

# GW-BAC1 BACnet Gateway

## User Guide For Interfacing Unitronics PLCs To Building Automation Systems: BACnet MS/TP, BACnet/IP, Modbus/TCP.



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The mark is a symbol of a high-quality BACnet product.

Go to <http://www.bacnetinternational.net/btl/> for more information about the BACnet Testing Laboratory.

## TABLE OF CONTENTS

<b>1</b>	<b>Introduction</b> .....	<b>5</b>
1.1	GW-BAC1 Gateway .....	5
1.2	Record Identification Data .....	5
1.3	Technical Support .....	5
<b>2</b>	<b>Interfacing GW-BAC1 to Devices</b> .....	<b>6</b>
2.1	GW-BAC1 Showing Connection Ports .....	6
2.2	Connecting a Unitronics PLC to the GW-BAC1 via Modbus RS-485.....	7
2.2.1	Biasing the Modbus RS-485 Network .....	8
2.2.2	End of Line Termination Switch for the Modbus RS-485 port on the GW-BAC1 .....	9
2.3	BACnet MS/TP Field Devices: Wiring Field Port to RS-485 Network .....	10
2.4	Connecting Power to GW-BAC1.....	11
<b>3</b>	<b>Creating configuration file and configuring the PLC</b> .....	<b>12</b>
3.1	UniBACnet configurator.....	12
3.2	PLC configuration example. ....	18
<b>4</b>	<b>ChangING the GW-BAC1 IP Address</b> .....	<b>21</b>
4.1	Connect the PC to GW-BAC1 via the Ethernet Port.....	21
4.2	BACnet/IP: Setting IP Address for Field Network .....	22
	<b>Appendix A. Troubleshooting</b> .....	<b>23</b>
	Appendix A.1. Check Wiring and Settings.....	23
	Appendix A.2. Diagnostic Capture .....	24
	Appendix A.3. LED Diagnostics for Modbus RTU Communications Between GW-BAC1 and Devices .....	27
	<b>Appendix B. Reference</b> .....	<b>28</b>
	Appendix B.1. Specifications.....	28
	Appendix B.2. Compliance with UL Regulations .....	28

**LIST OF FIGURES**

Figure 1: BACnet board.....	6
Figure 2: Power and RS-485 Connections.....	7
Figure 3: Modbus RS-485 Biasing Switch on the GW-BAC1.....	8
Figure 4: Modbus RS-485 End-Of-Line Termination Switch on the GW-BAC1.....	9
Figure 5: Connection from GW-BAC1 to RS-485 Field Network.....	10
Figure 6: RS-485 EOL Switch.....	10
Figure 7: Required current draw for the GW-BAC1.....	11
Figure 8: Power Connections.....	11
Figure 9: Tools menu on VisiLogic.....	12
Figure 10: Tools menu on UniLogic.....	12
Figure 11: BACnet Connection MS/TP Screen.....	13
Figure 12: BACnet Connection IP Screen.....	13
Figure 13: BACnet Nodes Screen.....	14
Figure 14: BACnet Map descriptors Screen.....	14
Figure 15: Modbus connection RTU Screen.....	15
Figure 16: Modbus connection IP Screen.....	15
Figure 17: Finish Screen.....	16
Figure 18: File Transfer Screen.....	17
Figure 19: File menu.....	17
Figure 20: MODBUS RTU configuration.....	18
Figure 21: Example of COM initialize.....	18
Figure 22: Example of Modbus configuration.....	19
Figure 23: Example of MODBUS TCP/IP configurator.....	19
Figure 24: Example of TCP/IP card and socket initialize.....	19
Figure 25: Example of TCP/IP card and socket initialize.....	20
Figure 26: Example of MODBUS Command.....	20
Figure 27: Ethernet Port Location.....	21
Figure 28: PC IP configuration.....	21
Figure 29: Changing IP Address via FST Web GUI.....	22
Figure 30: Ethernet Port Location.....	24
Figure 31: Diagnostic tool – device selection.....	24
Figure 32: Diagnostic selection.....	25
Figure 33: Diagnostic tool – start diagnostic.....	25
Figure 34: Diagnostic tool –diagnostic test complete.....	26
Figure 35: Diagnostic LEDs.....	27
Figure 36: Specifications.....	28

## 1 INTRODUCTION

### 1.1 GW-BAC1 Gateway

The GW-BAC1 is an external, high performance **Building Automation multi-protocol gateway** that has been preprogrammed for enabling Unitronics products (hereafter called "device") to various building automation protocols. These protocols include BACnet<sup>1</sup>MS/TP and BACnet/IP<sup>2</sup>. Configuration for the various protocols is done via Unitronics configuration tool UniBACnet Configurator.

### 1.2 Record Identification Data

Each GW-BAC1 has a unique serial number located on the underside of the unit. This number should be recorded, as it may be required for technical support.

### 1.3 Technical Support

For technical support and questions concerning setting up the GW-BAC1 to work with a Unitronics PLC (e.g. Vision, UniStream etc.) please contact Unitronics technical support at [support@unitronics.com](mailto:support@unitronics.com).

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<sup>1</sup> BACnet is a registered trademark of ASHRAE

2 INTERFACING GW-BAC1 TO DEVICES

2.1 GW-BAC1 Showing Connection Ports

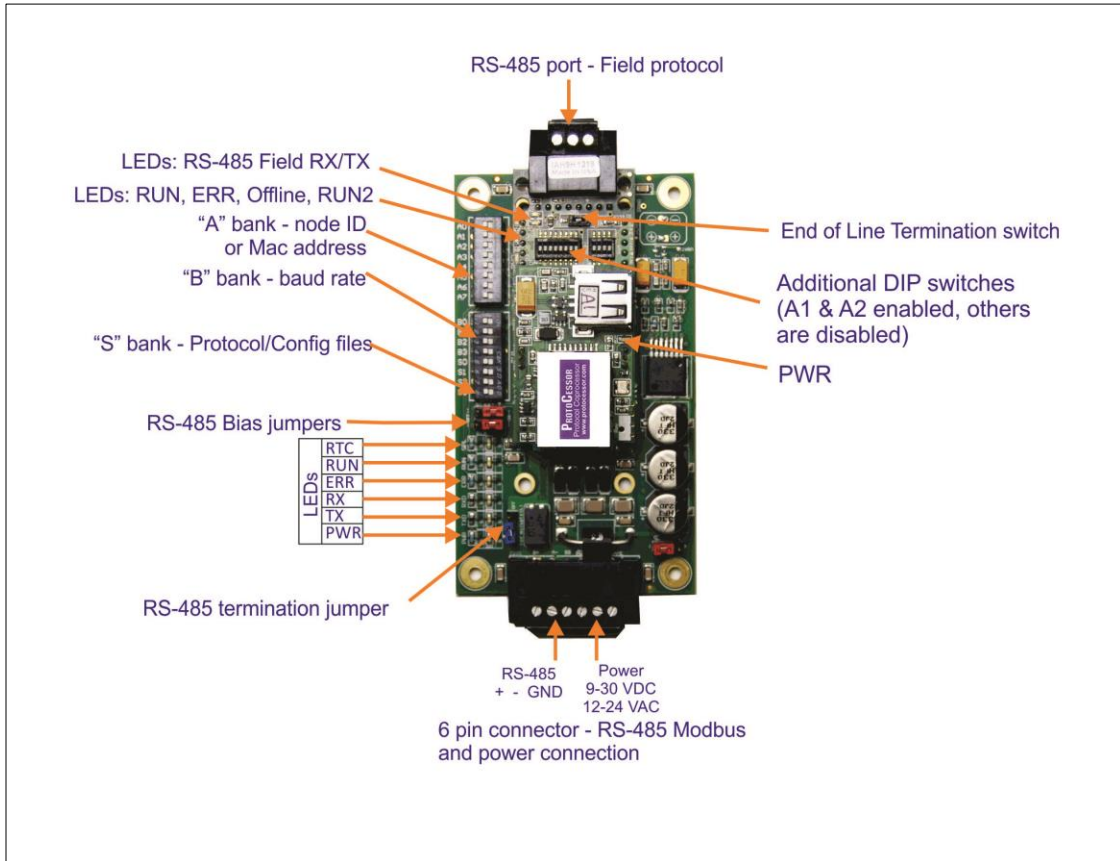


Figure 1: BACnet board

## 2.2 Connecting a Unitronics PLC to the GW-BAC1 via Modbus RS-485

### GW-BAC1 6 Pin Phoenix connector for RS-485 Device

- The 6 pin Phoenix connector is the same for GW-BAC1.
- Pins 1 through 3 are for Modbus RS-485 devices.
  - The RS-485 GND (Pin 3) is not typically connected.
- Pins 4 through 6 are for power. **Do not connect power** (wait until Section 3.4).

