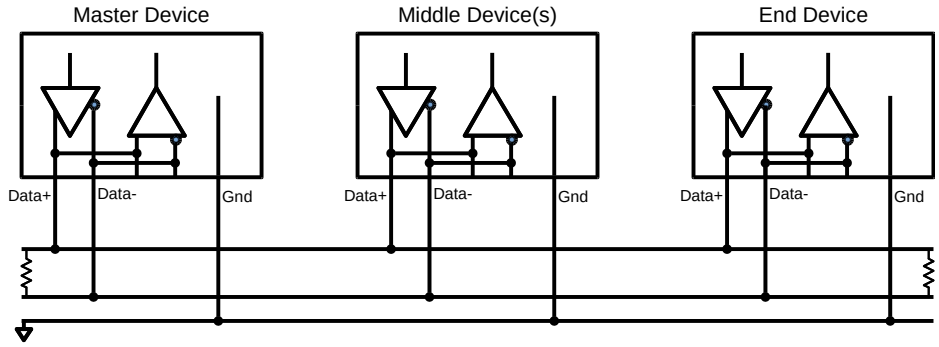
The serial ground (pin 5) is not isolated from the power supply and antenna ground. If isolation from field equipment is required, an external serial port isolation device would be required.

Multi-drop networks are designed to be wired in a daisy-chain arrangement as shown, rather than a star arrangement (multiple nodes connected to a single point). Typical RS-485 and RS-422 connections are shown in the following figures.

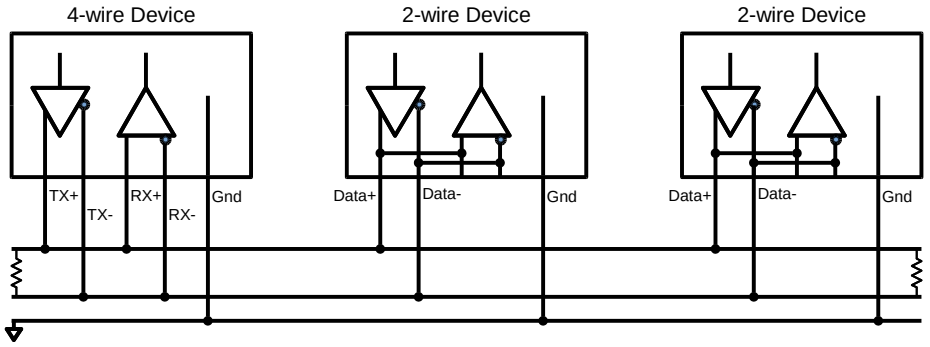
4-wire RS-485/422 Device Connections



2-wire RS-485 Device Connections



4-wire to 2-wire RS-485 Device Connections



5.5 Cellular Modem

The RediLink 10C and 20C provide a modem for cellular network communications. Only one modem may be used, depending on the chosen type of wireless technology. The modem is factory installed in the RediLink, and an SMA jack allows connection to an external cellular antenna. The Host cellular port is indicated on the RediLink label with the icon:

The EVDO modem is based on the Telit DE910-DUAL wireless module and provides dual band 1xRTT/CDMA/EVDO wireless support. The modem is certified for use on the Verizon cellular network.

The GSM/HSPA modem is based on the Telit HE910 wireless module and provides multi-band GSM/GPRS/EDGE/UMTS/HSPA+ wireless support. The modem is certified for use on the AT&T cellular network in the United States, and the Telus cellular network in Canada.

The choice of modem may depend on the quality or availability of cellular service at the intended location for device installation.

5.5.1 Cellular Account Activation

In order to use the RediLink with a cellular modem, each device must be included on an active data plan with the cellular carrier. If the application requires inbound (mobile-terminated) connections to the RediLink, it may be necessary to have a public, static IP address. For enhanced security, it may be desired rather to activate cellular service on a private network (APN/VPN) with static IP addresses.

5.5.2 Cellular Antenna

The RediLink with cellular modem requires an external cellular antenna. The antenna should be chosen with the correct frequency band, connector, cable length, and appropriate mounting type. The antenna connector requires an antenna with a standard male SMA plug and 50 ohm cable, with a minimum cable length of 20 cm and maximum gain (including cable loss) as follows:

Frequency	EVDO	GSM
824-846 MHz	5.12 dBi	5.22 dBi
1712-1752 MHz	n/a	3.31 dBi
1851-1907 MHz	6.12 dBi	6.45 dBi

5.5.3 Installing SIM Card

If a RediLink 10C or 20C with GSM/HSPA modem was not supplied with a SIM card pre-installed from the factory, the end user will need to install the SIM card. This requires removing the RediLink device from its housing and should only be performed by qualified technical personnel, observing anti-static precautions. The steps for installing or replacing a SIM card are as follows:

Step 1:

Remove power and all connectors from the front panel of the RediLink.
Remove the two mounting screws from either side of the front faceplate.

Step 2:
Gently slide the RediLink out of its enclosure to expose the SIM card slot.

Step 3:
Fully insert the SIM card into the SIM card slot, with the metal contacts facing down and the angled edge facing out.

Step 4:
Gently slide the RediLink board back into its housing and carefully replace the two mounting screws to avoid over-tightening.
Replace all front panel connectors.

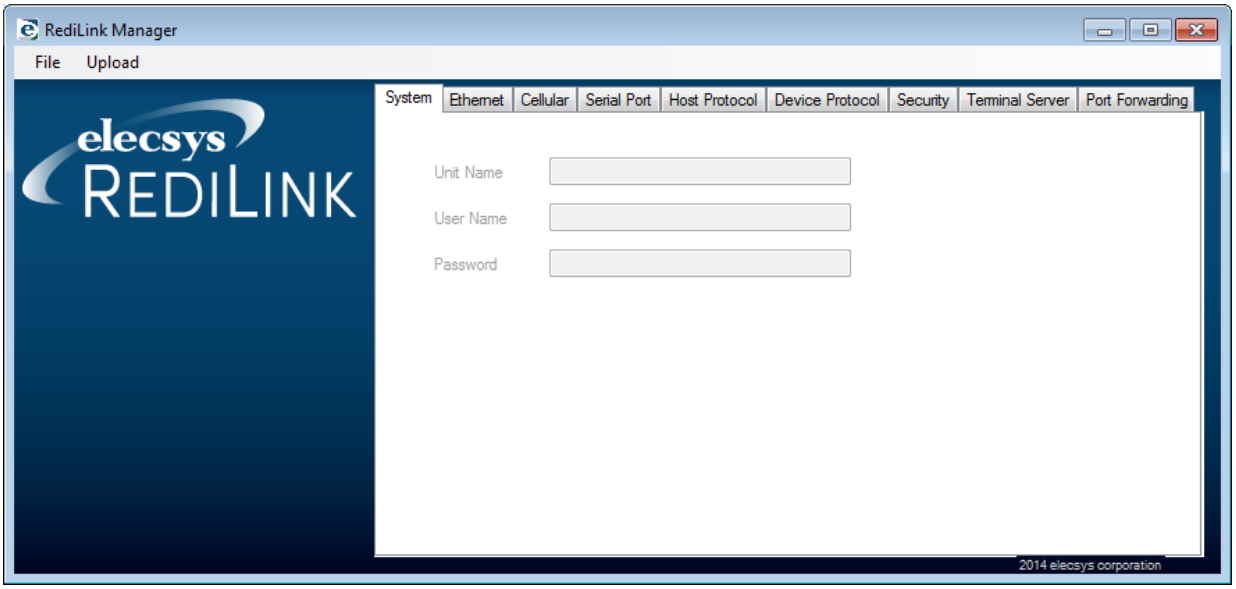
Step 5:
The RediLink needs to be configured for cellular using the RediLink Manager program (see Cellular Settings on page 40), including the HE910 modem type, APN, and any optional authentication.

6 RediLink Manager Software

The following sections describe the RediLink Manager software application, which is used to configure each RediLink device. The RediLink Manager communicates to the RediLink using a USB cable connected to the USB configuration port or using a TCP/IP connection for RediLink units that are accessible on a network.

6.1 Overview of RediLink Manager

The RediLink Manager is a Windows-based program is used to configure each RediLink device with its unique settings for a certain installation.



The RediLink Manager is used to create and modify configurations within the Windows application. The application provides a series of tabbed pages for the user to configure the properties of the serial, Ethernet, and cellular ports (including network addresses), the host and device protocol characteristics, and networking and security features. After defining the off-line configuration, the user then connects to a RediLink using the local USB serial configuration port to program the device for operation.

6.2 Software Installation

The RediLink Manager program is typically distributed with a RediLink development kit, or it may be downloaded from the Elecsys partner website, http://partner.elecsyscorp.com.

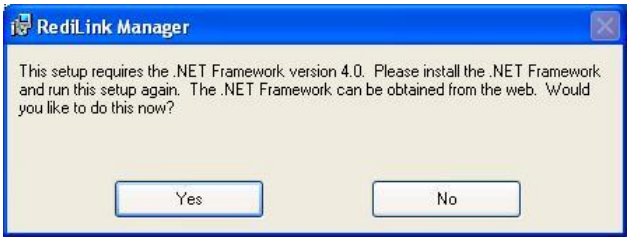
6.2.1 System Requirements

- Windows 7, Windows 8, Windows Server 2008, Windows Server 2012, Windows Vista SP2, Windows XP SP3
- Microsoft .NET 4.0 or higher
- Microsoft Excel 2007 or higher (required to create the device point list)

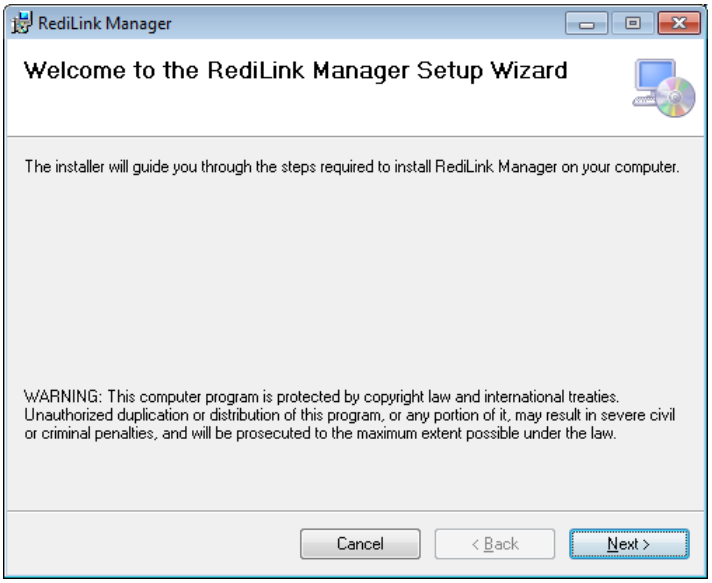
6.2.2 Installing the RediLink Manager

If a previous version of RediLink Manager is already installed, it must be uninstalled first before reinstalling. Run the **RM Setup.msi** program to install RediLink Manager.

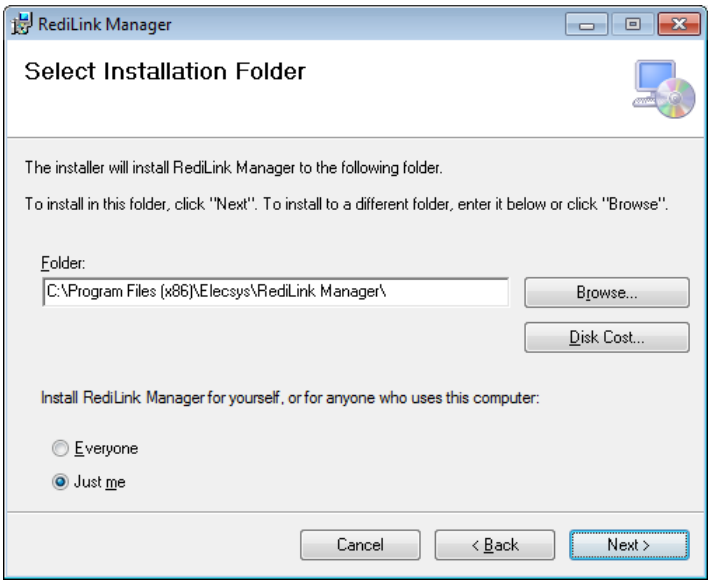
If the Microsoft .NET Framework is not already installed on the computer, the following prompt will be displayed. Click the **Yes** button to commence the process of downloading and installing the.NET Framework from the Microsoft Web site. If the computer does not have access to the Internet, you will need to download the Microsoft .NET Framework 4 Client Profile using an Internet-connected browser and install manually on this computer.



After the installer has verified that the Microsoft .NET Frame is properly installed, you will see a Welcome message. Click the **Next** button to continue.



Select the folder in which you wish to install the RediLink Manager. Select the *"Everyone"* or *"Just me"* installation option to put the shortcut into the global or user-specific Windows Start menu. Then click **Next** to continue, and **Next** again to install the software.



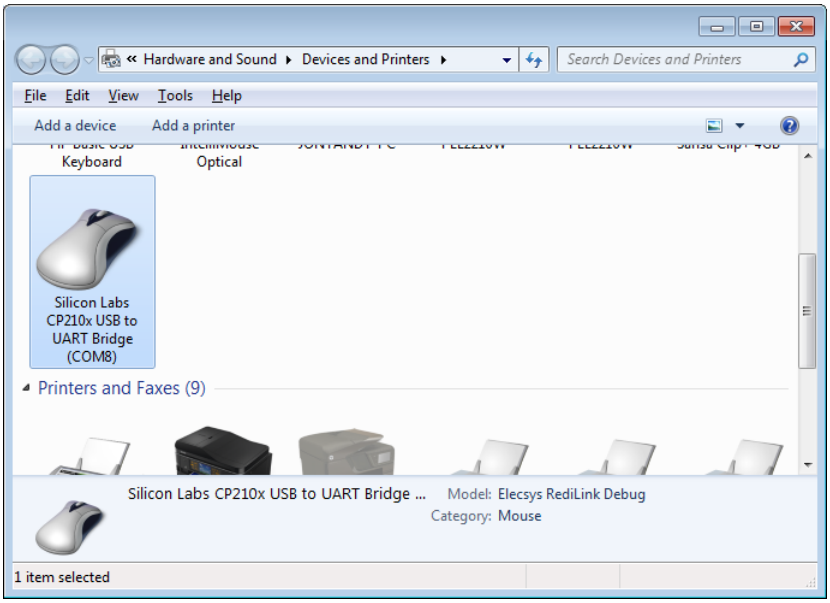
After successful installation, click the **Close** button. It is recommended to use Windows Update to check for any Microsoft security patches for the .NET Framework.

6.2.3 Install Silicon Labs USB Driver

Connect a USB cable from the configuration computer to the user configuration port on the front of the RediLink (USB type A male to Micro-USB type B male). The Windows operating system should recognize the port as a USB serial port.

If this is the first time you have plugged in the RediLink to the computer, you may need to install the "CP210x USB to UART Bridge VCP Driver" from Silicon Labs. Links to the appropriate driver for your operating system can be found on the http://partner.elecsyscorp.com website.

Open the Windows "Devices and Printers" window to confirm that the device appears as a "Silicon labs CP210x USB to UART Bridge," with a "COMx" port number designation, as shown in the following screen capture:



6.2.4 Uninstalling and Reinstalling

To reinstall or upgrade the RediLink Manager software, you must uninstall the program first. Note that uninstalling or reinstalling the application does not remove the configurations and templates stored in the local working directory.

To uninstall, open the Windows Control Panel and choose “Programs and Features” or “Add/Remove Programs”, depending on the version of Windows, and uninstall the RediLink Manager program.

6.2.5 Program File Locations

Each RediLink device typically has its own configuration file that is stored in the Windows system using an XML file format. Configurations are stored in a local working directory in the user’s Documents folder, under `Documents\Elecsys\RediLink`. The `CFG` sub-folder contains the configurations, and the `TMP` sub-folder contains a default template used by the application.

To archive the user’s saved configurations, the entire “RediLink” folder can be copied or zipped to a backup location. Individual configurations or the entire RediLink folder can be restored as needed from the backup location.

6.2.6 Point List Spreadsheets

The RediLink Manager uses a macro-enabled Excel spreadsheet (.xslm) to create a point list defining the data to be polled from the device connected to the Device Port. The spreadsheet uses a macro to save the point list as comma-separated values (CSV) for importing into the RediLink Manager. Default point list spreadsheets are installed with the RediLink Manager into the

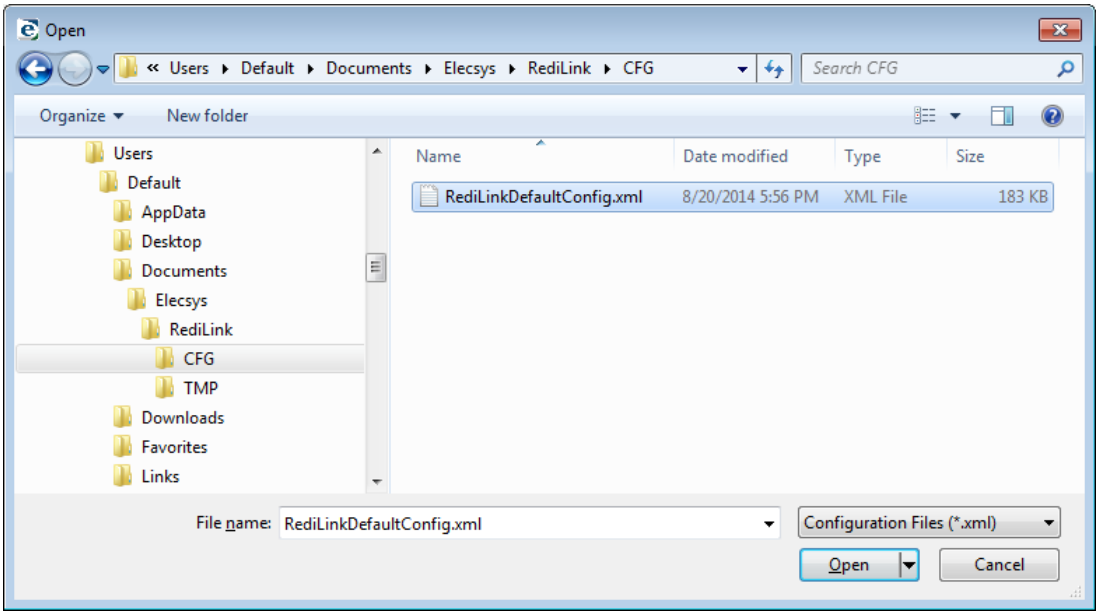
`Documents\RediLink` working directory and are discussed in sub-sections under Device Protocol Settings beginning on page 50.

