AUTOMATIONDIRECT.com

MB-GATEWAY

Hardware User Manual

Manual Number: MB-GATEWAY-USER-M

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MB-GATEWAY

HARDWARE USER MANUAL

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Please include the Manual Number and the Manual Issue, both shown below, when communicating with Technical Support regarding this publication.

Manual Number: MB-GATEWAY-USER-M

Issue: 1st Edition Rev. H

Issue Date: 02/2021

Publication History		
Issue	**Date**	**Description of Changes**
1st Edition	06/11	Original issue
Rev. A	01/12	Added Example 4 to Appendix
Rev. B	07/12	Added IP address reset note.
Rev. C	10/13	Added Autodetection notes. Added TCP to RTU diagrams.
Rev. D	02/16	Revised product photo
Rev E	09/17	Several minor revisions
Rev F	10/18	Minor revision to Appendix A, Application Examples
Rev G	02/20	Added Appendix C, Security Considerations for Control Systems Networks
Rev H	02/21	Added failsafe receiver to feature list

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Getting Started

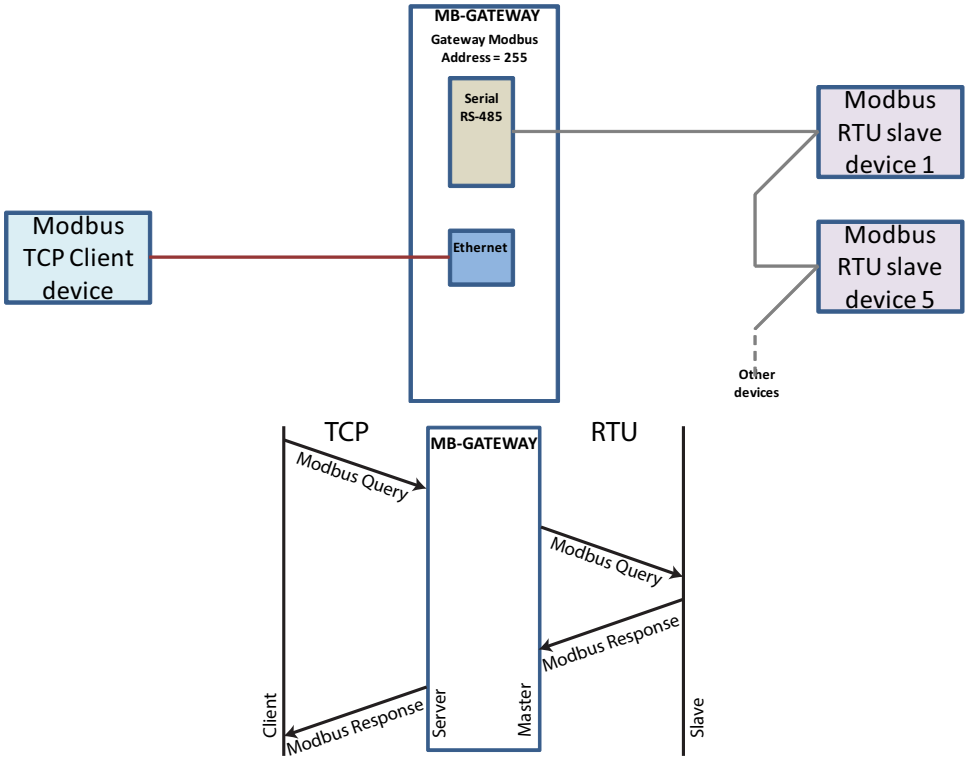
In this Chapter...

Introduction

Overview of this Publication

Modbus is one of the most popular communication protocols in the automation industry because it supports both traditional RS-232/422/485 devices and newly developed industrial Ethernet devices. Many industrial devices, such as PLCs, HMIs, instruments and meters use Modbus as their standard communication protocol. However, the Modbus protocols running over serial and Ethernet are so different that a communication gateway is needed as a bridge for integrating devices from these two networks. The MB-GATEWAY is a Modbus TCP (Ethernet) to Modbus RTU (Serial) Gateway which provides the necessary bridge to connect Modbus RTU (Serial) products to Ethernet LANs.

The Modbus TCP side of the Gateway functions as a TCP Server (slave) while the Modbus RTU side functions as a serial Client (master). The serial side physical interface is RS-422/485 2 or 4 wire so up to 128 Modbus RTU devices can be accessed by a Modbus TCP Client device (up to 12 simultaneous connections). The actual number of Modbus RTU slaves will depend on their individual transceiver loads.



The MB-GATEWAY User Manual describes the installation, configuration, and methods of operation of the MB-GATEWAY Module.

Who Should Read This Manual

This manual contains important information for those who will install, maintain, and/or operate The MB-GATEWAY Module.