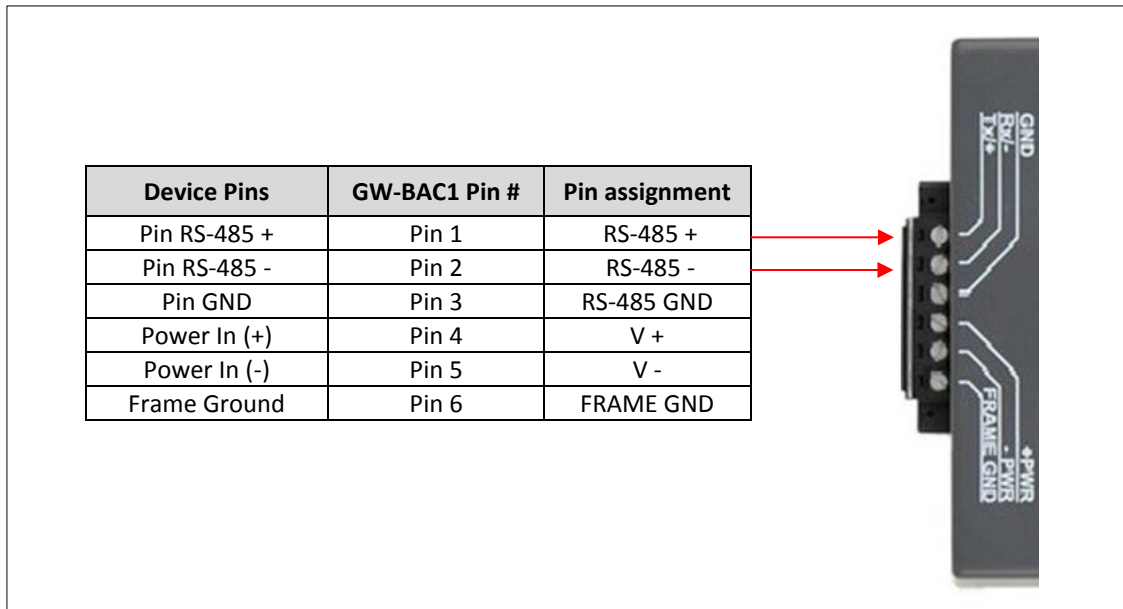


Figure 2: Power and RS-485 Connections

### 2.2.1 Biasing the Modbus RS-485 Network

- An RS-485 network with more than one device needs to have biasing to ensure proper communication. The biasing needs to be done on one device.
- The GW-BAC1 has 530 Ohm resistors that can be used to set the biasing. The GW-BAC1's default positions from the factory for the Biasing jumpers are OFF.

The OFF position is when the 2 RED biasing jumpers straddle the 4 pins closest to the outside of the board of the GW-BAC1. See Error! Reference source not found..

- **Only turn biasing ON:**
  - **IF the BMS cannot see more than one device connected to the GW-BAC1**
  - **AND you have checked all the settings (Modbus COM settings, wiring, and DIP switches).**
- To turn biasing ON, move the 2 RED biasing jumpers to straddle the 4 pins closest to the inside of the board of the GW-BAC1.

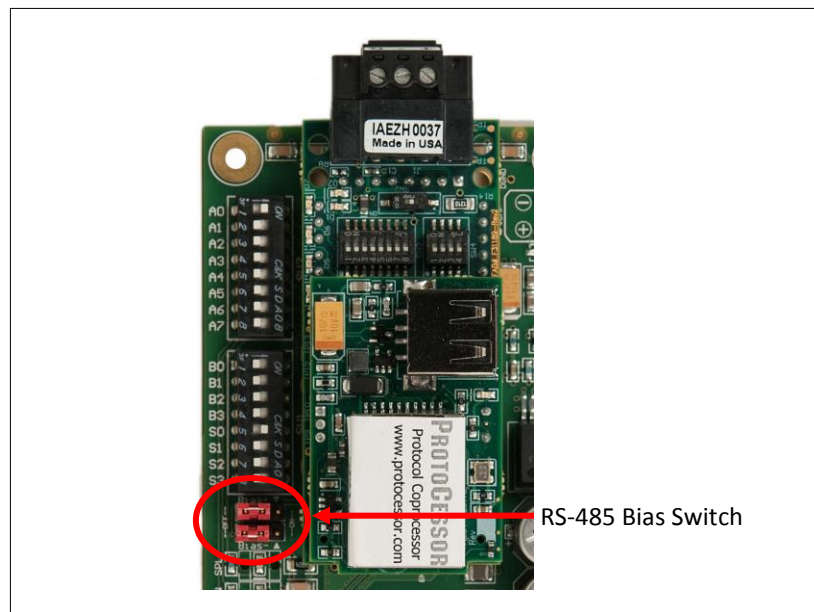


Figure 3: Modbus RS-485 Biasing Switch on the GW-BAC1



### 2.2.2 End of Line Termination Switch for the Modbus RS-485 port on the GW-BAC1

- On long RS-485 cabling runs, the RS-485 trunk must be properly terminated at each end.
- The GW-BAC1 has an End Of Line (EOL) blue jumper. The default setting for this Blue EOL switch is OFF with the jumper straddling the pins closest to the inside of the board of the GW-BAC1.
  - On short cabling runs the EOL switch does not need to be turned ON.
- **If the GW-BAC1 is placed at one of the ends of the trunk, set the blue EOL jumper to the ON position straddling the pins closest to the outside of the board of the GW-BAC1.**
- **Always leave the single Red Jumper in the A position (default factory setting).**

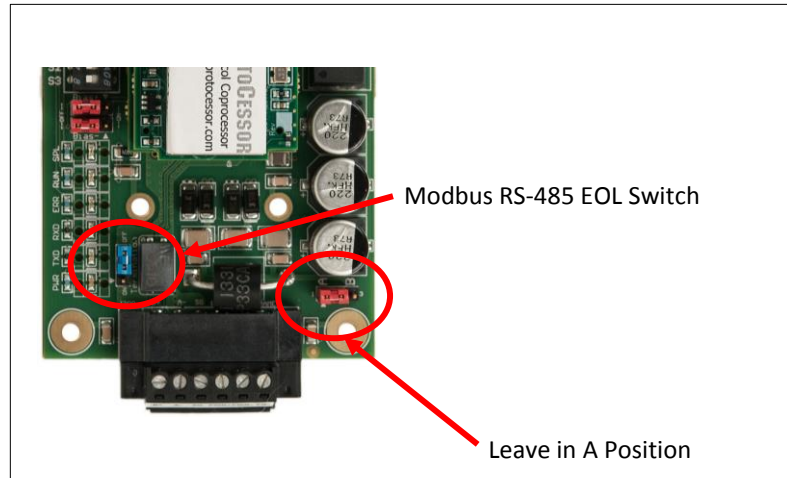


Figure 4: Modbus RS-485 End-Of-Line Termination Switch on the GW-BAC1

## 2.3 BACnet MS/TP Field Devices: Wiring Field Port to RS-485 Network

- Connect the BACnet MS/TP RS-485 network wires to the 3-pin RS-485 connector on GW-BAC1 as shown below in Error! Reference source not found..
  - The RS-485 GND (Pin 3) is not typically connected.
- See **Section 3** for information on connecting to BACnet/IP network.
- If the GW-BAC1 is the last device on the BACnet MS/TP trunk, then the End-Of-Line Termination Switch needs to be enabled (Error! Reference source not found.).
  - The default setting from the factory is OFF (switch position = right side).
  - To enable the EOL Termination, turn the EOL switch ON (switch position = left side).

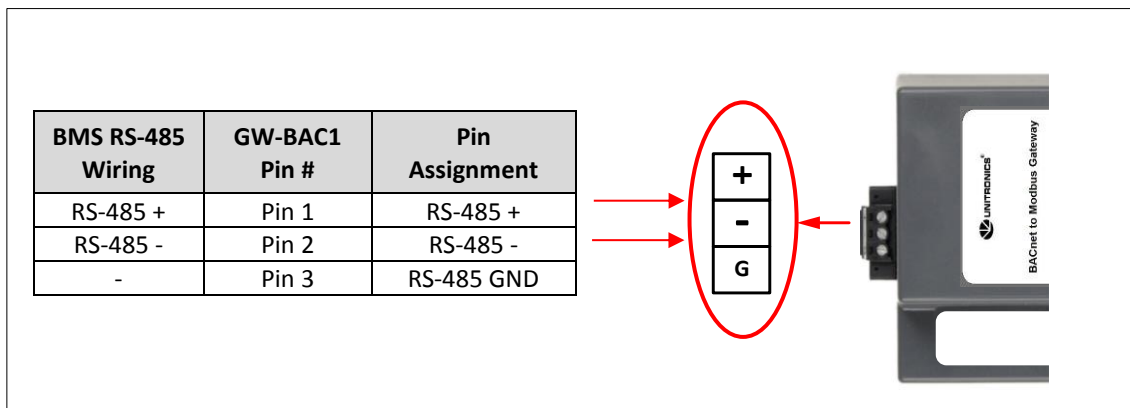


Figure 5: Connection from GW-BAC1 to RS-485 Field Network

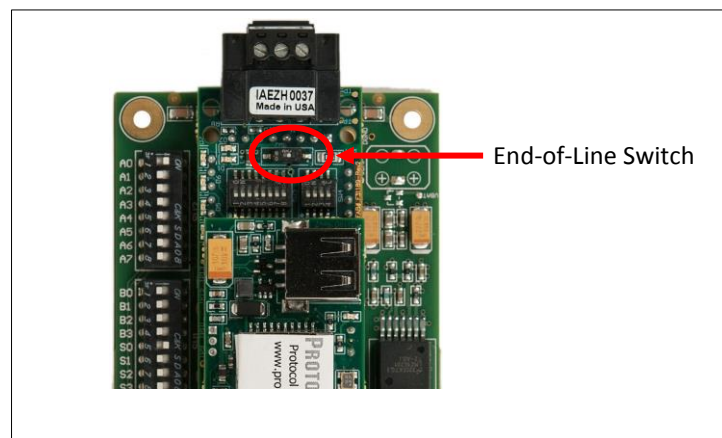


Figure 6: RS-485 EOL Switch

## 2.4 Connecting Power to GW-BAC1

Apply power to GW-BAC1 as show below in Error! Reference source not found.. Ensure that the power supply used complies with the specifications provided in Appendix B.1.

- GW-BAC1 accepts either 9-30VDC or 12-24 VAC on pins 4 and 5.
  - The “Frame Ground” (pin 6) is not typically connected.

Power Requirement for GW-BAC1 at 9V through 30 VDC or 12-24 VAC			
GW-BAC1 Family	Current Draw Type		
	12VDC/VAC	24VDC/VAC	30VDC
FPC – N34 (Typical)	170mA	100mA	80mA
FPC – N34 (Maximum)	240mA	140mA	100mA

Note: These values are ‘nominal’ and a safety margin should be added to the power supply of the host system. A safety margin of 25% is recommended.