6.3 Using the RediLink Manager

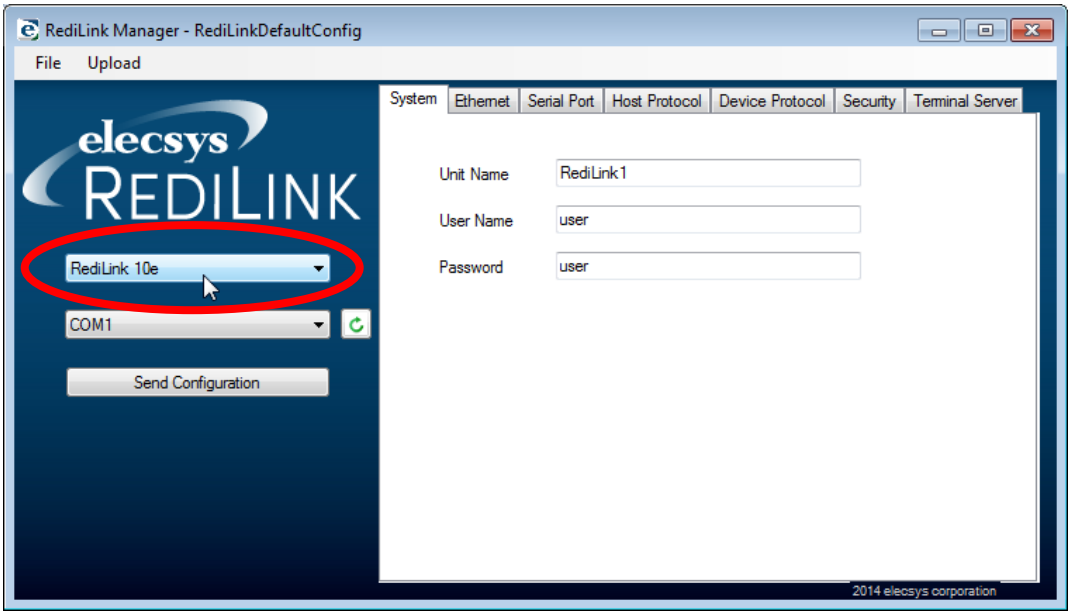
To use the RediLink Manager, click the RediLink Manager icon that appears in the “Elecsys” program group of the Windows Start menu. Before you can connect to a RediLink device, you must create or open a configuration file.

6.3.1 Create New Configuration

To create a new configuration, choose the **File | Open** menu option. In the default configuration directory (`Documents\Elecsys\RediLink\CFG`), select the **RediLinkDefaultConfig.xml** file.



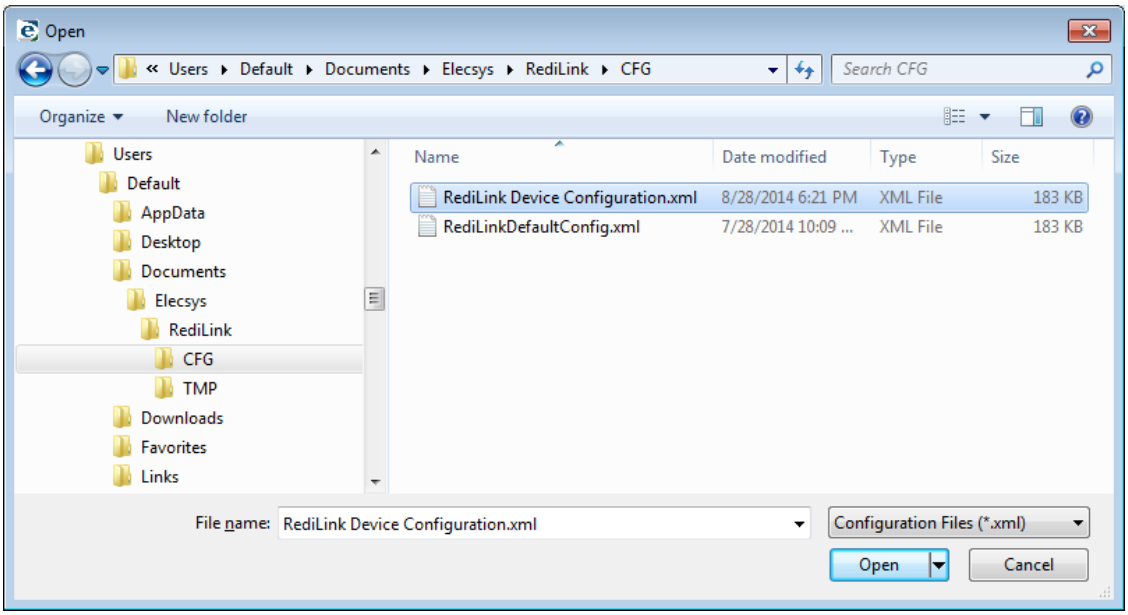
Select the RediLink device type in the drop-down list in the left side panel. This selection changes the available tabbed pages in the configuration window according to the available hardware options in each model.



To avoid overwriting the default configuration file, the RediLink Manager requires that the default configuration file be saved using a different filename.

6.3.2 Open Configuration

To open an existing configuration, choose the **File | Open** menu option and select the specific file for the RediLink device to be configured.



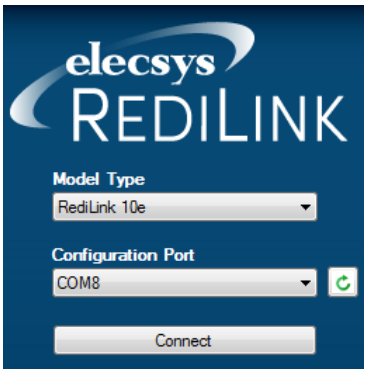
6.3.3 Save Configuration

Whenever changes are made to a configuration, an asterisk (*) is added following the configuration name in the title bar of the RediLink Manager application. Choose the **File | Save** meu option to save changes. Choose the **File | Save As** menu option to save with a different configuration name.

6.3.4 Connect to a RediLink

Connect a USB cable from the configuration computer to the USB user configuration port on the front of the RediLink (USB type A male to Micro-USB type B male cable).

With a configuration open, click the Refresh button  next to the **Configuration Port** selection list in RediLink Manager. This will update the list of available serial ports. Select from the list the COMx port that is attached to the RediLink. See Install Silicon Labs USB Driver on page 28 if Windows is not recognizing the USB serial port.



Click the **Connect** button to connect the RediLink Manager with the RediLink. The RediLink Manager reads information from the hardware including the current Unit Name and the list of supported protocols in the RediLink. After successfully connecting, the **Connect** button changes to **Send Configuration**, and the current “RediLink name” is displayed below the button.

If a RediLink has previously been configured, this “RediLink name” can be compared to the “Unit Name” property on the **System** tab to ensure the correct configuration is being used. Also for this reason, it is recommended to use a unique Unit Name for every RediLink configuration.

6.3.5 Send Configuration to RediLink

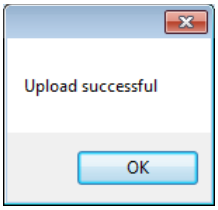
After connecting to the RediLink, click the **Send Configuration** button to transfer the current configuration to the RediLink. Before programming the RediLink, make sure that all of the properties are set correctly. In particular, confirm that the network settings of the RediLink are correct. See RediLink Configuration starting on page 37 for a full description of all the configurable properties of the RediLink.

While the configuration is being sent to the RediLink, a progress indication is displayed.

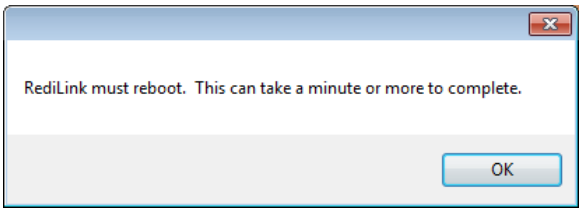
After the configuration has been transferred, the RediLink needs to be programmed to use the new configuration settings. The process of transferring and reconfiguring the RediLink will take at least 20-40 seconds for the programming to be completed.

IMPORTANT: Do not remove power while the RediLink is reconfiguring, or unexpected results may occur.

In many cases, the following prompt will be displayed when the reconfiguration is complete:



However, depending on the properties that were changed from the previous unit configuration, the RediLink may also need to perform an automatic system reboot, which will take about another minute. In this case, a different prompt is displayed:



In either case, once the RediLink has returned to its normal operational state, the Run light will begin its slow blink condition (see Status LEDs and Device Ports on page 17).

6.3.6 View RediLink Diagnostic Reports

The RediLink Manager provides a means of requesting diagnostic information about the RediLink. After connecting to a RediLink, select the **Report** menu, and click on one of the listed reports.

- **Unit ID** – Includes information such as the RediLink serial number, configuration name, Unit Name, type, and configured Host network address.
- **Version** – Includes the RediLink software and base image release numbers, as well as other system version information.
- **Network, Route, Cell Strength** – Includes IP address and route table, and (for units with cellular modem) the signal strength acquired just prior to the last data connection.
- **Uptime & Ram usage** – Information on how long the RediLink has been running since last reboot and the RAM and Flash usage.
- **Host Protocol details** – Statistics related to the RediLink's connection to a host system.
- **Device Protocol details** – Statistics related to the RediLink's connection to a protocol device.

- **Device Data** – List of all current values of data obtained from a protocol device, based on the RediLink's configured device Point List.
- **Non-zero Device Data** – List of all current non-zero values of data obtained from a protocol device.
- **VPN Connection** – Information related to the RediLink's VPN connection, if configured.

6.3.7 Apply System Update

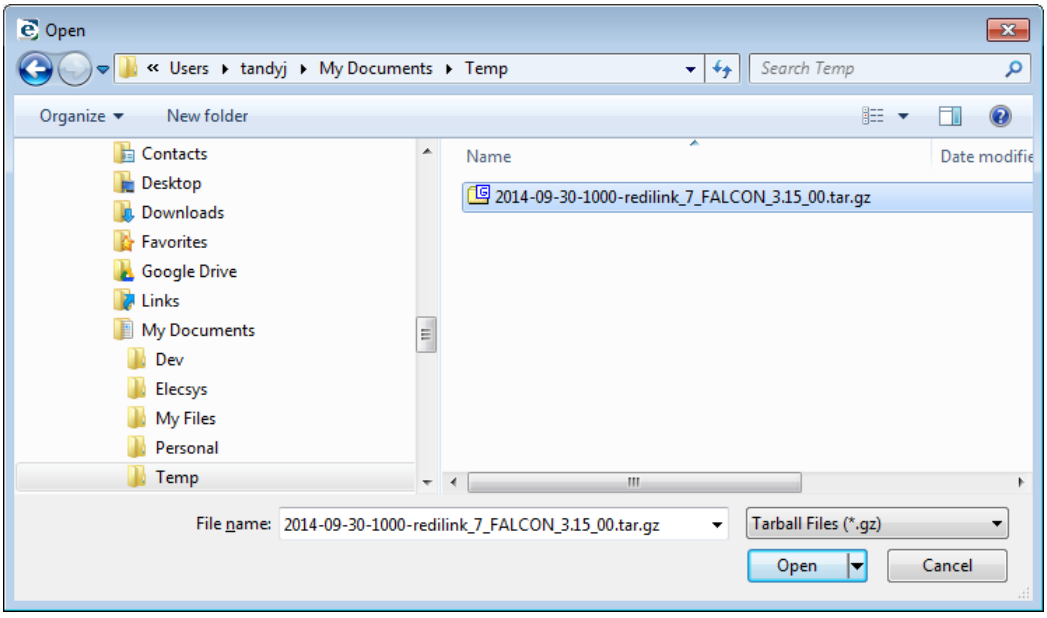
Software updates for the RediLink will be periodically released by Elecsys. When a software update is available for the RediLink, it will be available from Elecsys upon request.

To apply a software update to the RediLink, obtain the latest update file from Elecsys and save it to a known file location. Update files will generally have filenames that include a timestamp, description, and ".tar.gz" extension, such as:

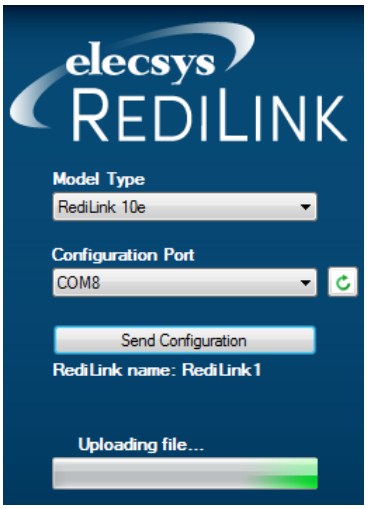
"2014-09-30-1000-redilink_7_FALCON_3.15_00.tar.gz"

The latest software firmware updates can be downloaded from the http://partner.elecsyscorp.com website.

Choose the **Upload | Tarball** menu option to apply the system software update to the RediLink. Browse to the file location where the update file exists, and click the **Open** button.



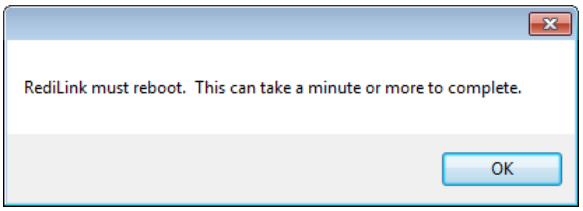
Depending on the size of the file and the speed of the connection, it may take several minutes for the file to transfer to the RediLink.



After the file is transferred, the unit will be reconfigured to install the update file.

IMPORTANT: Do not remove power while the RediLink is reconfiguring, or unexpected results may occur.

After applying the software update, the RediLink will perform an automatic system reboot, which will take about another minute. Once the RediLink has returned to its normal operational state, the Run light will begin its slow blink condition (see Status LEDs and Device Ports on page 17).



7 RediLink Configuration

Each RediLink must be configured with the specific settings to enable it to operate according to the requirements for a device installation. The following sections describe each of the configurable properties of the RediLink, which are contained on a series of tabbed pages in the RediLink Manager application. You must first have a configuration open before the tabs may be selected.

7.1 System Settings

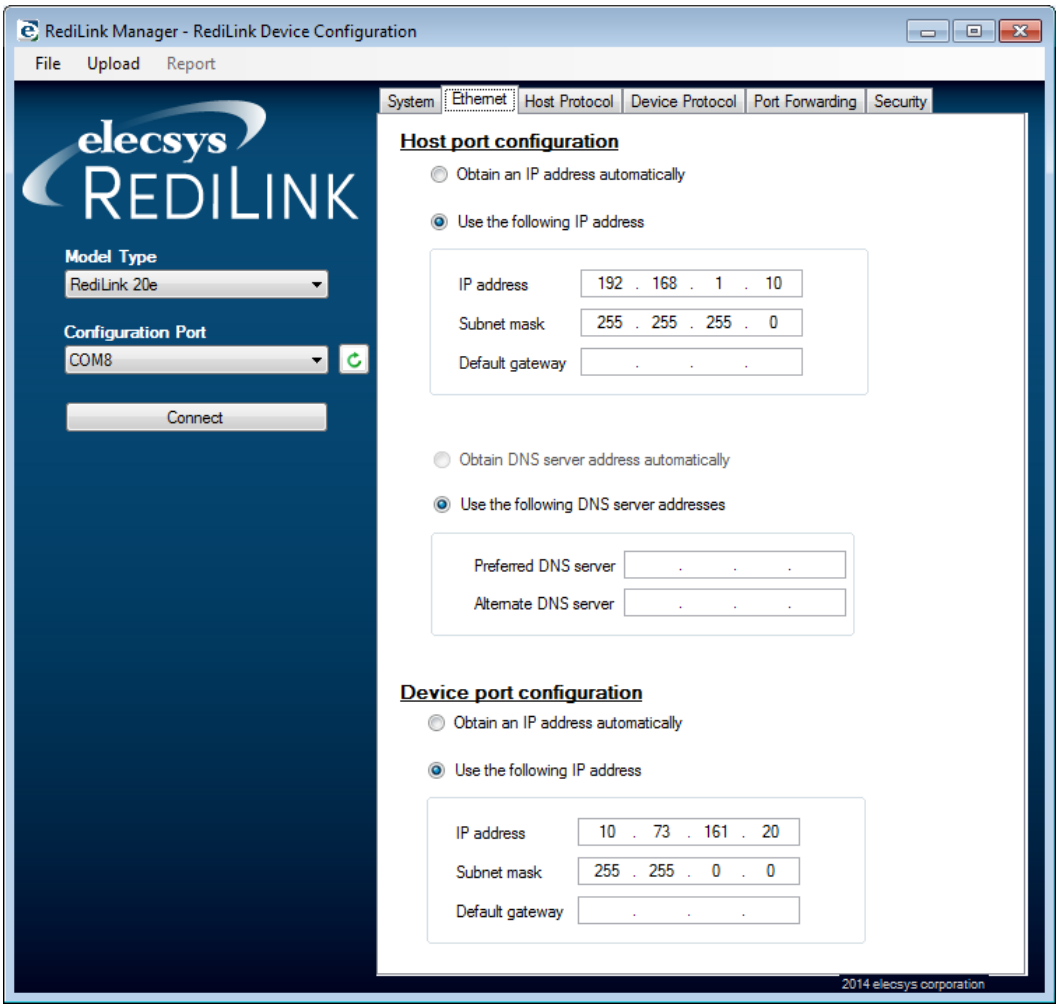
Click on the **System** tab to view the system settings of the RediLink configuration.