Figure 7: Required current draw for the GW-BAC1

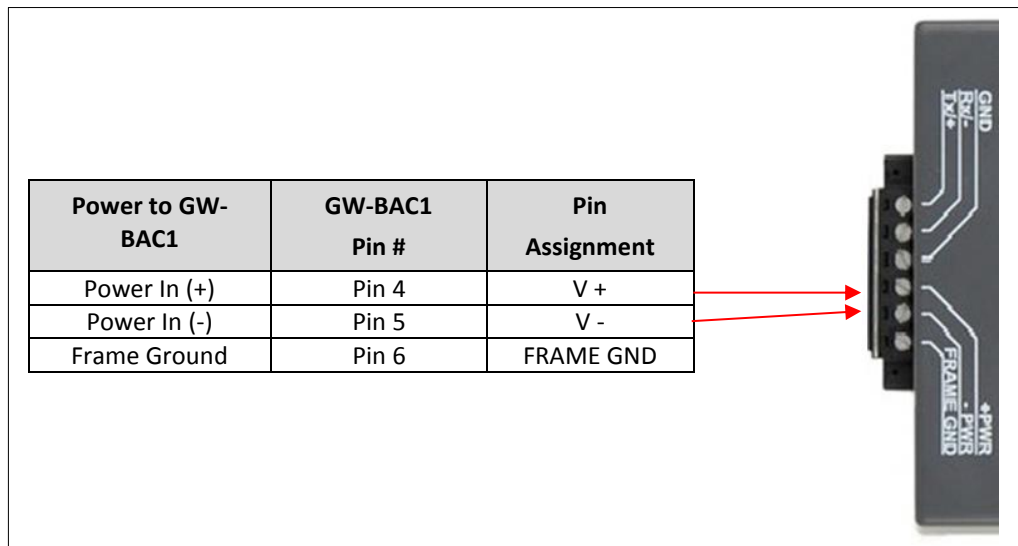


Figure 8: Power Connections

### 3 CREATING CONFIGURATION FILE AND CONFIGURATING THE PLC

#### 3.1 UniBACnet configurator

UniBACnet configurator is a tool provided Unitronics that allows the user to create the configuration file for the GW-BAC1 easily. Once created, the configuration file should be downloaded to the GW-BAC1 in order to enable it to communicate with the Unitronics PLC. The UniBACnet configurator can be launched from both the VisiLogic and UniLogic programming applications Tools menu.

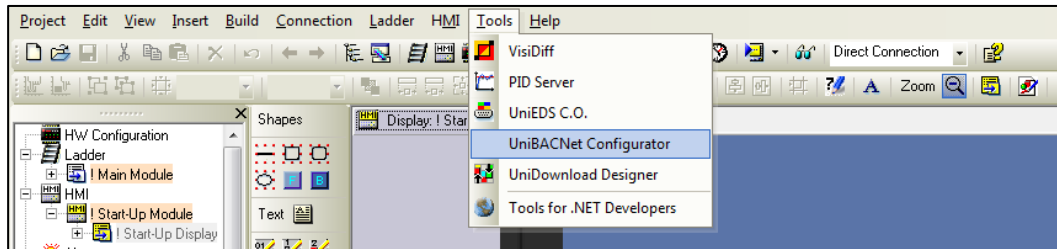


Figure 9: Tools menu on VisiLogic

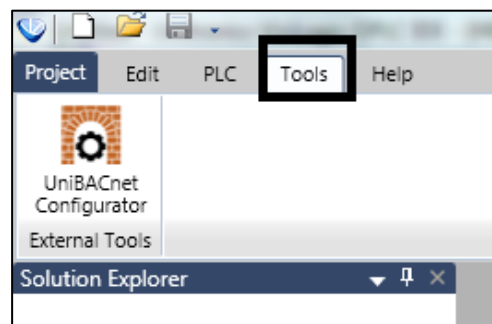


Figure 10: Tools menu on UniLogic

**Configuration file creation steps**

- BACnet Connection: Use this menu for setting up the BACnet Gateway communication parameters. First you must choose the type of BACnet Protocol: MS/TP (Serial) or IP.

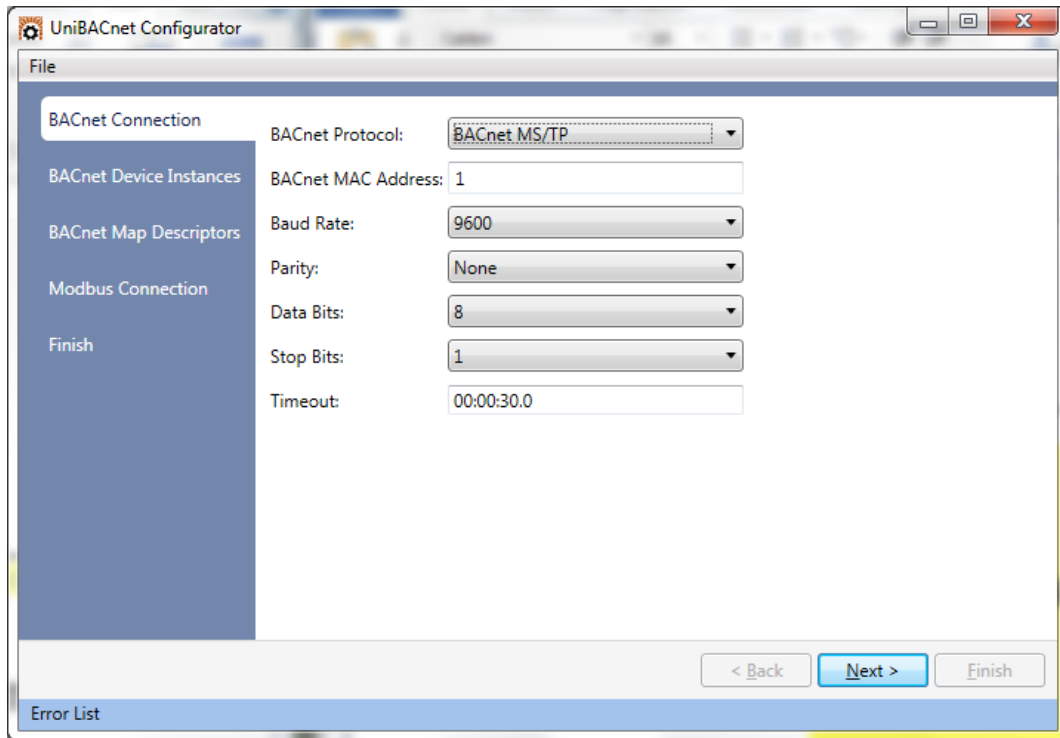


Figure 11: BACnet Connection MS/TP Screen

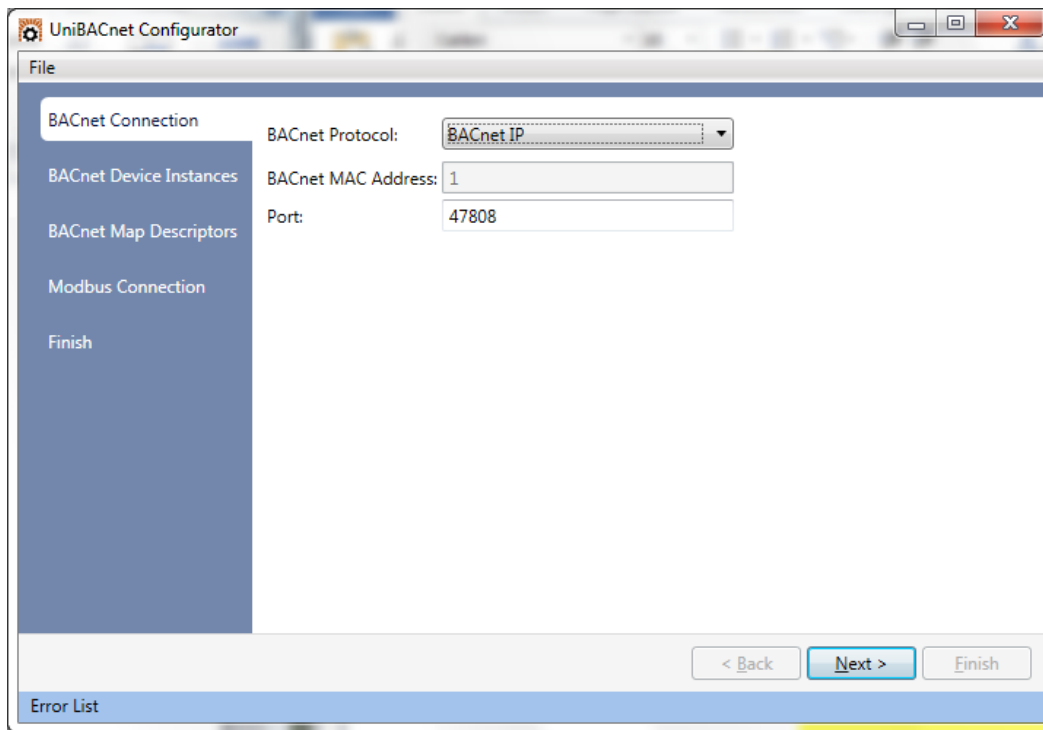


Figure 12: BACnet Connection IP Screen

- BACnet Device instance: Here you will add all the BACnet slave devices.

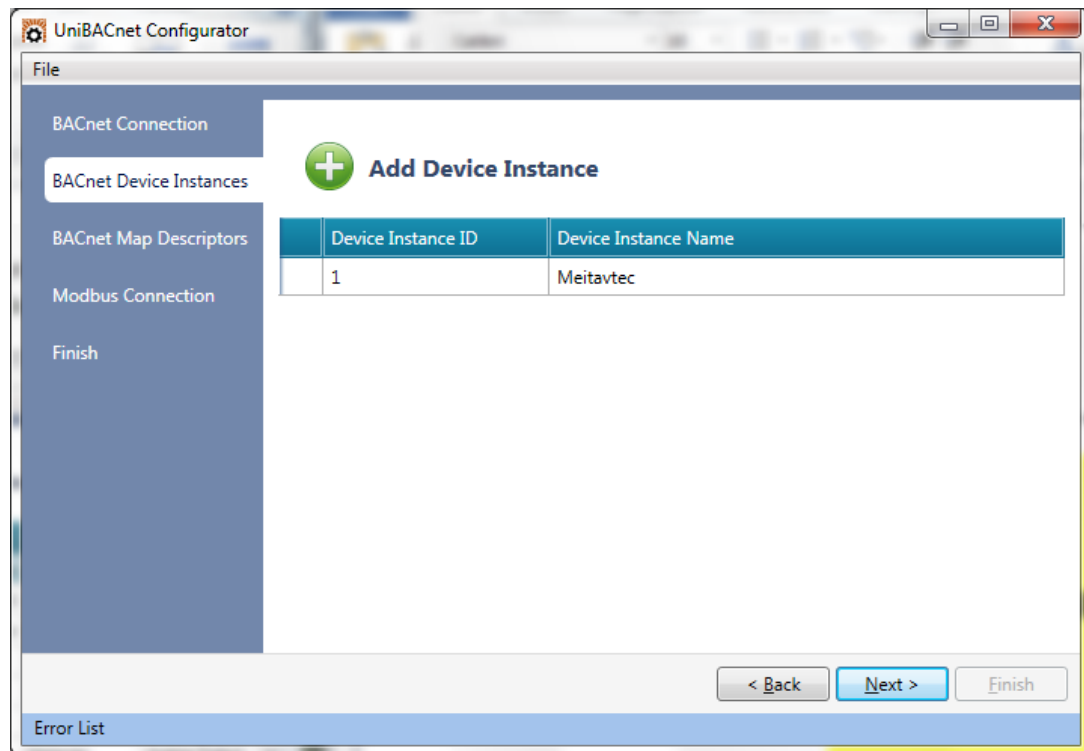


Figure 13: BACnet Nodes Screen

The Device instance must correspond with the ID given to the device. To assign an ID to the device please follow the configuration manual of the device.

- BACnet Map Descriptors: Here you will add the Inputs/Outputs/values to be read and or write in each node, select the format –Int16, Uint16, Int32, Uint32-, Object ID, scan interval and function type.

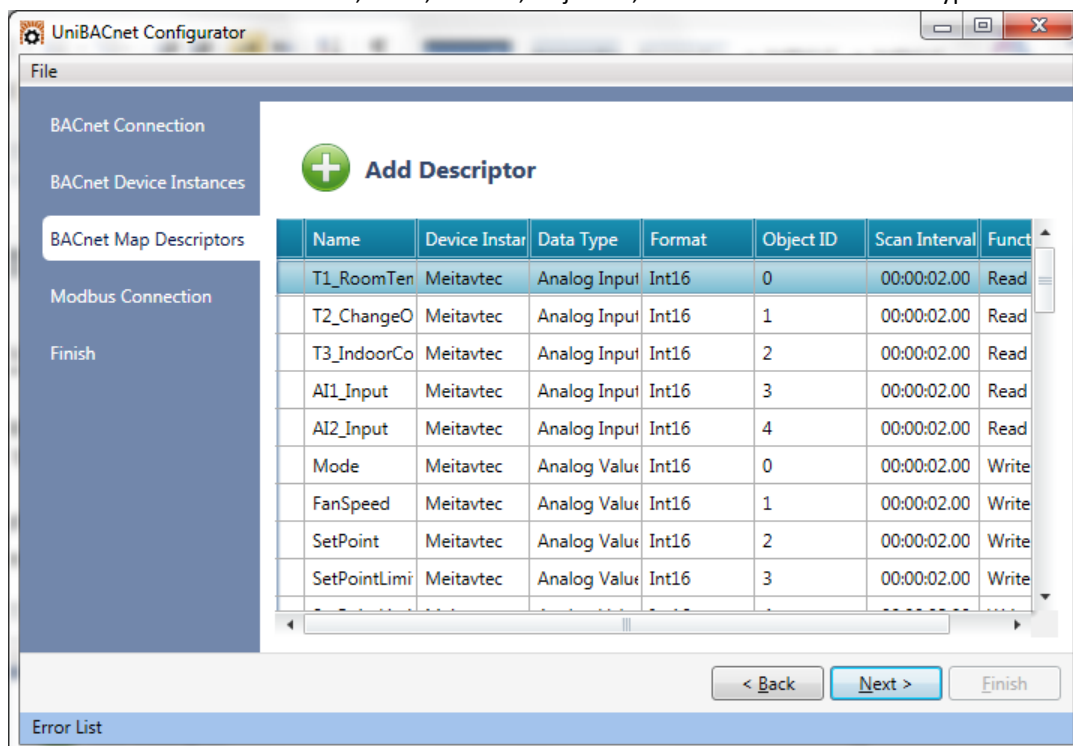
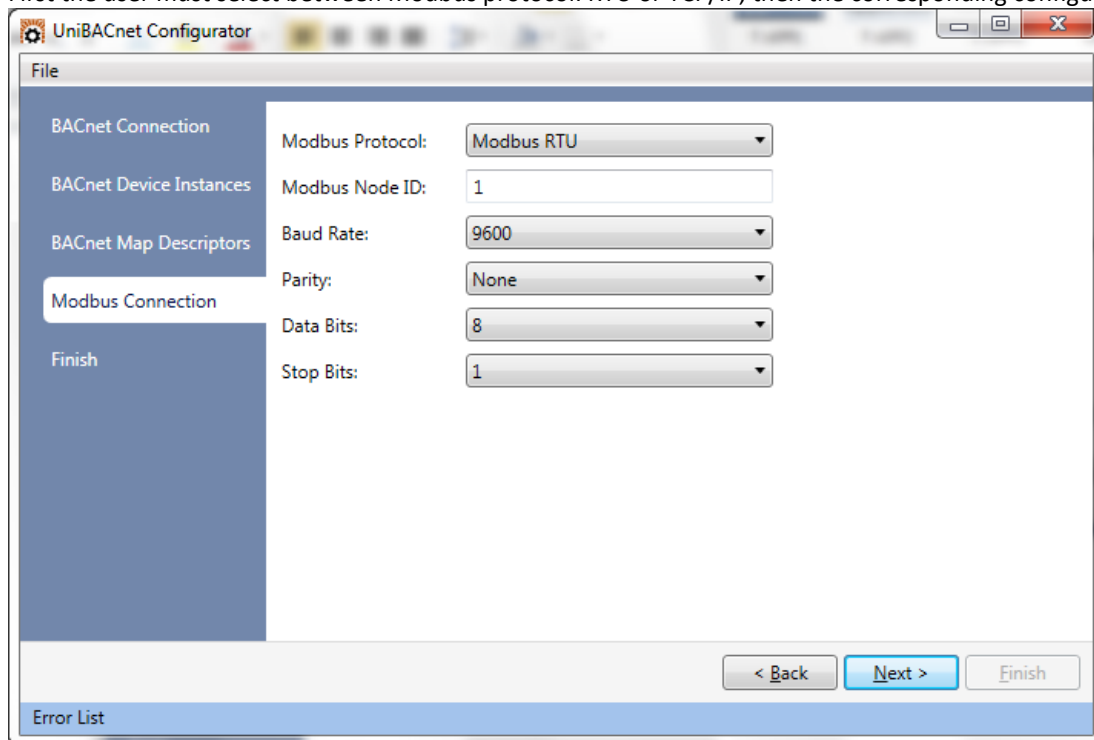


Figure 14: BACnet Map descriptors Screen

Note that the read function will let you read and write while write function will only let you write. Read and write block continuous means that the data will be read and write continuously. Write block on change means that only when there is change in the data, it will be written.

- Modbus Connection: Here the user will configure the Modbus connection to the PLC. First the user must select between Modbus protocol: RTU or TCP/IP, then the corresponding configuration.

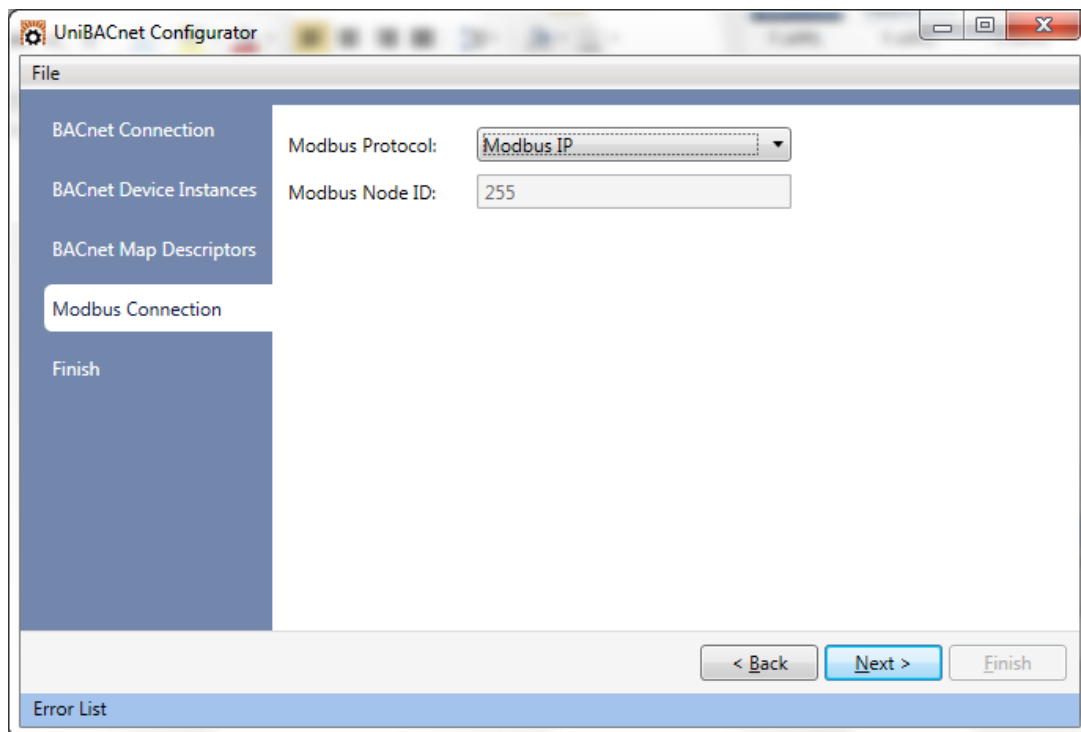


The screenshot shows the UniBACnet Configurator interface for the Modbus Connection RTU screen. The window title is "UniBACnet Configurator". On the left, there is a navigation pane with the following items: "File", "BACnet Connection", "BACnet Device Instances", "BACnet Map Descriptors", "Modbus Connection" (which is highlighted), and "Finish". The main area contains the following configuration fields:

Modbus Protocol:	Modbus RTU
Modbus Node ID:	1
Baud Rate:	9600
Parity:	None
Data Bits:	8
Stop Bits:	1

At the bottom right, there are three buttons: "< Back", "Next >", and "Finish". At the bottom left, there is an "Error List" section.