Property	Description
Unit Name	Enter a unique unit name for this RediLink (up to 31 characters). It is recommended to make the Unit Name unique among all RediLinks for consistent unit identification. *Other than unit identification, the RediLink's only functional use of the Unit Name is when the MQTT host protocol is selected, to identify the Report By Exception (RBE) data sent to an MQ server.*
User Name	The User Name is used when logging in to the diagnostic menu of a RediLink over a network connection. Enter a user name up to 13 characters.
Password	The Password is used when logging into the diagnostic menu of a RediLink over a network connection. Enter a password between 1 and 8 characters.

See Securing the RediLink on page 82 for more information on passwords and protecting the RediLink from unauthorized access.

7.2 Ethernet Settings

Click on the **Ethernet** tab to view the Ethernet settings of the RediLink configuration. This menu does not apply to the RediLink 10C, and its contents will vary depending on the model of RediLink being configured.



RediLink models (10E, 20E) that use Ethernet for the host connection will have a section on the Ethernet tab labeled “Host port configuration.” RediLink models (20E, 20C) that use Ethernet for the device connection will have a section on the Ethernet tab labeled “Device port configuration.” The DNS server properties are only available for the Host port configuration.

Set the properties of one or both Ethernet interfaces according to the networking requirements of your system. Consult a network administrator for information on how to properly configure the Ethernet addresses for the intended use.

Property	Description
Obtain an IP address automatically	Select this option for the RediLink to obtain its Ethernet IP address, subnet mask, and default gateway automatically from a DHCP server. *RediLink models with cellular will use the default gateway on the cellular interface. Only one network interface should be set as the default gateway.*
Use the following IP address	Select this option to specify the RediLink's Ethernet IP address, subnet mask, and default gateway. *This option should generally be used if a host system makes direct connections to the RediLink, requiring the IP address to be known and fixed, rather than dynamically assigned.*
IP address	Enter the IPv4 network address of the RediLink.
Subnet mask	Enter the IPv4 subnet mask in dotted notation, such as 255.255.255.0.
Default gateway	Enter the IPv4 network address of a default gateway, which will be used for the RediLink to reach any device not located on its local subnet. *Leave these fields blank if the default gateway is unused or unavailable on this Ethernet interface. Only one network interface should be set as the default gateway.*
Obtain DNS Server address automatically	Select this option for the RediLink to obtain its Domain Name Server address(es) automatically from a DHCP server. *This option is only available if **Obtain an IP address automatically** is selected. The DNS server properties are only available for the Host port Ethernet configuration, not the Device port.*
Use the following DNS server addresses	Select this option to specify the Domain Name Server address(es) to be used by the RediLink. *DNS is used whenever the RediLink has to connect to a named URL or FQDN, but may also remove delays in SSH connections due to reverse DNS lookup.*
Preferred DNS server **Alternate DNS server**	Enter the IPv4 network address of a DNS server, and optionally a second DNS server address to be used as an alternate if the preferred server cannot be accessed. *These fields may be left blank if DNS is not used.*

7.3 Cellular Settings

Click on the **Cellular** tab to view the cellular modem settings of the RediLink configuration. This menu applies only to the RediLink 10C and 20C.

Property	Description
Modem Type`	Select the type of cellular modem to be configured. The Modem Type must be set to match the actual hardware present in the RediLink. Options include: • **DE910-DUAL** – for CDMA/EVDO modem • **HE910** – for GSM/HSPA+ modem
APN	Enter the Access Point Name (APN) of the GSM/HSPA+ cellular carrier associated with this modem activation. The APN is the network gateway address and is specific to the account activation with the cellular carrier. *This property is not present with the DE910-DUAL (EVDO) modem configuration.*
Obtain an IP address automatically	Select this option for the RediLink to obtain its cellular IP address, subnet mask, and default gateway automatically from a DHCP server. *The RediLink always uses the cellular interface as the default gateway, if present. When using a cellular modem with a device Ethernet port (RediLink 20C), use static IP address on Ethernet with no default gateway.*
Use the following IP address	Select this option to specify the RediLink's cellular IP address, subnet mask, and default gateway. *This option should generally be used if a host system makes direct connections to the RediLink, so that the IP address is known and fixed, rather than dynamically assigned. However, be aware that the IP address is often assigned by the cellular carrier independently of this setting.*

Property	Description
IP address	Enter the IPv4 network address of the RediLink. *If the cellular account activation includes a static IP address, ensure that these settings match the assigned address, or use the **Obtain an IP address automatically** option.*
Subnet mask	Enter the IPv4 subnet mask in dotted notation, such as 255.255.255.0.
Authentication Mode	Select the network authentication method used by the cellular provider. Options include: • **Disabled** – no user-level authentication is required • **PAP** – Password Authentication Protocol • **CHAP** – Challenge Handshake Authentication Protocol *This option is determined by the cellular network activation and should be set according to the requirements of the cellular carrier.*
User Name **Password**	If PAP or CHAP authentication mode is selected, enter the user name and password of the cellular account. These are used by the RediLink when establishing the cellular connection.

7.4 Serial Port Settings

Click on the **Serial Port** tab to view the serial device port settings of the RediLink configuration. This menu applies only to the RediLink 10E and 10C, and the serial port settings configured here are used by the protocol selected on the **Device Protocol** tab.

Property	Description
Baud Rate	Select the baud rate of the device serial port, up to 115.2K baud. *All serial port settings should be configured to match the device attached to the RediLink's serial port.*

Property	Description
Parity	Select the parity of the device serial port (**None, Odd, or Even**).
Word Length	Select the word length to use for data on the device serial port (**7 or 8 bits**).
Stop Bits	Select the number of stop bits for data on the device serial port (**1 or 2**).
Flow Control	Select whether or not to use RTS/CTS flow control for the device serial port. • For 2-wire or 4-wire RS-485/422, it is required to use **RTS/CTS** to internally control the internal transmit circuitry. • For RS-232, you can generally use **None**, unless the RediLink is connected to a modem that requires hardware flow control.
Serial Port Type	Select what type of serial port signals to use for communication to the device. See Device Serial Port on page 20 for a description of the physical pinout and wiring connections to use for each serial port type. Options include **RS-232**, **2-wire RS-485**, and **4-wire RS-485/422**.
RS-485/422 Termination	When **2-wire RS-485** or **4-wire RS-485/422** serial port type is used, select whether or not to use an internal 120 ohm resistor for port termination. See RS-485/422 Wiring Diagrams on page 22 for a discussion of the termination resistor.

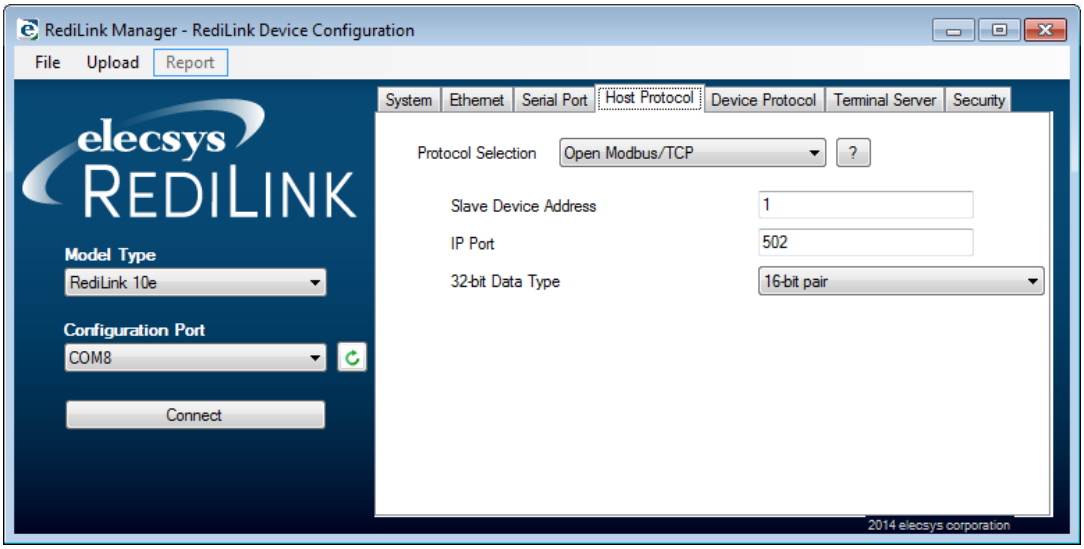
7.5 Host Protocol Settings

Click on the **Host Protocol** tab to view the protocol settings of the RediLink configuration that will be used to communicate with the enterprise data host system. The properties shown in the Host Protocol tab will vary depending on the protocol selected. See the following sections for a description of each RediLink host protocol option.

- **Modbus Host Protocol**
  - Modbus RTU (encapsulated TCP)
  - Open Modbus/TCP
- **DNP 3.0 (TCP) Host Protocol**
- **MQTT RBE Host Protocol**

7.5.1 Modbus Host Protocol

On the **Host Protocol** tab, select one of the Modbus host protocol options. When using the Modbus protocol, a remote Modbus host system will connect to the RediLink via its host port (Ethernet or cellular) to request device data, and the RediLink will respond to those requests with its last-known data values. The RediLink will also allow the remote Modbus host to send command data, which will be written to the connected device using its configured Device protocol.

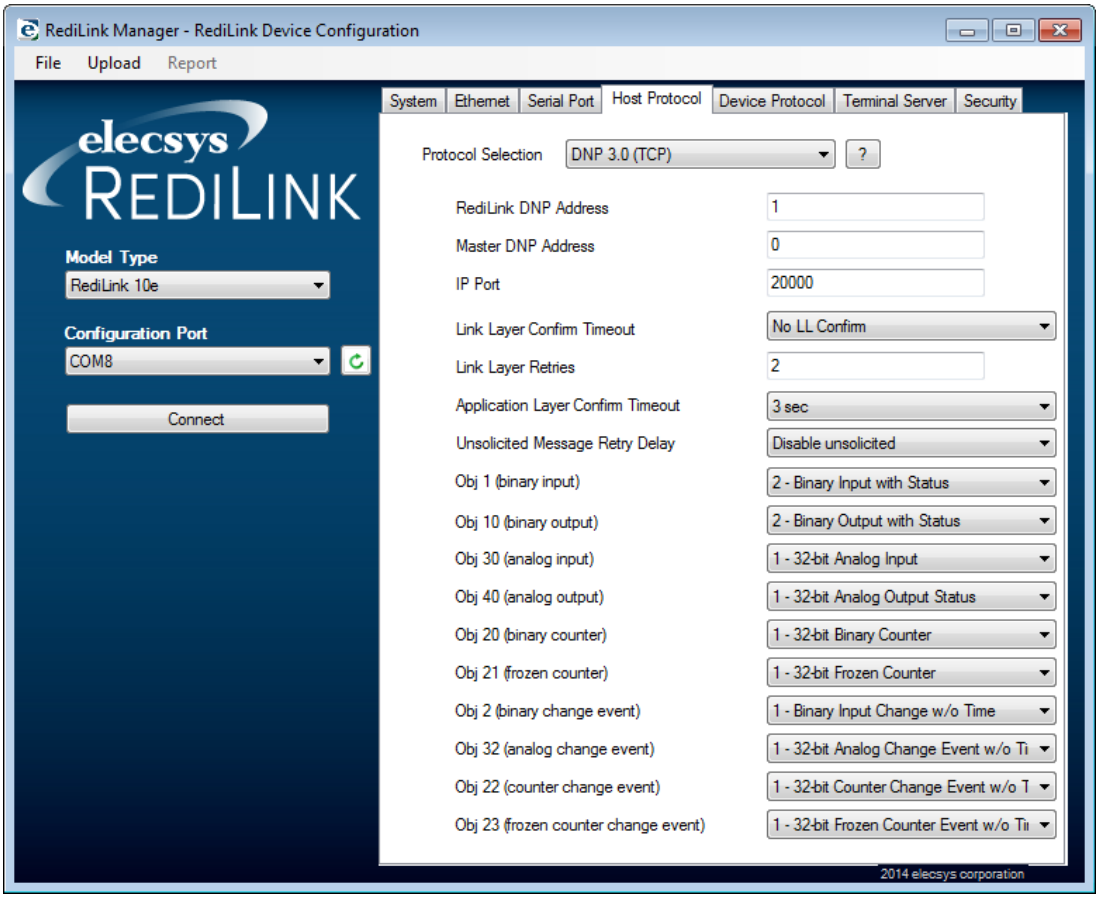


Property	Description
Protocol Selection	Select the protocol used by the host system to communication with the RediLink. For Modbus protocol, there are several options, which should be chosen according to the capabilities of the host. • **Modbus RTU (encapsulated TCP)** – this option uses the Modbus RTU protocol that is standard for serial communication, but wrapped within TCP/IP messages, such as through a terminal server. • **Open Modbus/TCP** – this option uses a specialized version of Modbus for TCP/IP, similar to Modbus RTU data packets but including six additional header bytes with no CRC.
Slave Device Address	Enter the address of the RediLink that defines the Modbus slave address to which it will reply when polled by a Modbus host system. *The Slave Device Address should be a number between 1 and 255.*
IP Port	Enter the numeric IP port on which the RediLink will listen for incoming TCP connections from a Modbus host system. *Encapsulated Modbus has no standard IP port by definition, but is configured by convention in a given installation. Open Modbus/TCP generally uses IP port 502 by default but can be configurable.*

Property	Description
32-bit Data Type	Select the method by which the RediLink returns 32-bit data values to the Modbus host system. Options include: • **16-bit pair** – Each 32-bit value is returned as a consecutive pair of registers, which must be polled by the host. The first register in each pair contains the least-significant word. • **32-bit** – Each 32-bit value is requested by the host as a single register address. The bytes in the Modbus response are returned with the least-significant word first, followed by the most-significant word. The RediLink only allows 32-bit data to be stored in the 40,xxx register range, not the 30,xxx range. When using the 16-bit pair method, each pair of registers must be polled together (requesting a single register of any pair will return an error). The Modbus host is responsible for interpreting each pair of registers as a single 32-bit integer or floating point value. *For Boolean and 16-bit data values, this setting has no effect. For 32-bit data, all values will be returned to the host using either the 16-bit pair or 32-bit register method. See the following paragraphs for an example.*

7.5.2 DNP 3.0 Host Protocol

On the **Host Protocol** tab, select the DNP3.0 (TCP) host protocol option. When using the DNP 3.0 protocol, a remote DNP master will connect to the RediLink via its host port (Ethernet or cellular) to request device data, and the RediLink will respond to those requests with its last-known data values. The RediLink may be configured to report data unsolicited to a connected master when the data changes. The RediLink will also allow the remote DNP host to send command data, which will be written to the connected device using its configured protocol.



Property	Description
Protocol Selection	Select the protocol used by the host system to communicate with the RediLink. • **DNP 3.0 (TCP)** – this option uses the DNP 3.0 protocol to return data to a DNP host upon request or unsolicited as data changes.
RediLink DNP Address	Enter the address of the RediLink that defines the DNP slave address to which it will reply when polled by a DNP master station. *The RediLink DNP Address should be number between 0 and 65535.*
Master DNP Address	Enter the master station address of the DNP host that will communicate with the RediLink. *The Master DNP Address should be a number between 0 and 65535.*

Property	Description
IP Port	Enter the numeric IP port on which the RediLink will listen for incoming TCP connections from a DNP master station.
Link Layer Confirm Timeout	Select the DNP 3.0 link layer confirm timeout from the list of options, or select **No LL Confirm** to disable link layer confirmations. *The Link Layer Confirm Timeout is the timeout and retry period for unacknowledged messages at the DNP link layer.*
Link Layer Retries	Enter the number of link layer retry messages to attempt per message. *This applies only if the **Link layer Confirm Timeout** has not been disabled.*
Application Layer Confirm Timeout	Select the DNP 3.0 application layer confirm timeout from the list of options. *The Application Layer Confirm Timeout is the timeout and retry period for unacknowledged DNP application layer messages, where message confirmations are required.*
Unsolicited Message Retry Delay	Select the DNP 3.0 unsolicited Message Retry Delay from the list of available options, or select **Disable unsolicited** to prevent the RediLink from sending unsolicited messages (i.e., use only poll-response). *The **Unsolicited Message Retry Delay** option is the amount of time the RediLink will wait for an acknowledgement after sending an unsolicited message before retrying.*
Default Variations	The remaining DNP configuration options define how the RediLink will respond to various requests from the DNP master station, if the DNP master sends a request for an Object without specifying the Variation. If the Variation is specified in the Master request, the RediLink will respond according to the request rather than using these Default Variations.
Obj 1 (binary input)	Default variation for Object 1.
Obj 10 (binary output)	Default variation for Object 10.
Obj 30 (analog input)	Default variation for Object 30.
Obj 40 (analog output)	Default variation for Object 40.
Obj 20 (binary counter)	Default variation for Object 20.
Obj 21 (frozen counter)	Default variation for Object 21.
Obj 2 (binary change event)	Default variation for Object 2.
Obj 32 (analog change event)	Default variation for Object 32.
Obj 22 (counter change event)	Default variation for Object 22.