Figure 15: Modbus connection RTU Screen



The screenshot shows the UniBACnet Configurator interface for the Modbus Connection IP screen. The window title is "UniBACnet Configurator". On the left, there is a navigation pane with the following items: "File", "BACnet Connection", "BACnet Device Instances", "BACnet Map Descriptors", "Modbus Connection" (which is highlighted), and "Finish". The main area contains the following configuration fields:

Modbus Protocol:	Modbus IP
Modbus Node ID:	255

At the bottom right, there are three buttons: "< Back", "Next >", and "Finish". At the bottom left, there is an "Error List" section.

Figure 16: Modbus connection IP Screen

- Finish: This window will show the addressing map of the data to be read/write from/to the device -to be use in VisiLogic ladder logic- and will let you export the configuration file that you will download to the GW-BAC1 via the GUI browser.

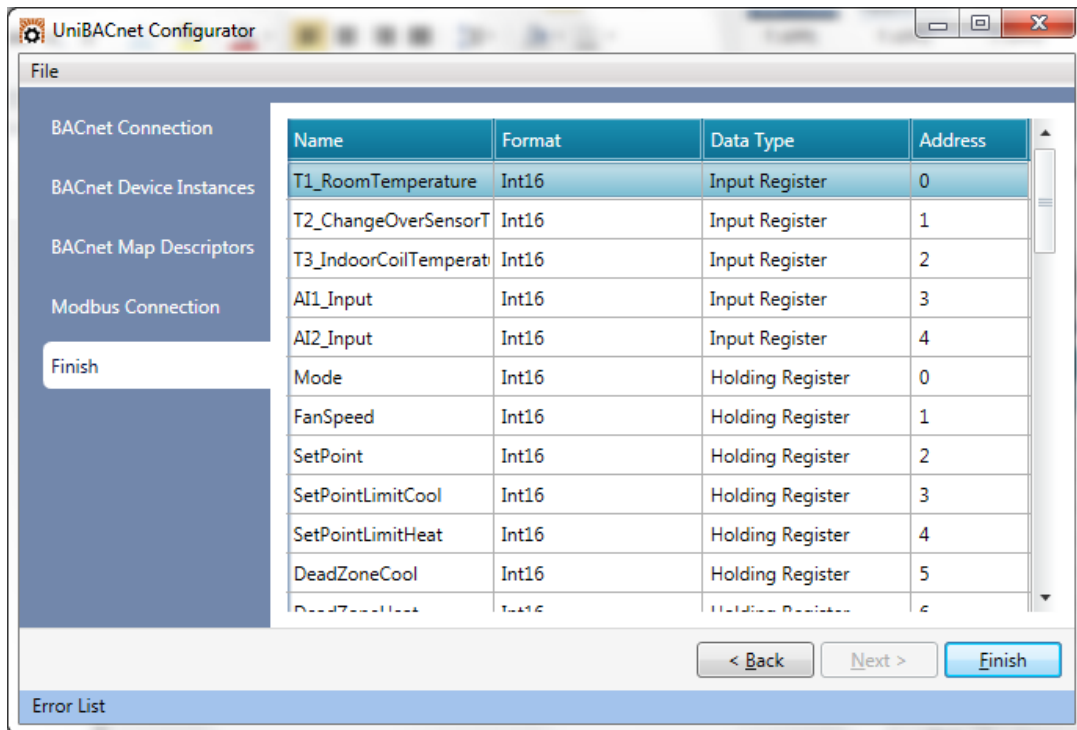


Figure 17: Finish Screen

Once you have created the configuration file, it has to be downloaded to the GW-BAC1 unit according to the following instructions.

- Connect a standard CAT5 Ethernet cable (Straight through or Cross-Over) between the PC and GW-BAC1
- The Default IP Address of GW-BAC1 is **192.168.1.24**, Subnet Mask is **255.255.255.0**. If the PC and GW-BAC1 are on different IP Networks, assign a static IP Address to the PC on the 192.168.1.xxx network

- Go to  >  >  Network Connections

- Right-click on Local Area Connection > Properties

- Highlight   > 

- Select: Use the following IP address

Use the following IP address:

IP address:

Subnet mask:

Default gateway:

- Click  twice



- h. After setting your PC to be on the same subnet as the GW-BAC1, open a web browser on your PC and enter the IP address of the GW-BAC1; the default address is 192.168.1.24.
- i. If IP address of the GW-BAC1 has been changed by previous configuration, download FieldServer Toolbox to discover unknown IP address of the GW-BAC1.  
<http://www.fieldserver.com/docs/downloads/FieldServer-Toolbox.zip>
- j. The FST Web GUI page will be presented.

From the FST Web GUI's landing page, click on "Setup" to expand the navigation tree and then select "File transfer" to access the IP Settings menu. (Error! Reference source not found.)

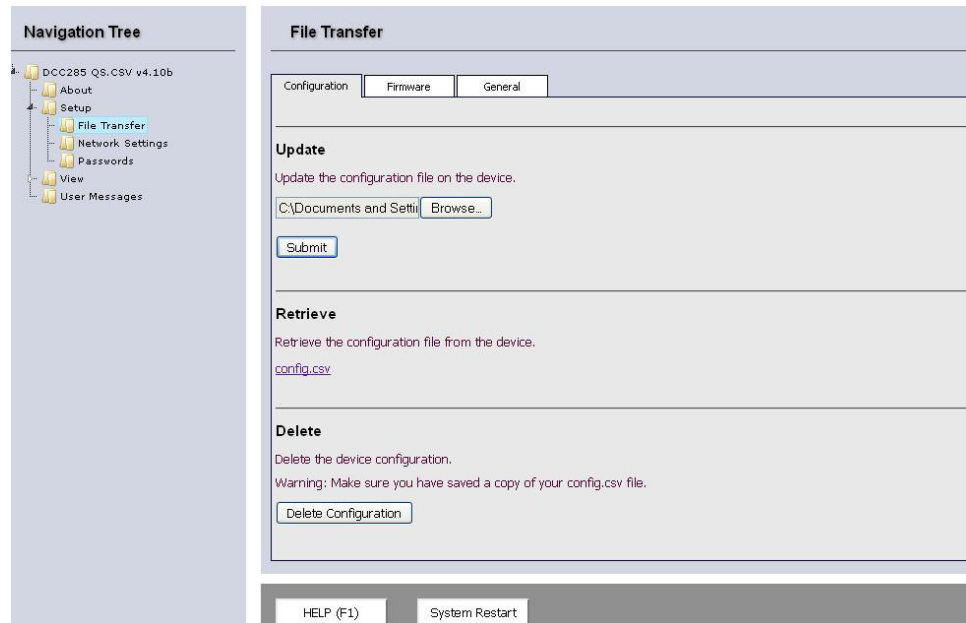


Figure 18: File Transfer Screen

- k. Select browse and look for the CSV file you just created.
  - l. Click on submit button. The download process should take a couple of seconds.
  - m. To finish please click on system restart.
- The **File** menu will let you save the current configuration or open a previously saved one.

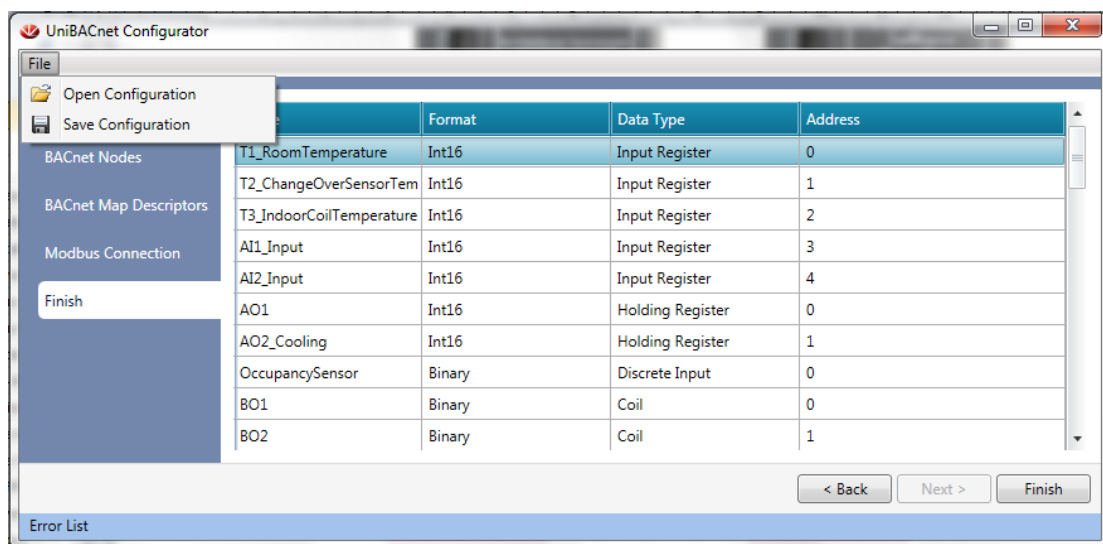


Figure 19: File menu

### 3.2 PLC configuration example.

Please note: The following section provides an example of the required configuration using the Vision570 PLC. The configuration required for your specific application may require some changes. VisiLogic includes further examples for BACnet/Modbus RTU and BACnet/Modbus TCP\_IP.

In all setting the PLC must be configured as a MODBUS master. Depending on the MODBUS protocol the user has chosen, the PLC needs to be configured as MODBUS RTU or MODBUS TCP\_IP master.

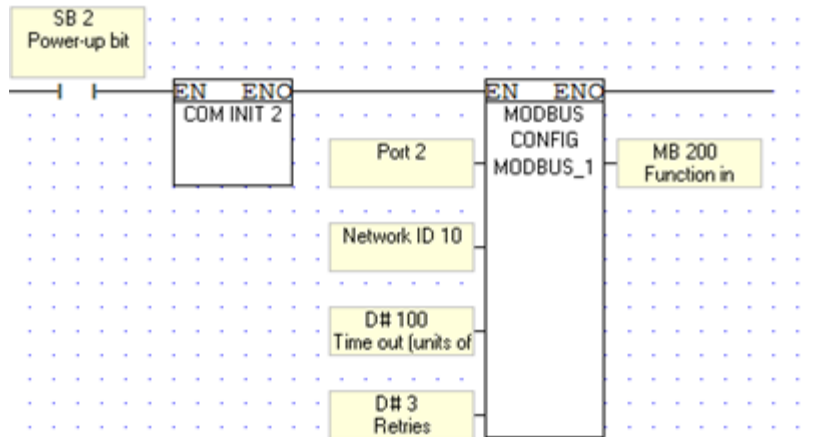


Figure 20: MODBUS RTU configuration

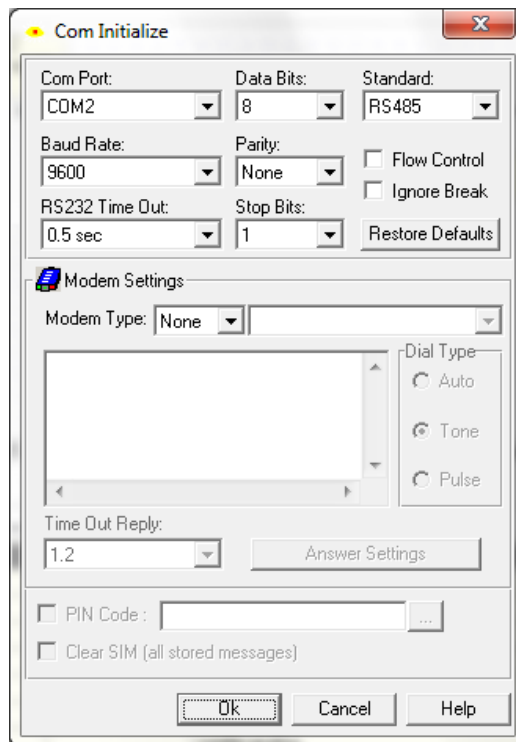


Figure 21: Example of COM initialize

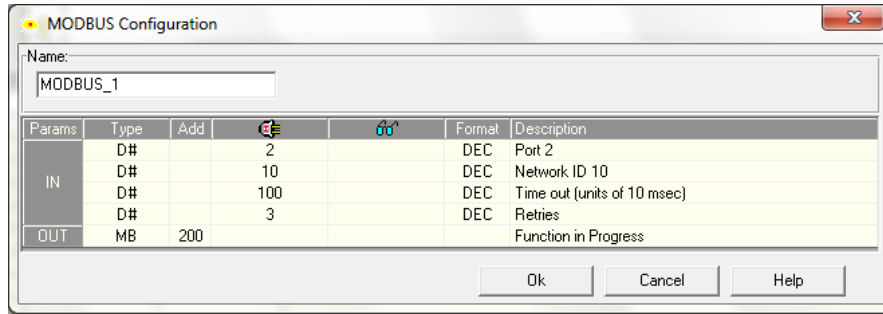


Figure 22: Example of Modbus configuration

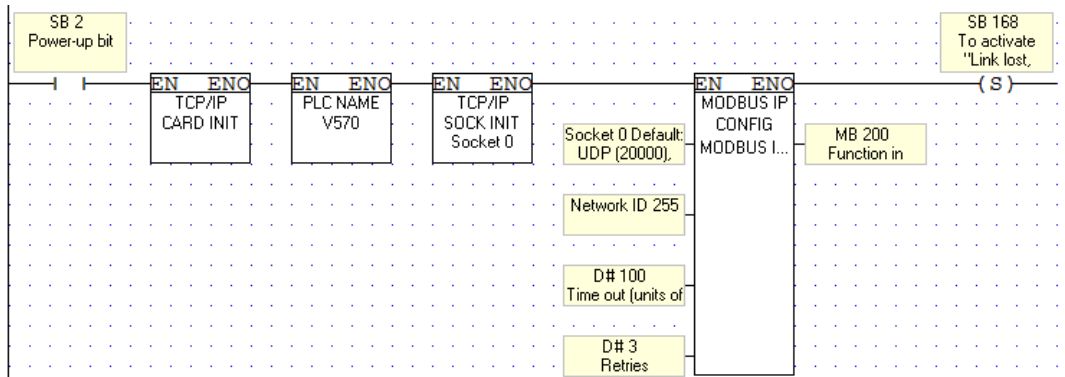


Figure 23: Example of MODBUS TCP/IP configurator

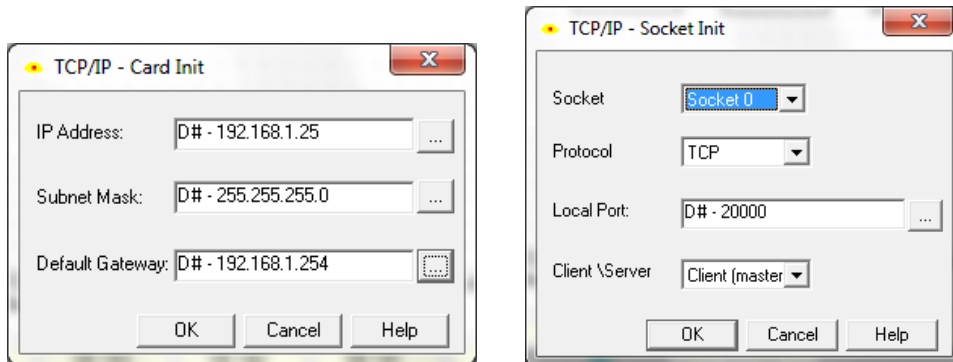


Figure 24: Example of TCP/IP card and socket initialize

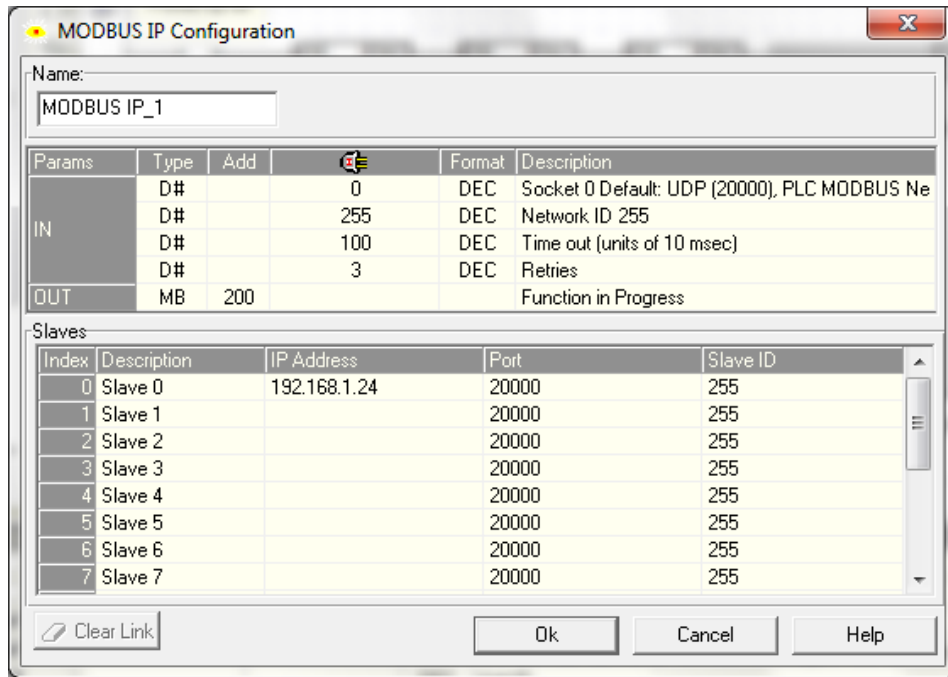


Figure 25: Example of TCP/IP card and socket initialize

After the initial configuration, add the proper Modbus commands to read/write data using the addresses table obtained in the finish screen of the UniBACnet Configurator.

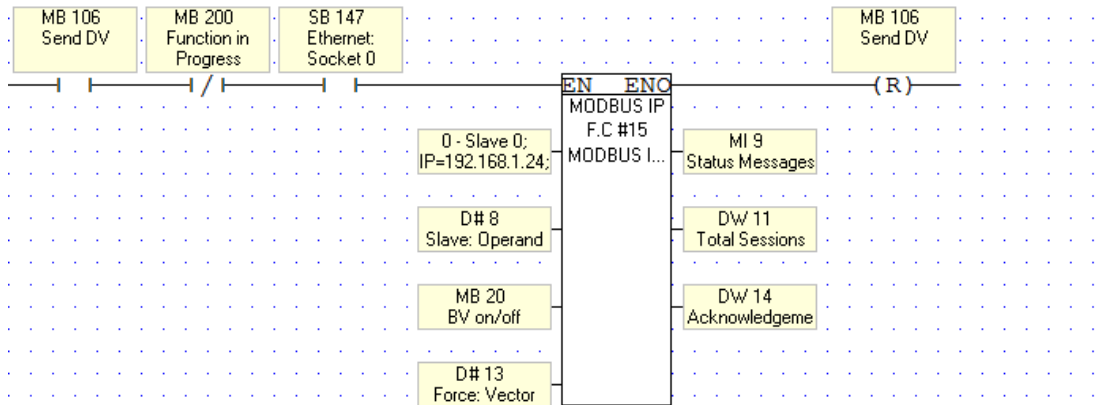


Figure 26: Example of MODBUS Command

## 4 CHANGING THE GW-BAC1 IP ADDRESS

### 4.1 Connect the PC to GW-BAC1 via the Ethernet Port



Figure 27: Ethernet Port Location

- Connect a standard CAT5 Ethernet cable (Straight through or Cross-Over) between the PC and GW-BAC1
- The Default IP Address of GW-BAC1 is **192.168.1.24**, Subnet Mask is **255.255.255.0**. If the PC and GW-BAC1 are on different IP Networks, assign a static IP Address to the PC on the 192.168.1.xxx network

- Go to  >  Control Panel >  Network Connections

- Right-click on Local Area Connection > Properties

- Highlight   Internet Protocol (TCP/IP) > 

- Select: Use the following IP address

Use the following IP address:

IP address:	192 . 168 . 1 . 11
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	. . .