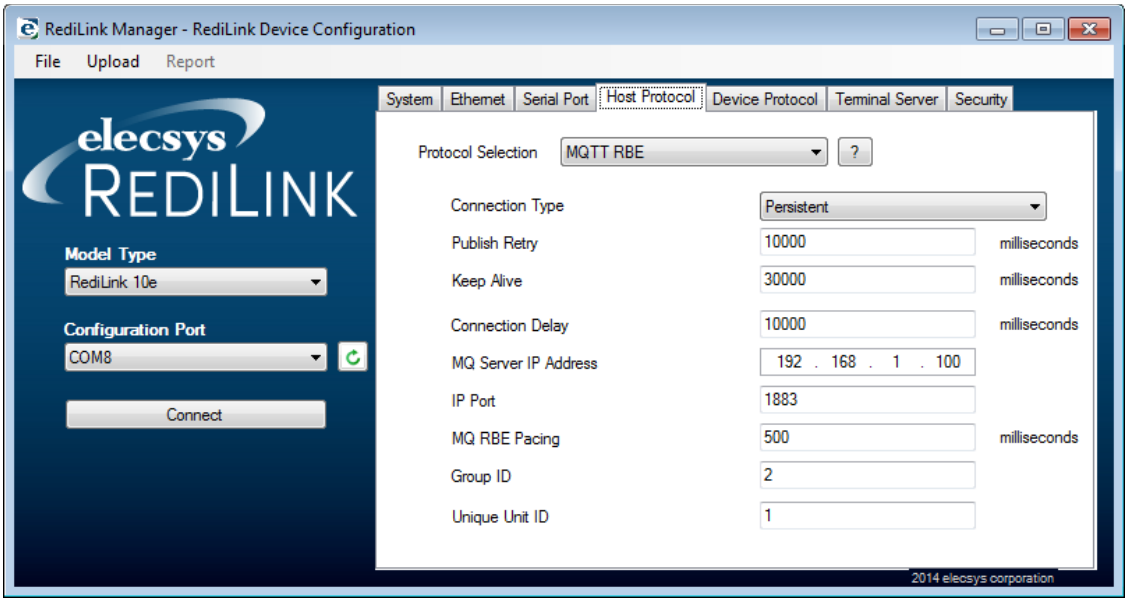
Property	Description
Obj 23 (frozen counter change event)	Default variation for Object 23.

The RediLink automatically assigns all Binary Inputs (Object 1) to DNP Class 1, all Analog Inputs (Object 30) to Class 2, and all Binary Counters and Frozen Counters (Objects 20 and 21) to Class 3. If the **Unsolicited Message Retry Delay** option is not disabled, the DNP master may enable unsolicited reporting of Class 1, 2, and/or 3 data.

See Importing Modbus Point List (page 52), Importing DF1 Point List (page 60), or S&C Point List (page 70) for information on how the device data is mapped into Destination Registers (DNP Object types) in the RediLink.

7.5.3 MQTT RBE Host Protocol

On the **Host Protocol** tab, select the MQTT RBE host protocol option. When using the MQTT RBE protocol, the RediLink will connect to a remote MQTT broker/server via its host port (Ethernet or cellular) and will report data unsolicited when the data changes. The RediLink will also subscribe to the broker for command data sent from a remote host, which will be written to the connected device using its configured protocol.



MQTT protocol (MQ Telemetry Transport) is a simple publish/subscribe lightweight messaging protocol, using a single TCP/IP port connection from client to server. The publish/subscribe messaging model facilitates one-to-many distribution, in which the sending applications or devices do not need to know anything about the receiver. It is ideal for constrained networks (low bandwidth, high latency, data limits, and/or fragile connections). MQTT message headers are kept as small as

possible, and its on-demand, push-style message distribution keeps network utilization low. For more information on the MQTT protocol, see http://mqtt.org.

The "MQTT RBE" protocol uses the MQTT protocol for message transport for Report-By-Exception transmission of data register values whenever their values change. The binary message payload contains the register locations and values of the data being reported in each message. MQTT clients can publish a command to the broker, and the RediLink subscribes to the command message types in order to write values to a connected device. Other MQTT RBE message types are used to provide a health check to ensure the connection is healthy between the RediLink and the broker. In the event that the RediLink becomes disconnected from the broker, clients who have subscribed to the Last Will and Testament message are notified of the lost connection. Currently, the RediLink only supports up to MQTT version 3.0.

The MQTT RBE protocol used in the RediLink is the same as used in the Elecsys Director products. It is supported by the Elecsys OPC Appliance host application and other third-party MQTT host systems.

Property	Description
Unit Name (System tab)	On the **System** tab, enter a unique ID (Client Identifier) for each RediLink or other device. The MQTT Client Identifier must be between 1 and 31 characters and must be unique across all clients connecting to the same MQTT server. If connecting to a server that does not support MQTT protocol version 3.1.1 or higher, the Client ID must be 23 characters maximum and is limited to alphanumeric characters.
Protocol Selection	Select the protocol used by the host system to communicate with the RediLink. • **MQTT RBE** – this option uses the MQTT RBE protocol to return data to an MQTT broker unsolicited as data changes.
Connection Type	Select the type of connection to use from the RediLink to the broker. Options are: • **Persistent** – Connection is maintained permanently to the broker depending on network conditions. • **Nonpersistent** – Connection is made to the broker only when needed to report data. The use of nonpersistent connections is not normally recommended for MQTT RBE systems, because it doesn't allow other host systems to verify constant integrity of the data.
Publish Retry	Enter the retry time in milliseconds for unacknowledged published messages.
Keep Alive	Enter the keep-alive time in milliseconds to maintain a persistent connection with the broker using Health Echo messages. *The MQ server should send out Health Echo messages and the RediLink will respond to confirm that it is still actively in communication with the server. The Health Echo message contains a 32-bit sequence number.*

Property	Description
Connection Delay	Enter the connection delay time in milliseconds. *The **Connection Delay** is the time after making an unsuccessful connection to the broker before retrying the connection.*
MQ Server IP Address **IP Port**	Enter the IPv4 address and port of the MQ server to which the RediLink will connect when using an unencrypted connection. The RediLink does not support the use of URL/FQDN broker addresses in this mode. **Note:** When using the VPN security option, the **MQ Server IP Address** must be set to 127.0.0.1 and the **IP Port** must be set to 65001 (TLS/SSL). In this mode, the RediLink does allow the broker address as a URL/FQDN, which is configured in the **Security** tab. See Security/VPN Settings on page 79 for more information about VPN configuration settings.
MQ RBE Pacing	Enter the minimum time in milliseconds between RBE messages sent from the RediLink. *The **MQ RBE Pacing** is used to prevent the RediLink from flooding the broker and network bandwidth if data, such as an analog input, is continually changing.*
Group ID	The **Group ID** is a unique ID for the RediLink and forms part of the MQ topic for all published messages. The Group ID must be defined uniquely for all RediLink or other devices connecting to an MQTT broker. *The **Group ID** is also called "HCP_ID" in the Elecsys Directors and OPC Server and is used to uniquely identify which messages are destined for which server.*
Unique Unit ID	The **Unique Unit ID** is a numeric value (1 to 65535) that identifies the RediLink when it connects to an Elecsys OPC Server and must therefore be defined uniquely for all RediLink or Director units connecting to the OPC Server. When using the RediLink with another host protocol or an MQTT broker other than the Elecsys OPC Server, this field is unused but must still contain a numeric value.

When the RediLink connects to a server to report data using MQTT RBE protocol, the following data packets are used.

- Connect (and Disconnect) from the MQ broker using standard messages
- Publish Last Will & Testament message on MQ topic:
  RBE/***GroupID***/DCERT/***UnitName***
- Publish device data using Report by Exception on MQ topic:
  RBE/***GroupID***/***UnitName***/Channel0/***RtuName-RtuNumber***

- Respond to Health Echo requests on MQ topic:
  RBE/***GroupID***/ECHO/***UnitName***

- Subscribe to commands using the following two topics:
  sys/***UnitName***/#
  cmd/***UnitName***/#

  (where "GroupID" is defined on the **Device Protocol** tab, "UnitName" is defined on the **System** tab, "RTUName" is set according to the Device protocol such as "Modbus" or "DF1", and "RtuNumber" is the Device Address defined on the **Device Protocol** tab).

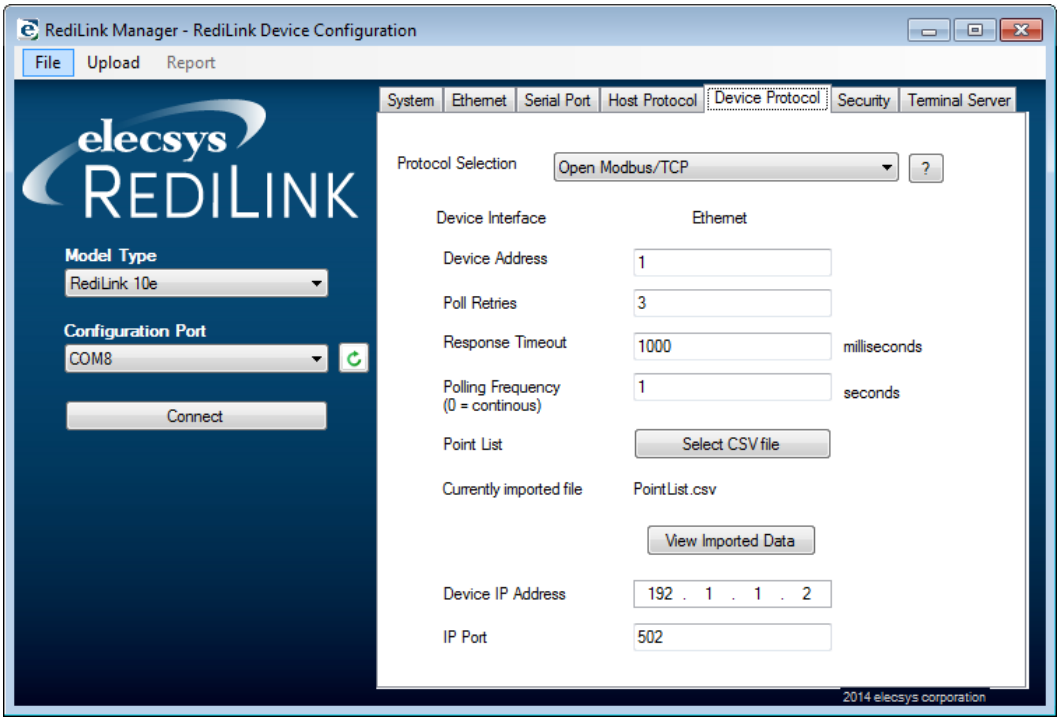
7.6 Device Protocol Settings

Click on the **Device Protocol** tab to view the protocol settings of the RediLink configuration which will be used to communicate with a field device. The properties shown in the Device Protocol tab will vary depending on the protocol selected. See the following sections for a description of each RediLink device protocol option.

- **Modbus Device Protocol**
  - Modbus RTU (serial)
  - Modbus ASCII (serial)
  - Modbus RTU (encapsulated TCP)
  - Modbus ASCII (encapsulated TCP)
  - Open Modbus/TCP
- **Allen Bradley Device Protocol**
  - Allen Bradley DF1 (serial)
  - Allen Bradley DF1/PCCC (TCP)

7.6.1 Modbus Device Protocol

On the **Device Protocol** tab, select one of the Modbus device protocol options. When using the Modbus protocol, the RediLink acts as a master to the connected Modbus device, polling it for data values. The RediLink will also write command data to the device that is received from a remote host.



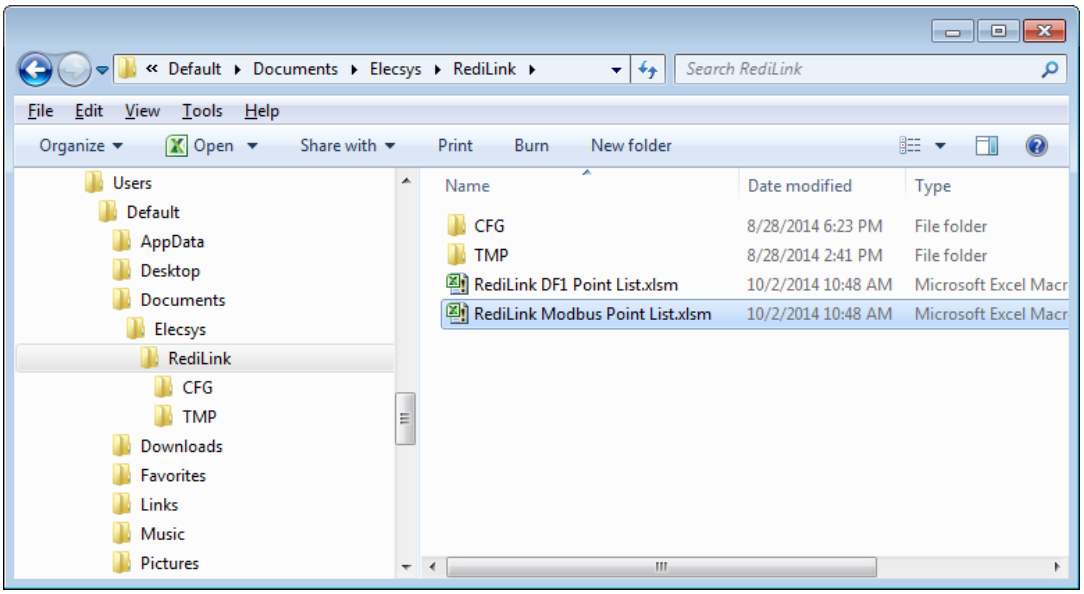
Property	Description
Protocol Selection	Select the protocol used by the RediLink to communicate with the attached field device. For Modbus protocol, there are several options, which should be chosen according to the capabilities of the device and the RediLink model type. <u>RediLink 10E and 10C only</u>: • **Modbus RTU (serial)** – this option uses the Modbus RTU (binary) protocol to communicate with a serial Modbus device. • **Modbus ASCII (serial)** – this option uses the Modbus ASCII protocol to communicate with a serial Modbus device. <u>RediLink 20E and 20C only</u>: • **Modbus RTU (encapsulated TCP)** – this option uses the Modbus RTU protocol that is standard for serial communication, encapsulated within TCP/IP packets such as through a terminal server, to communicate with an Ethernet-connected Modbus RTU device. • **Modbus ASCII (encapsulated TCP)** – this option uses the Modbus

Property	Description
	ASCII protocol encapsulated within TCP/IP to communicate with an Ethernet-connected Modbus ASCII device. • **Open Modbus/TCP**– this option uses a specialized version of Modbus for TCP/IP, similar to Modbus RTU protocol but including six additional header bytes in the protocol messages.
Device Interface	This field is for information only, indicating the type of device port available for this RediLink model (serial or Ethernet).
Device Address	Enter the Modbus slave address of the device to be polled by the RediLink. *The Device Address should be a number between 1 and 255.*
Poll Retries	Enter the number of attempts to retry each poll to the device in case of timeout or a failed message.
Response Timeout	Enter the time in milliseconds to wait for a response from the device before timing out and retrying the poll.
Polling Frequency	Enter the time in seconds between sequences of polls to the device, or enter zero (0) for continuous polling. *All defined polls use the same polling frequency. If the time required to complete the list of defined polls exceeds the polling frequency, the next cycle of polls will begin immediately.*
Point List	Click the **Select CSV File** button to import a point list that defines the data to request from the device. See Importing Modbus Point List on page 52 for an explanation of how to create and import the Point List spreadsheet. (If the Protocol Selection is changed, the Point List must be imported again.) Click the **View Imported Data** button to view the Point List after it has been imported.
Currently imported file	This field is for information only, indicating the name of the most recently imported Point List.
Device IP Address	Enter the IPv4 address of the Modbus device (Ethernet only) to which the RediLink should connect.
IP Port	Enter the numeric IP port of the Modbus device (Ethernet only) to which the RediLink should connect. *Encapsulated Modbus TCP has no standard IP port by definition, but is configured by convention in a given installation. Open Modbus/TCP generally uses IP port 502 by default but can be configurable.*

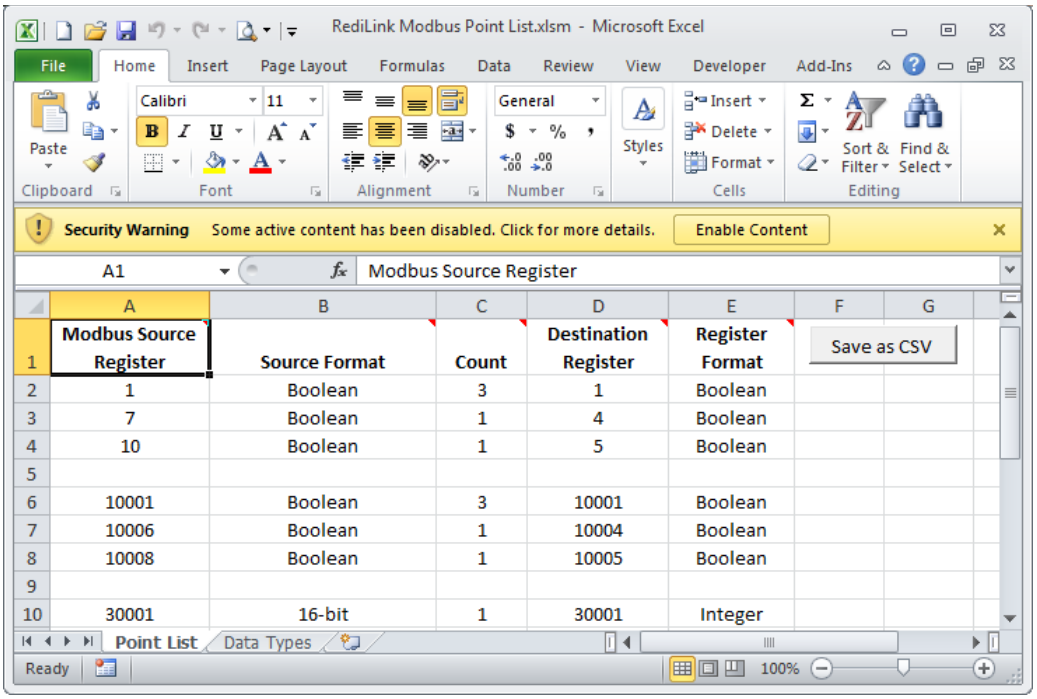
7.6.2 Importing Modbus Point List

The Point List defines the register addresses to be polled from the connected device using its native protocol, and also defines the address locations in which to store the data in the RediLink's memory. The RediLink Manager is supplied with a default Excel spreadsheet to define a list of Modbus polls, which is used to generate the CSV file to be imported into the configuration.