- Click  twice

Figure 28: PC IP configuration

## 4.2 BACnet/IP: Setting IP Address for Field Network

- Open a browser application and type default IP address of the GW-BAC1 192.162.1.24. The FST Web GUI page will be presented.
- From the FST Web GUI's landing page, click on "Setup" to expand the navigation tree and then select "Network Settings" to access the IP Settings menu. (Error! Reference source not found.)

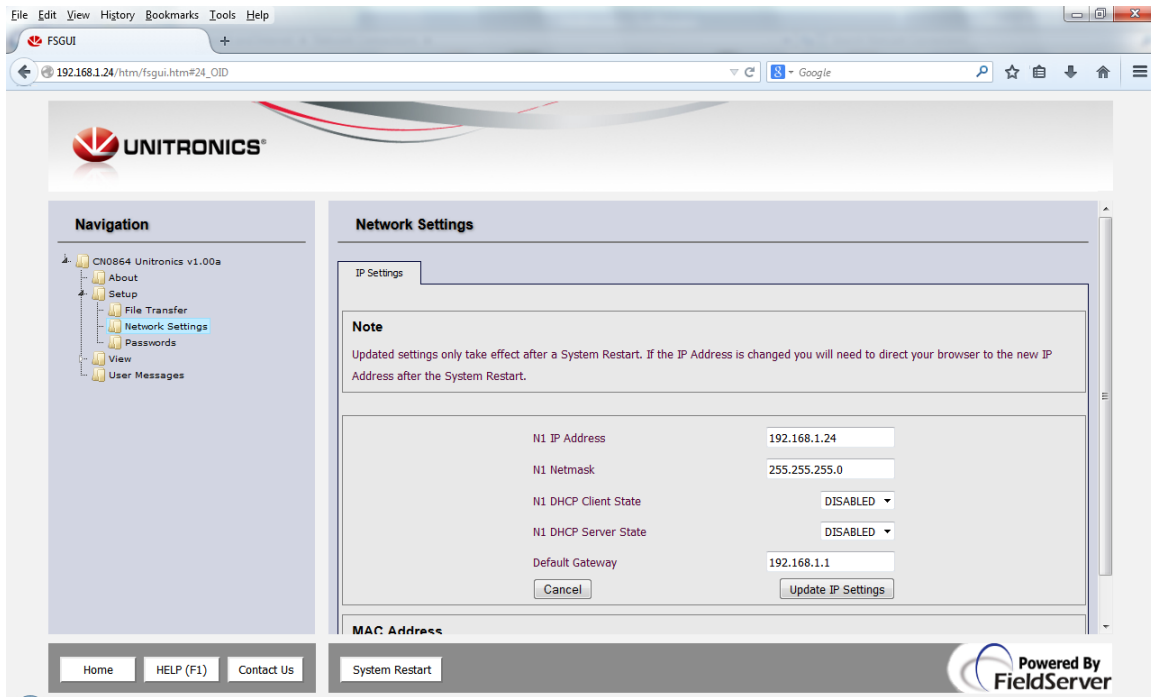


Figure 29: Changing IP Address via FST Web GUI

- Enter the new IP address for the GW-BAC1's Ethernet port in the "N1 IP address" field.
- If necessary, change the Subnet Mask setting in the "N1 Netmask" field.
- If necessary, change the IP Gateway setting in the "Default Gateway" field.
- Note: If the GW-BAC1 is connected to a router, the IP Gateway of the GW-BAC1 should be set to the IP address of the router that it is connected to.
- Click the "System Restart" button at the bottom of the page to apply changes and restart the GW-BAC1.
- Unplug Ethernet cable from PC and connect the GW-BAC1 to the network hub or router.
- **Record the IP address assigned to the GW-BAC1 for future reference.**

## Appendix A. Troubleshooting

### Appendix A.1. Check Wiring and Settings

- If Tx/Rx are not flashing rapidly then there is a COM issue on the Modbus side and you need to check the following things:
  - Visual observations of LEDs on GW-BAC1. **(Appendix A.3)**
  - Check baud rate, parity, data bits, stop bits
  - Check Modbus device address
  - Verify wiring
- Field COM problems:
  - Visual observations of LEDs on GW-BAC1. **(Appendix A.3)**
  - Visual dipswitch settings (using correct baud rate and device instance)
  - Verify IP address setting
  - Verify wiring

**If the problem still exists, a Diagnostic Capture needs to be taken and sent to Unitronics technical support. (Appendix A.2)**

## Appendix A.2. Diagnostic Capture


- Once the log in Diagnostic Capture is complete, email it to [support@unitronics.com](mailto:support@unitronics.com). The Diagnostic Capture will allow us to rapidly diagnose the problem.

Ensure that FieldServer Toolbox is loaded on the PC that is currently being used, or download FieldServer-Toolbox.zip at <http://www.processor.com/tech-support/utilities-and-design-documents.php>

- Extract the executable file and complete the installation.



Figure 30: Ethernet Port Location

- Disable any wireless Ethernet adapters on the PC/Laptop
- Disable firewall and virus protection software if possible
- Connect a standard cat5 Ethernet cable between the PC and GW-BAC1
- Double click on the FS toolbox Utility.
- **Step 1:** Take a Log
  - Click on the diagnose icon  of the desired device.

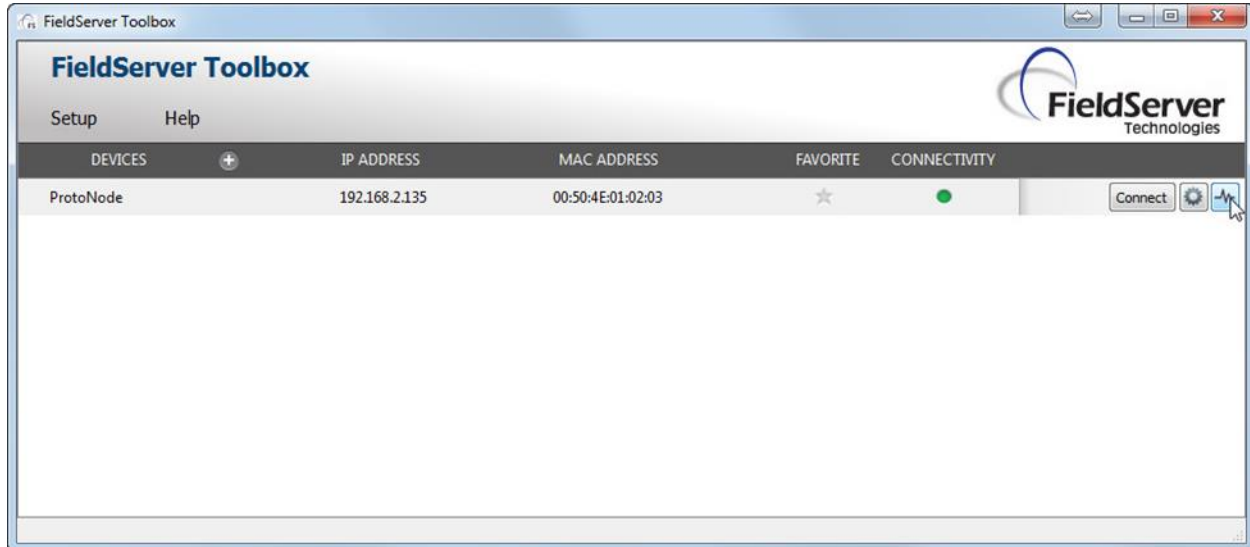


Figure 31: Diagnostic tool – device selection



- Select full Diagnostic

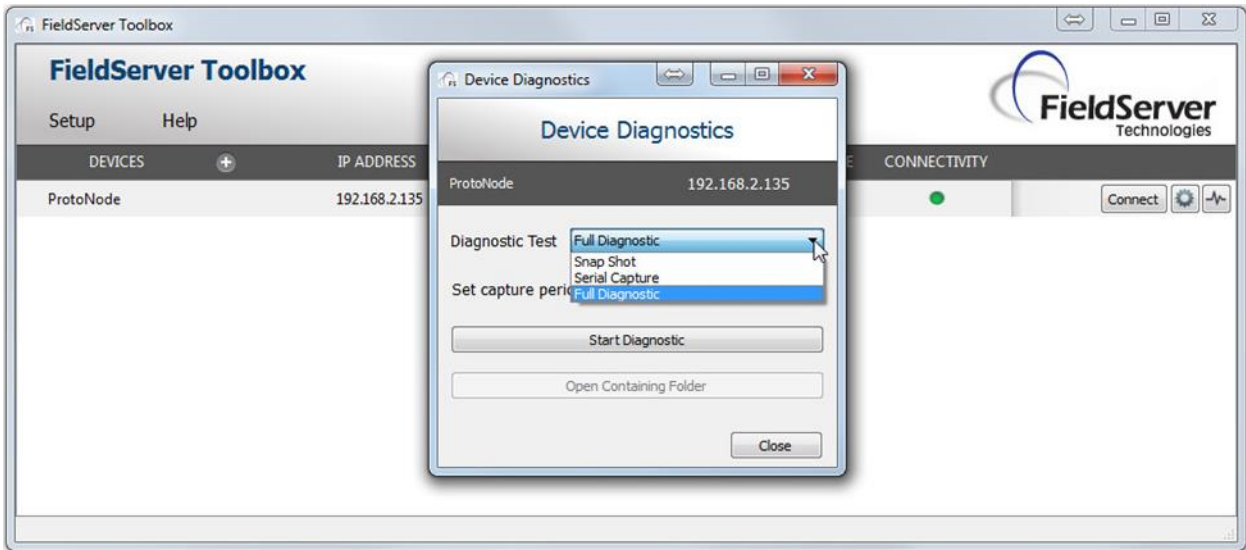


Figure 32: Diagnostic selection

- If desired, the default capture period can be changed.
- Click on Start Diagnostic.