Use Microsoft Excel to open the supplied “RediLink Modbus Point List.xlsm” spreadsheet from its default location in `Documents\Elecsys\RediLink` (or a similar spreadsheet).



If Excel gives a security warning, click the **Enable Content** button to enable the macro supplied in the spreadsheet.



	A	B	C	D	E
1	Modbus Source Register	Source Format	Count	Destination Register	Register Format
2	1	Boolean	3	1	Boolean
3	7	Boolean	1	4	Boolean
4	10	Boolean	1	5	Boolean
5					
6	10001	Boolean	3	10001	Boolean
7	10006	Boolean	1	10004	Boolean
8	10008	Boolean	1	10005	Boolean
9					
10	30001	16-bit	1	30001	Integer

Each row in the spreadsheet represents one poll request to the device for a specified type of data (rows may be left blank for visual clarity.) All rows containing unneeded point information should be

deleted from the spreadsheet. The Modbus point list provides the following columns for entering Point List details:

#	Column	Description
A	**Modbus Source Register**	Enter the starting Modbus point number in the device for each poll. The Modbus Source Register may be entered in one of two formats: • **Register** – Enter the source Modbus register address, such as 1 (coil registers), 10001 (status registers), 30001 (input registers), and 40001 (holding registers). • **Function:Offset** – Enter the source Modbus address as "***function*:*offset***" where "function" is either 1 (coil registers) or 3 (holding registers), and "offset" is the point offset within the set of coils or holding registers (0 to 65535). A coil with offset 0 is the same as Modbus address 1, and a holding register with offset 0 is Modbus address 40001. (The Function:Offset format only supports Modbus function codes 1 and 3.) For instance, using a Modbus Source Register of "3:10" is equivalent to entering an absolute register address of "40011".

#	Column	Description
B	**Source Format**	Select the data format of the source data in the Modbus device, using one of the following types: • **Boolean** – Boolean format should be used with Modbus coils or status registers. All other Source Formats should be used with Modbus input or holding registers. • **16-bit** – 16-bit integer data registers. • **16-bit pair (MSW first)** – Use this format where the Modbus device stores 32-bit integer or floating point values using two consecutive 16-bit registers. The first register in each pair should contain the most-significant 16-bit word of each value. • **16-bit pair (LSW first)** – Modbus device stores 32-bit values using two consecutive 16-bit registers, where the first register in each pair contains the least-significant 16-bit word of each value. • **32-bit (MSW first)** – Use this format where the Modbus device stores 32-bit integer or floating point values with the entire 32 bits contained within one numbered Modbus register. The most-significant 16-bit word of each value is returned first in the Modbus message. • **32-bit (LSW first)** – Modbus device stores 32-bit values with all 32 bits within one numbered Modbus register. The least-significant 16-bit word of each value is returned first in the Modbus message. If polling 32-bit data from a Modbus device, the device documentation should be consulted. Typically, these registers will be listed either as consecutively numbered addresses (“32-bit” type), or they will be listed with only even or odd numbered addresses (“16-bit pair” type).
C	**Count**	Enter the Count of data values to read from the Modbus device, using the specified Source Format. Each 32-bit entity counts as one value (using either “32-bit” or “16-bit pair” Source Format). For instance, if a poll requests ten Modbus registers (40051 through 40060) as a “16-bit pair” data type, the Count should be set to 5, representing the five pairs of registers making up the five 32-bit values.

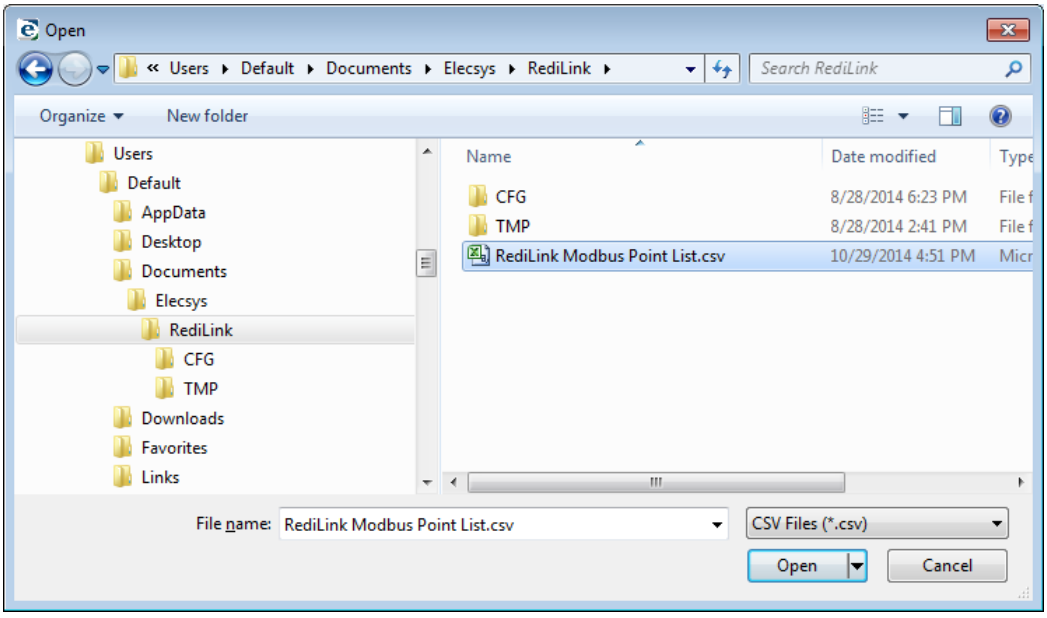
#	Column	Description
D	**Destination Register**	Enter the starting Destination Register in the RediLink to store the data received from the Modbus device. The choice of Destination Register should take into consideration the Source Format of the device protocol data and the Host Protocol being used by the host system. The Destination Register specifies how the host system will obtain the device data and may be entered in one of two formats: • **Modbus format** – When using the Modbus or MQTT RBE host protocol, enter Modbus register address, such as 1 (coil registers), 10001 (status registers), 30001 (input registers), or 40001 (holding registers). • **DNP format** – When using the DNP 3.0 host protocol, enter the Destination Register as an "***object*:*offset***" point number, where the "object" is a DNP object (1=binary inputs, 20=running counters, 30=analog inputs, etc.) and "offset" is the zero-based point number within that object type. In either case, the Destination Register should be compatible with the Source Format (Boolean source data should be stored into Boolean destination registers, and it is recommended to group 16-bit integers, 32-bit integers, and floating point data into groups of similar type Destination Registers) Care should be taken to avoid overlapping Destination Registers defined in different Point List rows. In addition, when the Host Protocol is set to one of the Modbus types, some additional rules for Destination Register must be followed: 1. Destination Register addresses 30xxx only support 16-bit source data (not 32-bit or 16-bit pair). 2. Destination Register addresses 40xxx must be defined with all 16-bit registers first (for instance, starting with register 40001), followed by all 32-bit integer registers (including 16-bit pair source type), and finally all 32-bit floating point data. 3. Whether or not integer data is being polled from the device, space must be allowed in the Destination Registers for at least one 16-bit integer and one 32-bit integer. (For instance, this effectively means that 40001 should always be reserved for 16-bit data; and floating point data should be separated from 16-bit data by at least one register.)

#	Column	Description
E	**Register Format**	Select the destination register format in the RediLink where the device data will be stored. The Register Format should be consistent with the Source Format and Destination Register address: • **Boolean** – Should be used for Boolean source format data. • **Signed** – Signed integer format, which should only be used with device data points that use signed integer data (-32768 to +32767, or -2147483648 to +2147483647), and should only used with MQTT or DNP analog destination registers. Do not use Signed format with a Modbus host protocol. • **Integer** – Unsigned integer format, which can be used for any 16-bit or 32-bit integer value. • **Float** – Should be used for registers using a 32-bit (or 16-bit pair) Source Format, where the device data contains IEEE 754 floating point values. These are stored into floating point registers in the RediLink.

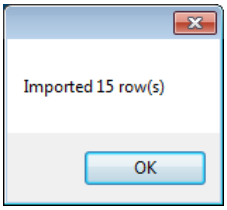
After entering all the Modbus Point List data into the Excel spreadsheet, the spreadsheet can be saved using the native format (.XSLM). Then click the **Save as CSV** button to create a copy of the spreadsheet in a comma-separated value format. The CSV file will be saved automatically in the same folder as the original spreadsheet, but with a .CSV extension.

NOTE: If the button is selected when clicked rather than running the save macro, you will need to enable macros in the Excel worksheet, as mentioned earlier in this section.

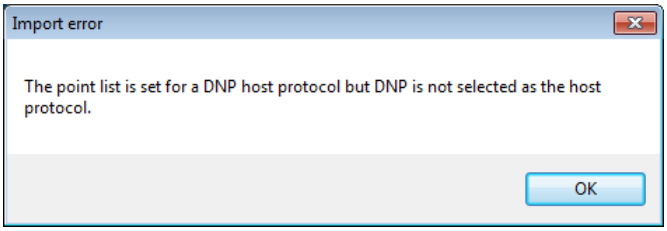
In the **Device Protocol** tab of the RediLink Manager, click the **Select CSV file** button. Browse to the location where .CSV file was created, and click the **Open** button to import the Point List into the RediLink Manager configuration.

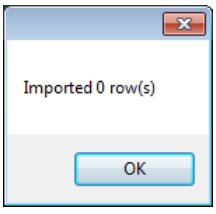


If the import was performed successfully, a dialog box is shown with the number of rows that were imported (non-blank Point List rows).



If there is a problem with the data entered in the Point List, an error message will be displayed.





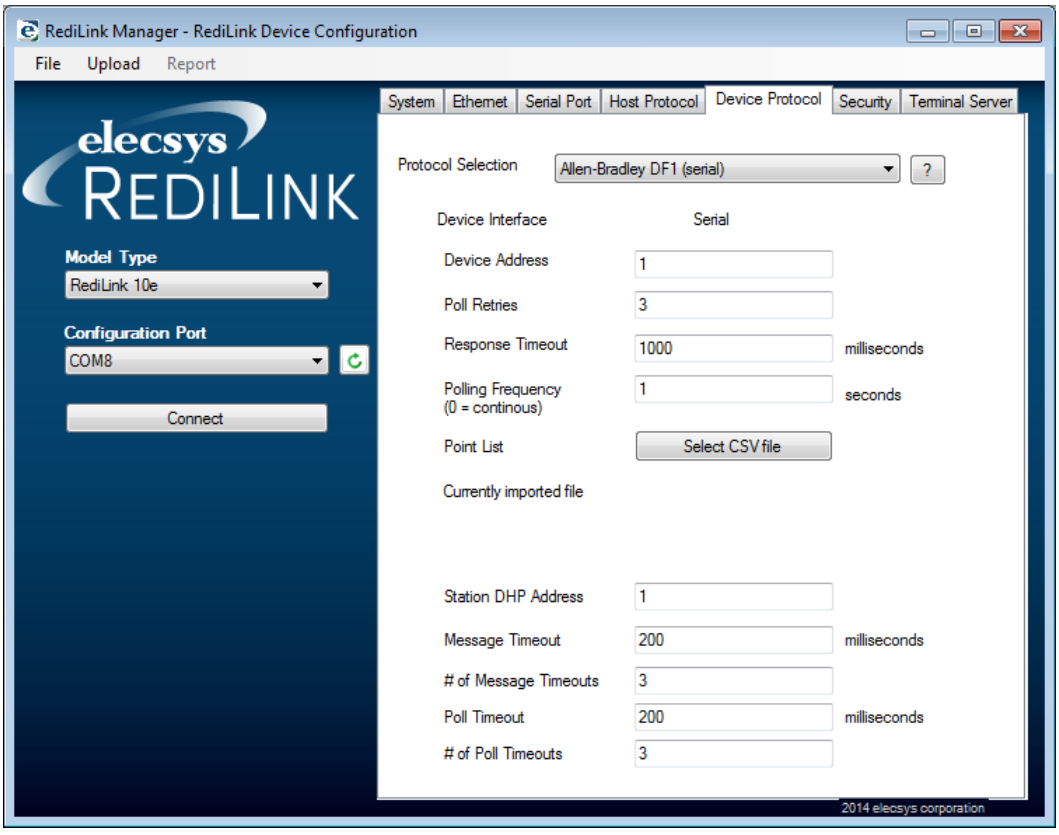
Some of the reasons why an import might fail include:

- Source Registers are used in any Point List row which are different from the configured Device Protocol (DF1 instead of Modbus, or vice versa)
- Destination Registers are used in any Point List row which are different from the configured Host Protocol (DNP instead of Modbus, or vice versa)
- Other errors in the data of the CSV file that produce unexpected results.

7.6.3 Allen Bradley DF1 Serial Device Protocol

On the **Device Protocol** tab, select the Allen Bradley DF1 (serial) device protocol option. This option applies only when using a RediLink 10E or 10C. When using the DF1 protocol, the RediLink will act as a master to the connected Allen Bradley serial device, polling it for data values. The RediLink will also write command data to the device that is received from a remote host.

(If using an Ethernet connection to an Allen Bradley PLC, see Allen Bradley DF1/PCCC Device Protocol on page 67.)

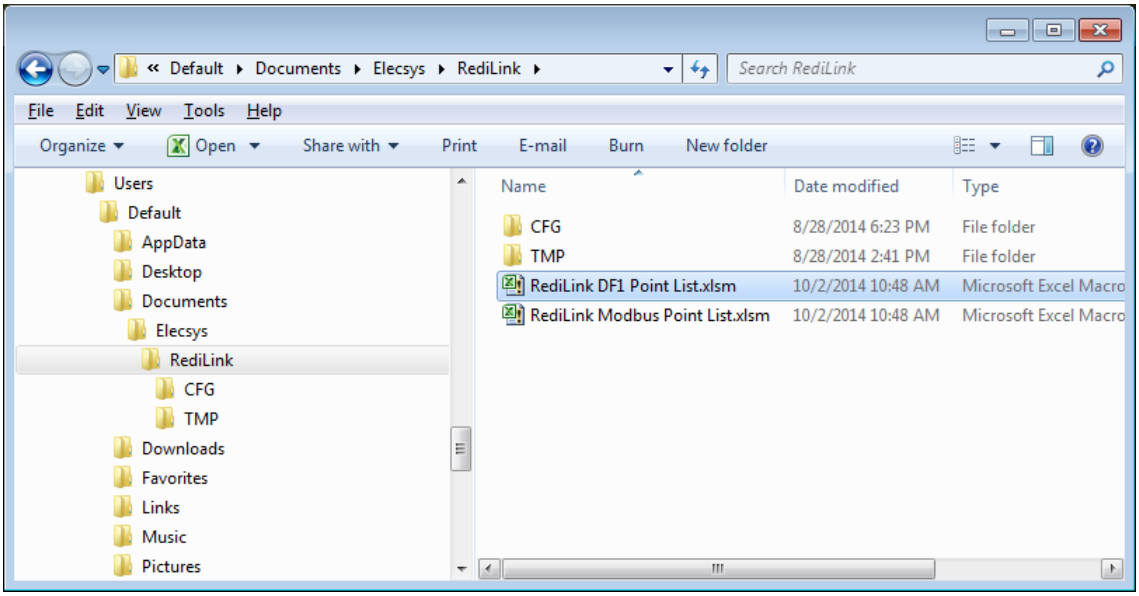


Property	Description
Protocol Selection	Select the protocol used by the RediLink to communicate with the attached field device. The DF1 serial device protocol applies only to the RediLink 10E and 10C (see Allen Bradley DF1/PCCC Device Protocol on page 67 for configuring DF1 protocol on an Ethernet device interface). • **Allen-Bradley DF1 (serial)** – this option uses the DF1 protocol to communicate with an Allen-Bradley PLC over serial.
Device Interface	This field is for information only, indicating the type of device port available for this RediLink model (serial).
Device Address	Enter the DF1 slave address of the PLC to be polled by the RediLink. *The Device Address should be a number between 1 and 255.*
Poll Retries	Enter the number of attempts to retry each poll to the device in case of timeout or a failed message.
Response Timeout	Enter the time in milliseconds to wait for a response from the device before timing out and retrying the poll.
Polling Frequency	Enter the time in seconds between sequences of polls to the device, or enter zero (0) for continuous polling *All defined polls use the same polling frequency. If the time required to complete the list of defined polls exceeds the polling frequency, the next cycle of polls will begin immediately.*
Point List	Click the **Select CSV File** button to import a point list that defines the data to request from the device. See Importing DF1 Point List on page 60 for an explanation of how to create and import the Point List spreadsheet. (If the Protocol Selection is changed, the Point List must be imported again.) Click the **View Imported Data** button to view the Point List after it has been imported.
Currently imported file	This field is for information only, indicating the name of the most recently imported Point List.
RediLink DF1 Address	Enter the DF1 master address of the RediLink to be used when it communicates with the PLC.
Message Timeout	Enter the DF1 message timeout in milliseconds.
# of Message Timeouts	Enter the number of DF1 message timeouts.
Poll Timeout	Enter the DF1 poll timeout in milliseconds.
# of Poll Timeouts	Enter the number of DF1 poll timeouts.