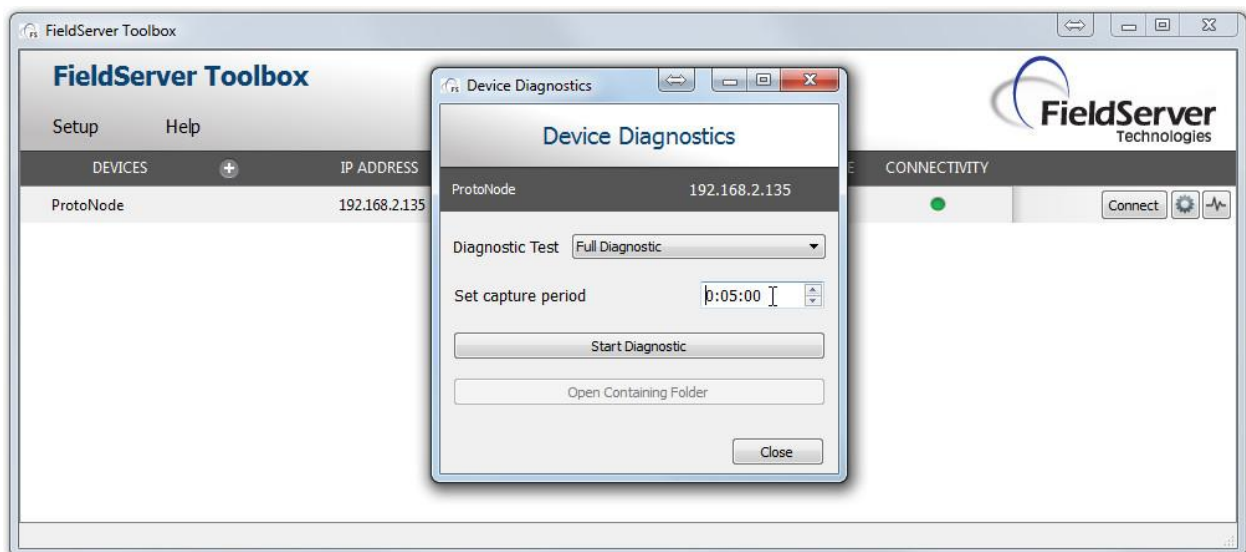


Figure 33: Diagnostic tool – start diagnostic

- Wait for Capture period to finish. Diagnostic Test Complete window will appear. Continue to step 2.

- **Step 2:** Send Log
  - Once the Diagnostic test is complete, a .zip file will be saved on the PC.

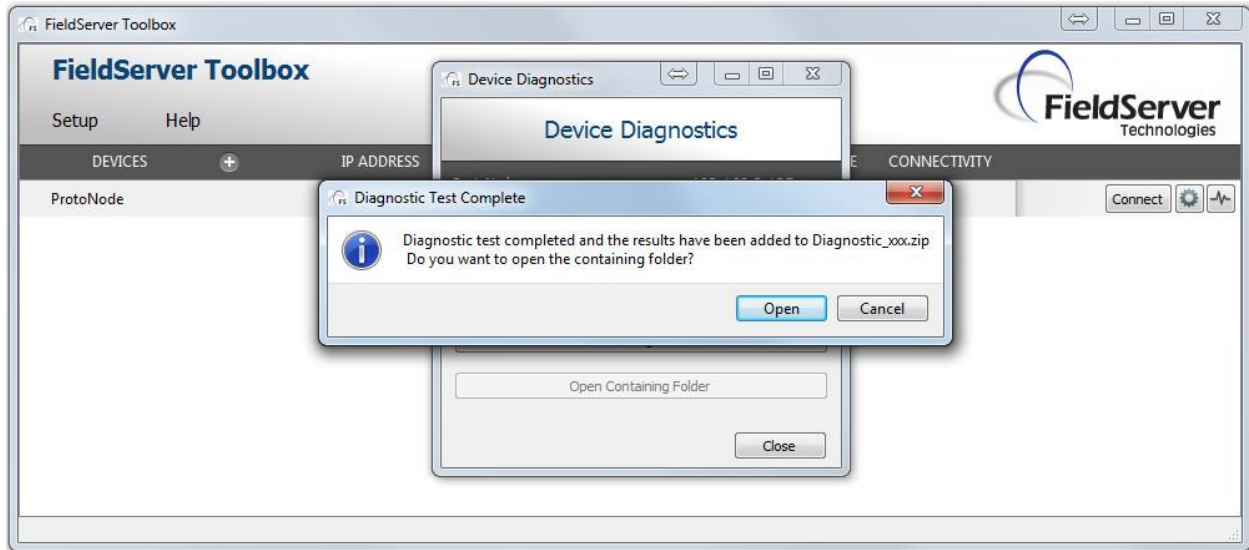


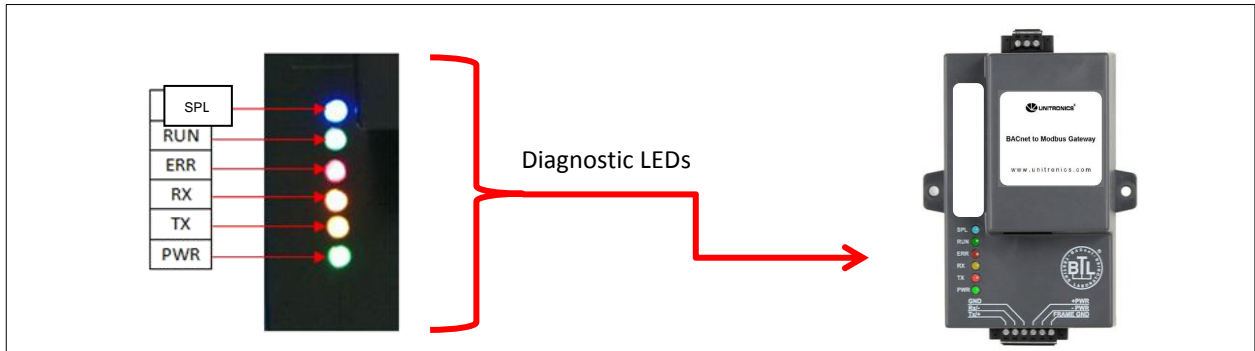
Figure 34: Diagnostic tool –diagnostic test complete

- Choose open to launch explorer and have it point directly at the correct folder. Send the Diagnostic zip file to support@fieldserver.com

 Diagnostic_2014-07-17_20-15.zip	2014/07/17 20:16	zip Archive	676 KB
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Appendix A.3. LED Diagnostics for Modbus RTU Communications Between GW-BAC1 and Devices

Please see the diagram below for GW-BAC1 LED Locations.



Tag	Description
<b>SPL</b>	The SPL LED will light if the GW-BAC1 is off line.
<b>RUN</b>	The RUN LED will start flashing 20 seconds after power indicating normal operation.
<b>ERR</b>	The SYS ERR LED will go on solid 15 seconds after power up. It will turn off after 5 seconds. A steady red light will indicate there is a system error on GW-BAC1. If this occurs, immediately report the related "system error" shown in the error screen of the GUI interface to Unitronics technical support for evaluation.
<b>RX</b>	The RX LED will flash when a message is received on the host port.
<b>TX</b>	The TX LED will flash when a message is sent on the host port.
<b>PWR</b>	This is the power light and should show steady green at all times when GW-BAC1 is powered.

Figure 35: Diagnostic LEDs

## Appendix B. Reference

## Appendix B.1. Specifications



	GW-BAC1
<b>Electrical Connections</b>	One 6-pin Phoenix connector, one RS-485 +/- ground port, power +/- frame ground port One 3-pin RS-485 Phoenix connector, one RS-485 +/- ground port One Ethernet-10/100 Ethernet port
<b>Approvals:</b>	CE Certified; TUV approved to UL 916, EN 60950-1, EN 50491-3 and CSA C22-2 standards; FCC Class A Part 15; DNP3 Conformance Tested; OPC Self-tested for Compliance; RoHS Compliant; CSA 205 Approved BTL Marked
<b>Power Requirements</b>	Multi-mode power adapter: 9-30VDC or 12 - 24VAC
<b>Physical Dimensions</b>	11.5 cm L x 8.3 cm W x 4.1 cm H (4.5 x 3.2 x 1.6 in.)
<b>Weight:</b>	0.2 kg (0.4 lbs)
<b>Operating Temperature:</b>	-40°C to 75°C (-40°F to 167°F)
<b>Surge Suppression</b>	EN61000-4-2 ESD EN61000-4-3 EMC EN61000-4-4 EFT
<b>Humidity:</b>	5 - 90% RH (non-condensing)
(Specifications subject to change without notice)	

Figure 36: Specifications

## Appendix B.2. Compliance with UL Regulations

For UL compliance, the following instructions must be met when operating GW-BAC1.

- The units shall be powered by listed LPS or Class 2 power supply suited to the expected operating temperature range.
- The interconnecting power connector and power cable shall:
  - Comply with local electrical code.
  - Be suited to the expected operating temperature range.
  - Meet the current and voltage rating for GW-BAC1/Net
- Furthermore, the interconnecting power cable shall:
  - Be of length not exceeding 3.05m (118.3")
  - Be constructed of materials rated VW-1 or FT-1 or better
- If the unit is to be installed in an operating environment with a temperature above 65 °C, it should be installed in a Restricted Access Area requiring a key or a special tool to gain access
- This device must not be connected to a LAN segment with outdoor wiring.