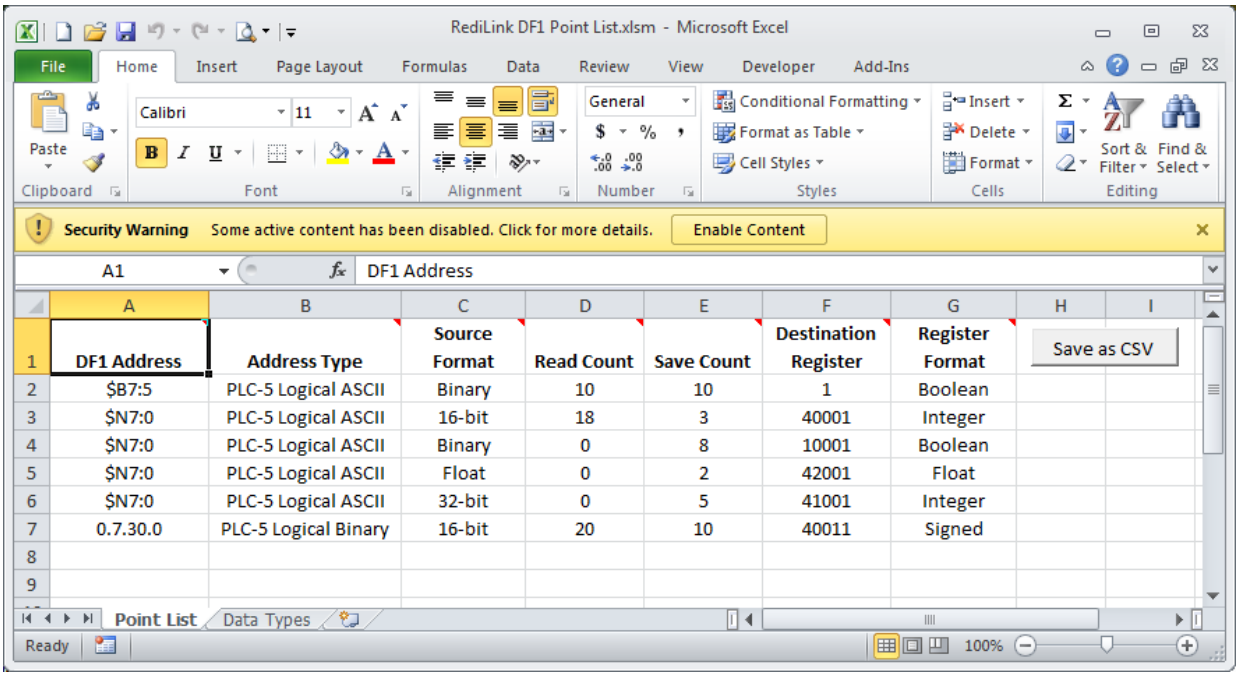
7.6.4 Importing DF1 Point List

The Point List defines the register addresses to be polled from the connected device using its native protocol, and also defines the address locations in which to store the data in the RediLink's memory. The RediLink Manager is supplied with a default Excel spreadsheet to define a list of Allen Bradley DF1 polls, which is used to generate the CSV file to be imported into the configuration.

Use Microsoft Excel to open the supplied “RediLink DF1 Point List.xlsm” spreadsheet from its default location in `Documents\Elecsys\RediLink` (or a similar spreadsheet).



If Excel gives a security warning, click the **Enable Content** button to enable the macro supplied in the spreadsheet.



Each row in the spreadsheet represents one poll request to the device for a specified type of data (rows may be left blank for visual clarity.) All rows containing unneeded point information should be

deleted from the spreadsheet. The DF1 point list provides the following columns for entering Point List details:

#	Column	Description
A **B**	**DF1 Address** **Address Type**	Enter the starting DF1 point address in the device for each poll. The DF1 Address may be entered in one of four formats using either the logical or physical addresses, specified by the Address Type: • **PLC-5 Logical ASCII** – Enter DF1 address in a format such as: $N7:30 • **PLC-5 Logical BInary** – Enter DF1 address in a format such as: 0.7.30.0 • **PLC-2 Logical** or **PLC-2 Physical** – Enter DF1 address as an octal address value.
C	**Source Format**	Select the data format of the source data in the DF1 device, using one of the following types: • **Binary** – Binary format should be used with digital coils or status registers. • **16-bit** – 16-bit integer data registers. • **Float** – 32-bit floating point data registers in the PLC.

<table>
<tr><th>#</th><th>Column</th><th>Description</th></tr>
<tr><td>D

E</td><td>Read Count

Save Count</td><td>Enter the Read Count of data values to read from the DF1 device, using the specified Source Format. Use the Save Count to determine how many of the values should be stored in the RediLink.

For instance, if a poll requests ten integer registers but only wants to keep the first three, the Read Count should be set to 10 and the Save Count to 3.
When reading bit-packed integers into individual bit registers in the RediLink, the Save Count should be a multiple of 16, the Data Type should be Integer, and the Destination Register should be a binary type.

If reading a file from the DF1 device that contains a mixed set of data types (binary, integer, and floating point), one DF1 poll can be issued but parsed into different data types – use multiple rows in the table with the same DF1 Address, set the Read Count to the total number of points, and configure the Write Count according to data type.
For instance, if a PLC contains 2 integer registers with status bits, 3 integer values, and 5 floating point values, three rows in the table might be configured as follows:

<table>
<tr><th>DF1 Address</th><th>Data Type</th><th>Read Count</th><th>Write Count</th><th>Destination</th></tr>
<tr><td>$N7:30</td><td>Integer</td><td>10</td><td>32</td><td>10001</td></tr>
<tr><td>$N7:30</td><td>Integer</td><td>0</td><td>3</td><td>30001</td></tr>
<tr><td>$N7:30</td><td>Float</td><td>0</td><td>5</td><td>42001</td></tr>
</table>
(where 10001-10032 is used for binary data, 30001-30003 for 16-bit integer data, and 42001-42005 for 32-bit floating point data).
Subsequent rows in the table might define other DF1 polls.</td></tr>
</table>

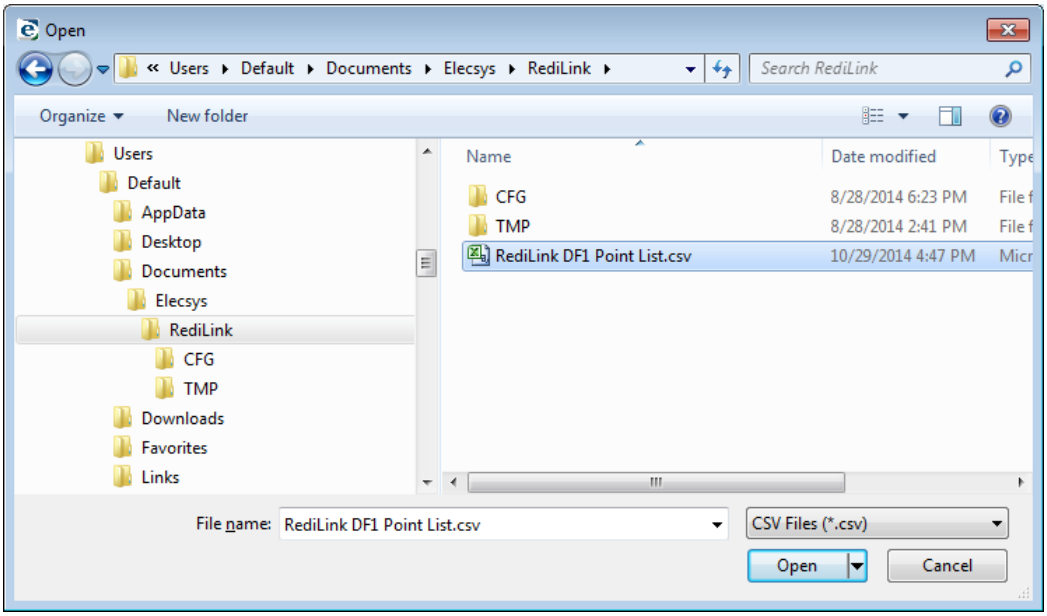
#	Column	Description
F	**Destination Register**	Enter the starting Destination Register in the RediLink to store the data received from the DF1 device. The choice of Destination Register should take into consideration the Source Format of the device protocol data and the Host Protocol being used by the host system. The Destination Register specifies how the host system will obtain the device data and may be entered in one of two formats: • **Modbus format** – When using the Modbus or MQTT RBE host protocol, enter Modbus register address, such as 1 (coil registers), 10001 (status registers), 30001 (input registers), or 40001 (holding registers). • **DNP format** – When using the DNP 3.0 host protocol, enter the Destination Register as an "***object*:*offset***" point number, where the "object" is a DNP object (1=binary inputs, 20=running counters, 30=analog inputs, etc.) and "offset" is the zero-based point number within that object type. In either case, the Destination Register should be compatible with the Source Format (Boolean/Binary source data should be stored into Boolean destination registers, and it is recommended to group 16-bit integers, 32-bit integers, and floating point data into groups of similar type Destination Registers) Care should be taken to avoid overlapping Destination Registers defined in different Point List rows. In addition, when the Host Protocol is set to one of the Modbus types, some additional rules for Destination Register must be followed: 1. Destination Register addresses 30xxx only support 16-bit source data (not 32-bit or 16-bit pair). 2. Destination Register addresses 40xxx must be defined with all 16-bit registers first (for instance, starting with register 40001), followed by all 32-bit integer registers (including 16-bit pair source type), and finally all 32-bit floating point data. 3. Whether or not integer data is being polled from the device, space must be allowed in the Destination Registers for at least one 16-bit integer and one 32-bit integer. (For instance, this effectively means that 40001 should always be reserved for 16-bit data; and floating point data should be separated from 16-bit data by at least one register.)

#	Column	Description
G	**Register Format**	Select the destination register format in the RediLink where the device data will be stored. The Register Format should be consistent with the Source Format and Destination Register address: • **Boolean** – Should be used for Boolean source format data. • **Signed** – Signed integer format, which should only be used with device data points that use signed integer data (-32768 to +32767, or -2147483648 to +2147483647), and should only used with MQTT or DNP analog destination registers. Do not use Signed format with a Modbus host protocol. • **Integer** – Unsigned integer format. • **Float** – Should be used for registers using a Float source format, where the device data contains IEEE 754 floating point values. These are stored into floating point registers in the RediLink.

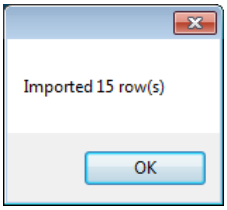
After entering all the DF1 Point List data into the Excel spreadsheet, the spreadsheet can be saved using the native format (.XSLM). Then click the **Save as CSV** button to create a copy of the spreadsheet in a comma-separated value format. The CSV file will be saved automatically in the same folder as the original spreadsheet, but with a .CSV extension.

NOTE: If the button is selected when clicked rather than running the save macro, you will need to enable macros in the Excel worksheet, as mentioned earlier in this section.

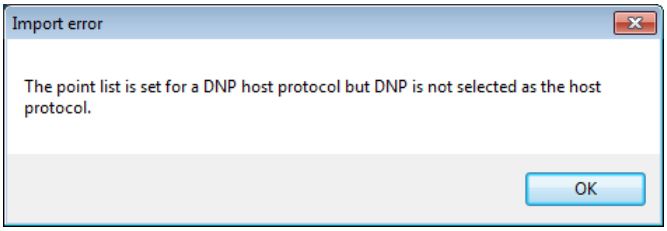
In the **Device Protocol** tab of the RediLink Manager, click the **Select CSV file** button. Browse to the location where .CSV file was created, and click the **Open** button to import the Point List into the RediLink Manager configuration.

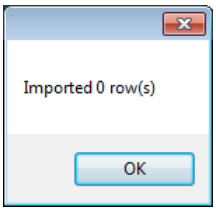


If the import was performed successfully, a dialog box is shown with the number of rows that were imported (non-blank Point List rows).



If there is a problem with the data entered in the Point List, an error message will be displayed.





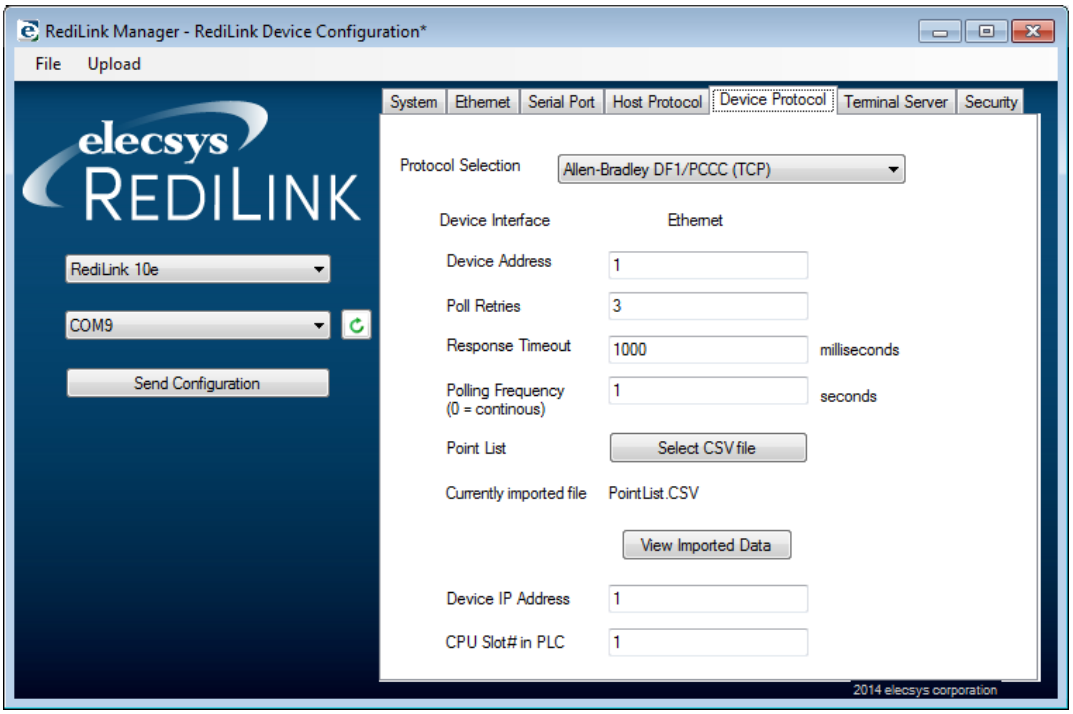
Some of the reasons why an import might fail include:

- Source Registers are used in any Point List row which are different from the configured Device Protocol (DF1 instead of Modbus, or vice versa)
- Destination Registers are used in any Point List row which are different from the configured Host Protocol (DNP instead of Modbus, or vice versa)
- Other errors in the data of the CSV file that produce unexpected results.

7.6.5 Allen Bradley DF1/PCCC Device Protocol

On the **Device Protocol** tab, select the Allen Bradley DF1/PCCC (TCP) device protocol option. This option applies only when using a RediLink 20E or 20C. When using the DF1 protocol, the RediLink will act as a master to the connected Allen Bradley Ethernet device, polling it for data values. The RediLink will also write command data to the device that is received from a remote host. The RediLink supports only the DF1/PCCC protocol for Ethernet, not Allen Bradley SIP protocol.

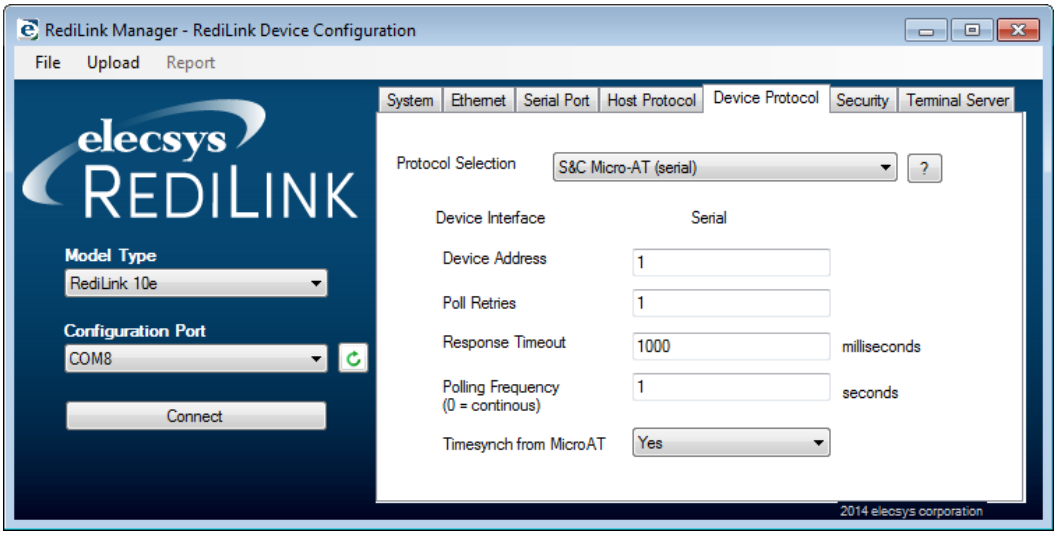
(If using a serial connection to an Allen Bradley PLC, see Allen Bradley DF1 Serial Device Protocol on page 59.)



Property	Description
Protocol Selection	Select the protocol used by the RediLink to communicate with the attached field device. The DF1/PCCC network device protocol applies only to the RediLink 20E and 20C (see Allen Bradley DF1 Serial Device Protocol on page 59 for configuring DF1 protocol on a serial device interface). • **Allen-Bradley DF1/PCCC (TCP)** – this option uses the DF1/PCCC protocol to communicate with an Allen-Bradley PLC over Ethernet. The RediLink does not support the SIP protocol.
Device Interface	This field is for information only, indicating the type of device port available for this RediLink model (Ethernet).
Device Address	Enter the DF1 slave address of the PLC to be polled by the RediLink. *The Device Address should be a number between 1 and 255.*
Poll Retries	Enter the number of attempts to retry each poll to the device in case of timeout or a failed message.
Response Timeout	Enter the time in milliseconds to wait for a response from the device before timing out and retrying the poll.
Polling Frequency	Enter the time in seconds between sequences of polls to the device, or enter zero (0) for continuous polling *All defined polls use the same polling frequency. If the time required to complete the list of defined polls exceeds the polling frequency, the next cycle of polls will begin immediately.*
Point List	Click the **Select CSV File** button to import a point list that defines the data to request from the device. See Importing DF1 Point List on page 60 for an explanation of how to create and import the Point List spreadsheet. (If the Protocol Selection is changed, the Point List must be imported again.) Click the **View Imported Data** button to view the Point List after it has been imported.
Currently imported file	This field is for information only, indicating the name of the most recently imported Point List.
Device IP Address	Enter the IPv4 address of the Allen Bradley PLC (Ethernet only) to which the RediLink should connect. *The IP port number is defaulted to 44818 in the protocol.*
CPU Slot# in PLC	Enter the slot number of the Ethernet card in the PLC backplane.

7.6.6 S&C Device Protocol

On the **Device Protocol** tab, select the S&C Micro-AT device protocol option. When using the S&C protocol, the RediLink acts as a master to the connected S&C Micro-AT device, polling it for data values. The RediLink will also write command data to the device that is received from a remote host.



Property	Description
Protocol Selection	Select the protocol used by the RediLink to communicate with the attached field device. The S&C Micro-AT protocol option only applies to the RediLink 10E or 20E, and the Serial Port configuration should be set to RS-232 at 19200 baud, no parity, 8 data bits, one stop bit, and no flow control.
Device Interface	This field is for information only, indicating the type of device port available for this RediLink model (serial).
Device Address	Enter the S&C Micro-AT slave address of the device to be polled by the RediLink. *The Device Address should be a number between 1 and 255.*
Poll Retries	Enter the number of attempts to retry each poll to the device in case of timeout or a failed message.
Response Timeout	Enter the time in milliseconds to wait for a response from the device before timing out and retrying the poll.
Polling Frequency	Enter the time in seconds between sequences of polls to the device, or enter zero (0) for continuous polling. *All defined polls use the same polling frequency. If the time required to complete the list of defined polls exceeds the polling frequency, the next cycle of polls will begin immediately.*
Timesynch from MicroAT	Select **Yes** or **No**, whether the RediLink clock should be synchronized according to the current date and time received from the Micro-AT device.

7.6.7 S&C Point List

The S&C Micro-AT protocol selection does not require an imported Point List, because the polling messages and RediLink database are hard coded. The following point list gives the list of register addresses for Micro-AT data, when using either a Modbus/MQTT or a DNP 3.0 Host Protocol. DNP analog values are 16-bit integer (Object 30, variation 2), unless indicated as “32-bit” (Object 30, variation 1) or “Float” (Object 30, variation 5)

S&C command	Description	Modbus/MQTT Register	DNP Point
Input	Super Auto	10001	Obj 1, pt. 0
Input	Left Open	10002	Obj 1, pt. 1
Input	Left Close	10003	Obj 1, pt. 2
Input	Left Coupled	10004	Obj 1, pt. 3
Input	Left Trip Open	10005	Obj 1, pt. 4
Input	Left Trip Close	10006	Obj 1, pt. 5
Input	Left Door	10007	Obj 1, pt. 6
Input	Left Shutter	10008	Obj 1, pt. 7
Input	Left Key	10009	Obj 1, pt. 8
Input	Left Super Trip Open	10010	Obj 1, pt. 9
Input	Left Super Trip Close	10011	Obj 1, pt. 10
Input	Left Charge to Open	10012	Obj 1, pt. 11
Input	Left Charge to Close	10013	Obj 1, pt. 12
Input	Left Capa Charge	10014	Obj 1, pt. 13
Input	Left Ext Reset	10015	Obj 1, pt. 14
Input	Left Ext Set	10016	Obj 1, pt. 15
Input	Right Open	10017	Obj 1, pt. 16
Input	Right Close	10018	Obj 1, pt. 17
Input	Right Couple	10019	Obj 1, pt. 18
Input	Right Trip Open	10020	Obj 1, pt. 19
Input	Right Trip Close	10021	Obj 1, pt. 20
Input	Right Door	10022	Obj 1, pt. 21
Input	Right Shutter	10023	Obj 1, pt. 22
Input	Right Key	10024	Obj 1, pt. 23
Input	Right SupTrip Open	10025	Obj 1, pt. 24
Input	Right SupTrip Close	10026	Obj 1, pt. 25
Input	Right Char To Open	10027	Obj 1, pt. 26
Input	Right Char to Close	10028	Obj 1, pt. 27
Input	Right Cap Charge	10029	Obj 1, pt. 28
Input	Right Ext Reset	10030	Obj 1, pt. 29
Input	Right Ext Set	10031	Obj 1, pt. 30
Input	Tie Switch Open	10032	Obj 1, pt. 31
Input	Tie Switch Close	10033	Obj 1, pt. 32

S&C command	Description	Modbus/MQTT Register	DNP Point
Input	Tie Switch Couple	10034	Obj 1, pt. 33
Input	Tie Switch Trp Open	10035	Obj 1, pt. 34
Input	Tie Switch Trip Close	10036	Obj 1, pt. 35
Input	Tie Switch Door	10037	Obj 1, pt. 36
Input	Tie Switch Key	10038	Obj 1, pt. 37
Input	Tie Sup Trip Open	10039	Obj 1, pt. 38
Input	Tie Sup Trip Close	10040	Obj 1, pt. 39
Output	Left Run Motor	10041	Obj 1, pt. 40
Output	Right Run Motor	10042	Obj 1, pt. 41
Output	Left Steer Open	10043	Obj 1, pt. 42
Output	Left Steer Close	10044	Obj 1, pt. 43
Output	Right Steer Open	10045	Obj 1, pt. 44
Output	Right Steer Close	10046	Obj 1, pt. 45
Output	Left Oper Trip	10047	Obj 1, pt. 46
Output	Right Oper Trip	10048	Obj 1, pt. 47
Output	Tie Oper Trip	10049	Obj 1, pt. 48
Output	Padding	10050	Obj 1, pt. 49
Not Ready	Right Not Coupled	10051	Obj 1, pt. 50
Not Ready	Left Not Coupled	10052	Obj 1, pt. 51
Not Ready	Bus Tie Not Coupled	10053	Obj 1, pt. 52
Not Ready	Right Not Closed	10054	Obj 1, pt. 53
Not Ready	Right Not Open	10055	Obj 1, pt. 54
Not Ready	Left Not Closed	10056	Obj 1, pt. 55
Not Ready	Left Not Open	10057	Obj 1, pt. 56
Not Ready	Right Door Unlatch	10058	Obj 1, pt. 57
Not Ready	Left Door Unlatch	10059	Obj 1, pt. 58
Not Ready	Bus Tie Door Latch	10060	Obj 1, pt. 59
Not Ready	Right Shutter Latch	10061	Obj 1, pt. 60
Not Ready	Left Shutter Latch	10062	Obj 1, pt. 61
Not Ready	Right Key Lock	10063	Obj 1, pt. 62
Not Ready	Left Key Lock	10064	Obj 1, pt. 63
Not Ready	Bus Tie Key Lock	10065	Obj 1, pt. 64
Not Ready	Unbalance Detect	10066	Obj 1, pt. 65
Not Ready	Remote In Auto	10067	Obj 1, pt. 66
Not Ready	Panel in Auto	10068	Obj 1, pt. 67
Not Ready	Right Gounded	10069	Obj 1, pt. 68
Not Ready	Lef Grounded	10070	Obj 1, pt. 69
Not Ready	Tank Pres Good	10071	Obj 1, pt. 70
Not Ready	Reserve 23	10072	Obj 1, pt. 71
Not Ready	Reserve 24	10073	Obj 1, pt. 72
Not Ready	Reserve 25	10074	Obj 1, pt. 73

S&C command	Description	Modbus/MQTT Register	DNP Point
Not Ready	Reserve 26	10075	Obj 1, pt. 74
Not Ready	Reserve 27	10076	Obj 1, pt. 75
Not Ready	Reserve 28	10077	Obj 1, pt. 76
Not Ready	Reserve 29	10078	Obj 1, pt. 77
Not Ready	Reserve 30	10079	Obj 1, pt. 78
Not Ready	Reserve 31	10080	Obj 1, pt. 79
Not Ready	Reserve 32	10081	Obj 1, pt. 80
Not Ready	Reserve 33	10082	Obj 1, pt. 81
Not Ready	Reserve 34	10083	Obj 1, pt. 82
Not Ready	Reserve 35	10084	Obj 1, pt. 83
Not Ready	Reserve 36	10085	Obj 1, pt. 84
Not Ready	Reserve 37	10086	Obj 1, pt. 85
Not Ready	Reserve 38	10087	Obj 1, pt. 86
Not Ready	Reserve 39	10088	Obj 1, pt. 87
Not Ready	Reserve 40	10089	Obj 1, pt. 88
Not Ready	Reserve 41	10090	Obj 1, pt. 89
Not Ready	Reserve 42	10091	Obj 1, pt. 90
Not Ready	Reserve 43	10092	Obj 1, pt. 91
Not Ready	Reserve 44	10093	Obj 1, pt. 92
Not Ready	Reserve 45	10094	Obj 1, pt. 93
Not Ready	Reserve 46	10095	Obj 1, pt. 94
Not Ready	Reserve 47	10096	Obj 1, pt. 95
Not Ready	Reserve 48	10097	Obj 1, pt. 96
Not Ready	Reserve 49	10098	Obj 1, pt. 97
Not Ready	Reserve 50	10099	Obj 1, pt. 98
Not Ready	Reserve 51	10100	Obj 1, pt. 99
Not Ready	Reserve 52	10101	Obj 1, pt. 100
Not Ready	Reserve 53	10102	Obj 1, pt. 101
Not Ready	Reserve 54	10103	Obj 1, pt. 102
Not Ready	Reserve 55	10104	Obj 1, pt. 103
Not Ready	Reserve 56	10105	Obj 1, pt. 104
Not Ready	Reserve 57	10106	Obj 1, pt. 105
Not Ready	Reserve 58	10107	Obj 1, pt. 106
Not Ready	Reserve 59	10108	Obj 1, pt. 107
Not Ready	Reserve 60	10109	Obj 1, pt. 108
Not Ready	Reserve 61	10110	Obj 1, pt. 109
Not Ready	Reserve 62	10111	Obj 1, pt. 110
Not Ready	Reserve 63	10112	Obj 1, pt. 111
Status	Left Src State	40121	Obj 30, pt. 110
Status	Right Src State	40122	Obj 30, pt. 111
Status	Left Over Current	40123	Obj 30, pt. 112

S&C command	Description	Modbus/MQTT Register	DNP Point
Status	Right Over Current	40124	Obj 30, pt. 113
Status	Ready	40125	Obj 30, pt. 114
Status	Event	40126	Obj 30, pt. 115
Status	Bus Type	40127	Obj 30, pt. 116
Status	Prefer Right	40128	Obj 30, pt. 117
Status	Lockout Install	40129	Obj 30, pt. 118
Status	Super Control	40130	Obj 30, pt. 119
Status	Year	40131	Obj 30, pt. 120
Status	Month	40132	Obj 30, pt. 121
Status	Day	40133	Obj 30, pt. 122
Status	Hour	40134	Obj 30, pt. 123
Status	Minute	40135	Obj 30, pt. 124
Status	Second	40136	Obj 30, pt. 125
Config	Sensing	40137	Obj 30, pt. 126
Config	Unbalanced Install	40138	Obj 30, pt. 127
Config	Unbalanced Detect	40139	Obj 30, pt. 128
Config	Return Mode	40140	Obj 30, pt. 129
Config	Return Trans	40141	Obj 30, pt. 130
Config	Lockout Install	40142	Obj 30, pt. 131
Config	Dwell	40143	Obj 30, pt. 132
Config	Supervisory	40144	Obj 30, pt. 133
Config	VERSION	40145	Obj 30, pt. 134
Config	REVISION	40146	Obj 30, pt. 135
Config	BUILD	40147	Obj 30, pt. 136
Current	Lockout Level	40148	Obj 30, pt. 137
Time	Source hour	40149	Obj 30, pt. 138
Time	Source minute	40150	Obj 30, pt. 139
Time	Source second	40151	Obj 30, pt. 140
Time	Window Hour	40152	Obj 30, pt. 141
Time	Window Minute	40153	Obj 30, pt. 142
Time	Window Second	40154	Obj 30, pt. 143
Events	Event Numb	40155	Obj 30, pt. 144
Events	Count	40156	Obj 30, pt. 145
Events	Last Event	40157	Obj 30, pt. 146
Events	Wrapper	40158	Obj 30, pt. 147
Events	Event ID	40159	Obj 30, pt. 148
Events	Flag Word	40160	Obj 30, pt. 149
Events	Seconds	40161	Obj 30, pt. 150
Events	Minutes	40162	Obj 30, pt. 151
Events	Hours	40163	Obj 30, pt. 152
Events	Day	40164	Obj 30, pt. 153

S&C command	Description	Modbus/MQTT Register	DNP Point
Events	Month	40165	Obj 30, pt. 154
Events	Year	40166	Obj 30, pt. 155
Events	Day of Week	40167	Obj 30, pt. 156
Events	Century	40168	Obj 30, pt. 157
Events	Left Src Cond	40169	Obj 30, pt. 158
Events	Right Src Cond	40170	Obj 30, pt. 159
Events	Left Over Current State	40171	Obj 30, pt. 160
Events	Right Over Current State	40172	Obj 30, pt. 161
Events	Left Oper State	40173	Obj 30, pt. 162
Events	Right Oper State	40174	Obj 30, pt. 163
Events	Bus Tie Oper State	40175	Obj 30, pt. 164
Events	Xfer State	40176	Obj 30, pt. 165
Events	Tick Count	40177	Obj 30, pt. 166
Time	Return Time	40191† (32-bit)	Obj 30, pt. 180 (32-bit)
Current	Left Current	40201† (Float)	Obj 30, pt. 190 (Float)
Current	Right Current	40202† (Float)	Obj 30, pt. 191 (Float)
Time	Left Loss	40203† (Float)	Obj 30, pt. 192 (Float)
Time	Right loss	40204† (Float)	Obj 30, pt. 193 (Float)
Time	Lockout Reset	40205† (Float)	Obj 30, pt. 194 (Float)
Time	Dwell Time	40206† (Float)	Obj 30, pt. 195 (Float)
Voltage	Loss Level	40207† (Float)	Obj 30, pt. 196 (Float)
Voltage	Return Level	40208† (Float)	Obj 30, pt. 197 (Float)
Voltage	Overvolt	40209† (Float)	Obj 30, pt. 198 (Float)
Voltage	Unbalance	40210† (Float)	Obj 30, pt. 199 (Float)
Voltage	Left Phase 1	40211† (Float)	Obj 30, pt. 200 (Float)
Voltage	Left Phase 2	40212† (Float)	Obj 30, pt. 201 (Float)
Voltage	Left Phase 3	40213† (Float)	Obj 30, pt. 202 (Float)
Voltage	Left Unbalance	40214† (Float)	Obj 30, pt. 203 (Float)
Voltage	Left Neg Seq	40215† (Float)	Obj 30, pt. 204 (Float)
Voltage	Left Pos Seq	40216† (Float)	Obj 30, pt. 205 (Float)
Voltage	Left Zero Seq	40217† (Float)	Obj 30, pt. 206 (Float)
Voltage	Right Phase 1	40218† (Float)	Obj 30, pt. 207 (Float)
Voltage	Right Phase 2	40219† (Float)	Obj 30, pt. 208 (Float)
Voltage	Right Phase 3	40220† (Float)	Obj 30, pt. 209 (Float)
Voltage	Right Unbalance	40221† (Float)	Obj 30, pt. 210 (Float)
Voltage	Right Neg Seq	40222† (Float)	Obj 30, pt. 211 (Float)
Voltage	Right Pos Seq	40223† (Float)	Obj 30, pt. 212 (Float)
Voltage	Right Zero Seq	40224† (Float)	Obj 30, pt. 213 (Float)
Events	Src 1 Phase 1	40225† (Float)	Obj 30, pt. 214 (Float)
Events	Src 1 Phase 2	40226† (Float)	Obj 30, pt. 215 (Float)
Events	Src 1 Phase 3	40227† (Float)	Obj 30, pt. 216 (Float)

S&C command	Description	Modbus/MQTT Register	DNP Point
Events	Src 2 Phase 1	40228† (Float)	Obj 30, pt. 217 (Float)
Events	Src 2 Phase 2	40229† (Float)	Obj 30, pt. 218 (Float)
Events	Src 2 Phase 3	40230† (Float)	Obj 30, pt. 219 (Float)
Events	Src 1 Neg Seq	40231† (Float)	Obj 30, pt. 220 (Float)
Events	Src 2 Neg Seq	40232† (Float)	Obj 30, pt. 221 (Float)
Events	Src 1 Zero Seq	40233† (Float)	Obj 30, pt. 222 (Float)
Events	Src 2 Zero Seq	40234† (Float)	Obj 30, pt. 223 (Float)
Events	ClearEvt *	40001	Obj 40, pt. 0
Events	Event Index *	40002	Obj 40, pt. 1

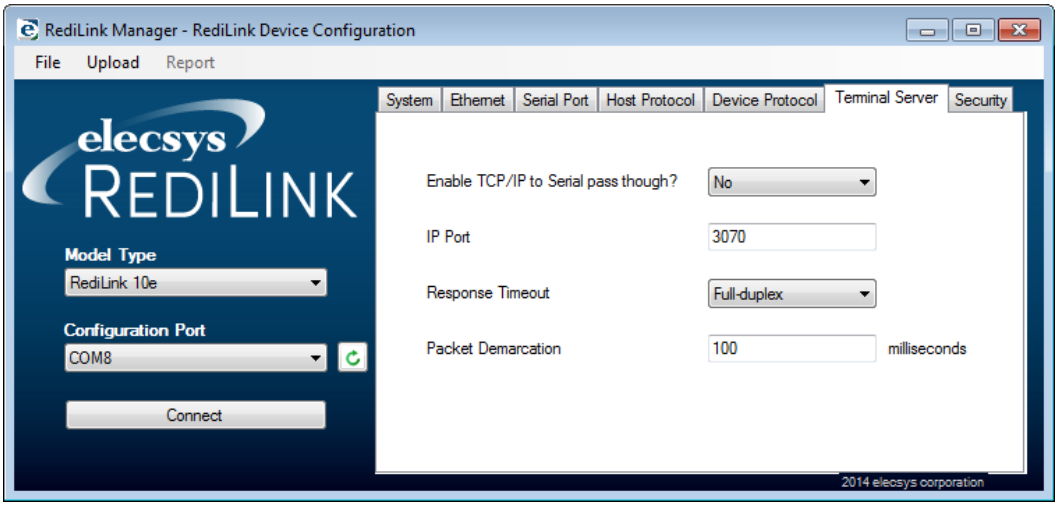
* The “Events” data registers contain the information from the most recently requested event in the Micro-AT device. Write the next consecutive “Event Index” value (40001, Obj. 40 pt. 1) to read the next event data into memory. Write a non-zero value to the ClearEvt register (40001, Obj. 40 pt. 0) to clear the event log in the Micro-AT device.

† When using the Modbus host protocol in 16-bit pair mode, the Modbus mapping used by the host system must be adjusted to account for the fact that pairs of 16-bit registers are used.

7.7 Terminal Server Settings

Click on the **Terminal Server** tab to view the IP to serial Terminal Server settings of the RediLink configuration. This menu applies only to the RediLink 10E and 10C.

The Terminal Server option allows a remote host to make a TCP/IP connection and pass data directly to and from device(s) attached to the RediLink serial port. The incoming TCP socket connection may come either through the Ethernet (RediLink 10E) or cellular (RediLink 10C) network interface.



The Terminal Server may be used, for instance, when a remote host needs to connect its configuration utility directly to a PLC, bypassing the Host and Device protocol polling options of the RediLink. The Terminal Server serial port can be used simultaneously with the serial Device Protocol polling, as long as the connected device is able to accept both polled and pass-through messages interchangeably.

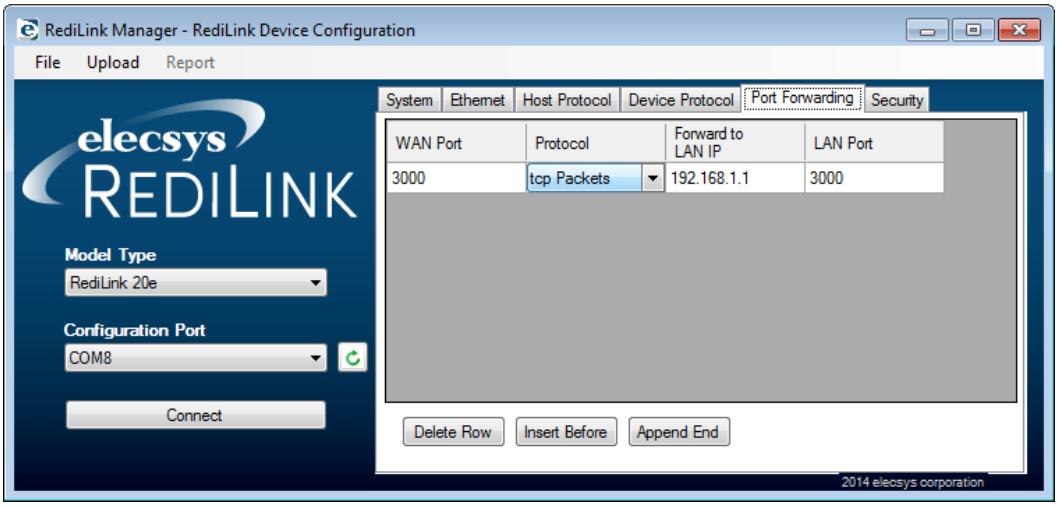
Property	Description
Enable TCP/IP to Serial pass through?	Select **Yes** to enable the Terminal Server feature for this RediLink, or **No** to disable it.
IP Port	Enter the numeric IP port on which the RediLink will listen for incoming TCP connections using the Terminal Server feature.

Property	Description
Response Timeout	Select **Full-duplex** if the serial port is used exclusively for Terminal Server capability (no Device Protocol polls configured). This option allows for protocols which don't follow a strict one-poll/one-response structure (such as protocols that allow for multiple responses to one poll, or unsolicited reporting from the device). If the serial port is being shared with a Device Protocol, select one of the options other than Full-duplex. The **Response Timeout** in seconds is used for poll/response pass-through protocols and indicates how long the RediLink will wait for a response to begin after sending a poll through the Terminal Server. The larger the timeout, the longer it may delay the polls sent by the RediLink using the configured Device Protocol. If the serial protocol only requires messages sent to the serial port but does not expect any response, choose the **Send only** option.
Packet Demarcation	Enter the time in milliseconds to wait for additional bytes of data on the serial port in response to a poll sent through the Terminal Server. This option determines how long to hold the serial port before allowing the configured Device Protocol to send the next poll and only applies when using a numbered **Response Timeout** (poll/response) setting. If the **Packet Demarcation** is set to an odd number, the Terminal Server also performs demarcation for packets received on the TCP/IP side. For instance, if multiple IP packets should be received from a remote host and buffered before sending to the serial device, an odd-numbered Packet Demarcation tells how long to wait for all the IP packets to arrive, in addition to providing byte demarcation of received data on the serial port.

7.8 Port Forwarding Settings

Click on the **Port Forwarding** tab to view the IP port forwarding settings of the RediLink configuration. This menu applies only to the RediLink 20E and 20C.

The Port Forwarding option allows a remote host to make a TCP connection to the RediLink, which will be routed directly to a TCP port of a device attached to the RediLink Ethernet device interface. The incoming TCP socket connection may come either through the Ethernet (RediLink 20E) or cellular (RediLink 20C) network port.



Click the **Append End** button to add a new row to the end of the Port Forwarding table.

Select an existing row in the Port Forwarding table and click the **Insert Before** button to insert a new row before it.

Select an existing row in the Port Forwarding Table and click the **Delete Row** button to delete it. To disable Port Forwarding on the RediLink, delete all existing rows in the table.

Configure the Port Forwarding option by entering data under the column headings described in the following table.

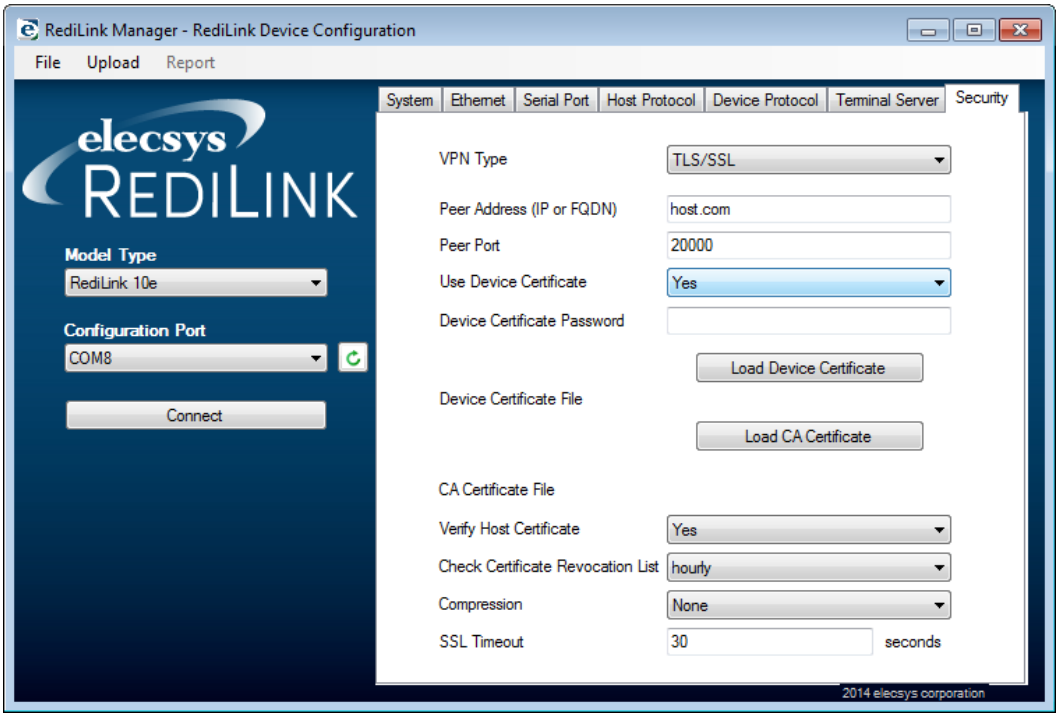
Property	Description
WAN Port	Enter the numeric IP port on which the RediLink will listen for the incoming Port Forwarding connection.
Protocol	Select either **tcp Packets** or **udp Packets** for the type of port (TCP or UDP) to be forwarded. *If you need to forward both a TCP and UDP port with the same number, add a separate row for each protocol.*

Property	Description
Forward to LAN IP **LAN Port**	Enter the IPv4 address and numeric IP port of the device on the local Ethernet interface to which the RediLink will forward data. *The IP address of the device needs to be accessible on the configured subnet of the Device Ethernet port (see Ethernet Settings on page 38).*

7.9 Security/VPN Settings

Click on the **Security** tab to view the VPN security settings of the RediLink configuration.

The VPN option should be used when the RediLink is required to make an authenticated, encrypted connection to a remote host system. A VPN tunnel is established between the RediLink and the host system, then the RediLink can communicate through the tunnel using one of the protocols configured on the Host Protocol tab. The properties shown in the Security tab will vary depending on the VPN selected. At present, the RediLink supports one VPN type: TLS/SSL.



Property	Description
VPN Type	Select **Disabled** to disable the VPN, or select **TLS/SSL** to enable the VPN.
Peer Address	Enter the address of the remote VPN server to which the RediLink will connect to establish the secure tunnel. *The **Peer Address** can be entered either as an IP address or as a fully-qualified domain name (FQDN).*

Property	Description
Peer Port	Enter the numeric IP port of the VPN server to which the RediLink will connect.
Use Device Certificate	Select whether to use a device certificate for authentication to the server. This may be required by some servers in order to authenticate the identity of the RediLink when it connects to the VPN. *If the VPN server does not require the incoming device to have a certificate for authentication, set this option to **No**.*
Device Certificate Password	If using a device certificate for authentication, it is highly recommended that the certificate file be password protected to ensure the protection of the credentials contained in the file. Enter the password of the certificate file if it exists; otherwise, leave the **Device Certificate Password** blank. *The **Device Certificate Password** is not stored in the RediLink configuration file and is only used when transferring the device certificate file, so that the RediLink software can access the certificate file.*
Load Device Certificate	After entering the certificate filename and password, click the **Load Device Certificate** button. Locate the .PFX file in the local file system and click the **Open** button to transfer the file to the RediLink. If there is a problem that prevents the RediLink from receiving or implementing the certificate file, an error message is returned. *The certificate file is stored in the RediLink separate from the configuration and only needs to be transferred once, even if other items in the RediLink configuration change.* ***IMPORTANT**: To avoid interruption in communication with the VPN server, a new certificate must be loaded into the RediLink before the expiry date of the currently installed certificate.*
Device Certificate File	This field is for information only, indicating the name of the most recently imported device certificate file, if one has been loaded.
Load CA Certificate	Click the **Load CA Certificate** button to upload a Certificate Authority file. Locate the CA certificate file in the local file system and click the **Open** button to transfer the file to the RediLink. To use the CA Certificate, the **Verify Host Certificate** option must be set to **Yes**. If there is a problem that prevents the RediLink from receiving or implementing the CA certificate file, an error message is returned. *The CA certificate file is stored in the RediLink separate from the configuration and only needs to be transferred once, even if other items in the RediLink configuration change.* ***IMPORTANT**: To avoid interruption in communication with the VPN server, a new CA certificate must be loaded into the RediLink before the expiry date of the currently installed certificate.*
CA Certificate File	This field is for information only, indicating the name of the most recently imported CA certificate file, if one has been loaded.

Property	Description
Verify Host Certificate	Select whether or not the RediLink is required to verify the authenticity of the VPN server's certificate during the connection to the server. Setting this option to **Yes** requires that a CA certificate is loaded to the RediLink; otherwise, it should be set to **No**. *This verification uses a third-party Certificate Authority to ensure that the VPN server is who it claims to be (no man-in-the-middle attack) and that the server's certificate hasn't been revoked. The location of the Certificate Authority is obtained from the CA certificate file.*
Check Certificate Revocation List	Select whether and how often to check with the third-party Certificate Authority for an updated the Certificate Revocation List (CRL). Options include: • **hourly** – check the CRL once/hour • **daily** – check the CRL once/day • **disabled** – don't check the CRL
Compression	Select whether to use data compression on the VPN communication, and if so what type of compression. Options include: **rle** and **zlib**
SSL Timeout	Enter the SSL message and connection timeout in seconds.

In addition to the settings on the Security tab, some other Host Protocol settings also need to be set appropriately for use through the VPN connection. See the relevant section under Host Protocol Settings beginning on page 42 for more information.

8 Miscellaneous

This section includes a few additional topics for users of the RediLink products.

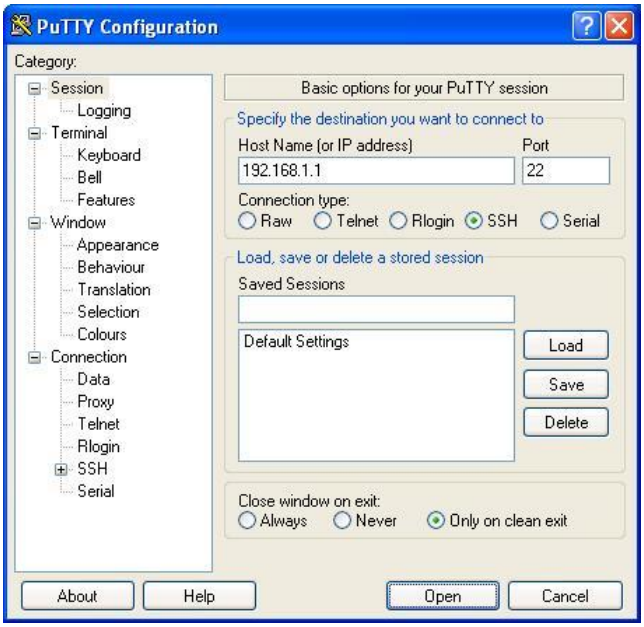
8.1 Setting Up PuTTY

When the RediLink is installed on a network, a user may connect to it for diagnostics using a secure network link using the Secure Shell (SSH) protocol. There are several software applications that can be used for SSH. This section describes how to install the free PuTTY program on Windows. If you already have another SSH client and/or are can use 'ssh' in Linux, you can skip this section.

Browse to the Internet site of the PuTTY program:
http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html

Under "Binaries", download the Windows Installer and install it in a Windows operating system.

From the Windows Start menu, run the PuTTY application. Enter the IP address of the RediLink as the **Host Name**, and click the **Open** button. You will be prompted for a login name and password.



8.2 Securing the RediLink

It is highly recommended to secure the RediLink before deploying it into a production environment, particularly if it may be exposed to a public network. The following sub-sections describe several security issues that should be considered.

This document is not intended to give final guidance or comprehensive details on all aspects of hardening the security of an embedded device. Consult with an IT administrator for advice on complying with corporate security requirements before installing this equipment.

8.2.1 Set RediLink User Password

The RediLink Manager includes a configuration for user login. This username and password should be changed from the default settings. See System Settings on page 37.

8.2.2 RediLink Firewall

The RediLink Manager automatically sets the Linux firewall to allow the types of network traffic required by the configuration. In some cases, an IT administrator may wish to have additional control over the RediLink firewall to allow or limit access beyond what is configurable in the RediLink Manager.

The RediLink firewall uses 'iptables', and its configuration file is stored in /etc/init.d/firewall.sh. An IT administrator may add additional scripting to the Linux startup sequence to modify or override the 'iptables' commands. However, avoid modifying the firewall.sh script itself, because this will be overwritten each time a new RediLink configuration is uploaded.