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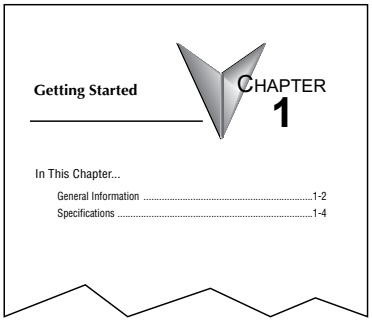
When you see the "exclamation mark" icon in the left-hand margin, the paragraph to its immediate right will be a warning. This information could prevent injury, loss of property, or even death (in extreme cases). The word WARNING: in boldface will mark the beginning of the text.

Key Topics for Each Chapter

The beginning of each chapter will list the key topics that can be found in that chapter.


Getting Started

CHAPTER 1

In This Chapter...

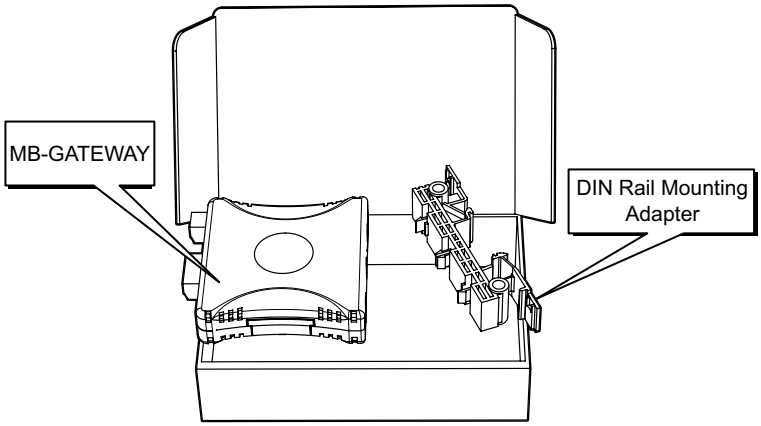
Product Overview

AutomationDirect's MB-GATEWAY is a single port Modbus Gateway module that converts Modbus TCP to Modbus RTU. It supports up to 12 simultaneous Modbus TCP Client (master) Ethernet connections, and up to 128 RTU Server (slave) Serial connections. MB-GATEWAY requires 10VDC to 36VDC from an external power supply. Each module has one RJ45 10/100 Mbps Ethernet port and one RS-422/485 2 or 4 wire Serial Port. It supports NetEdit (Ver 3.8 and later) or Web Browser based configuration tools.

Key features include:

- Automatic Read Function
- RJ45 10/100 Mbps Ethernet Port
- RS-422/485 2 or 4 wire Serial Port
- True failsafe receiver while maintaining EIA/TIA-485 compatibility
- Supports NetEdit and Web Browser configuration tools
- Autodetects Ethernet cable types (MDI/MDX)
- 35mm DIN rail mount

What's in the Box

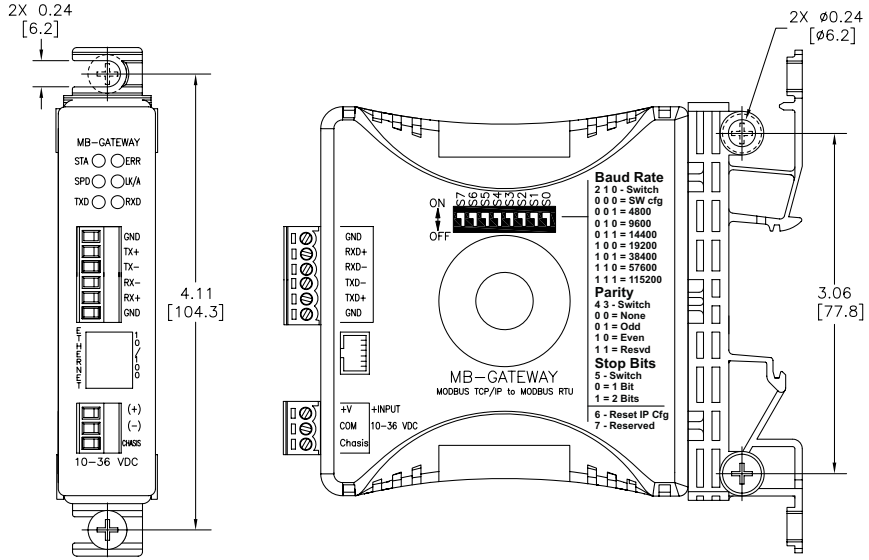


Mounting / Clearance Information

There are two options for mounting the MB-GATEWAY module.

Direct Mounting

The MB-GATEWAY module can be mounted in either a low-profile orientation or a slim-mount orientation using screw holes on the provided mounting adapter. Screws are not provided



DIN Rail Mounting

The MB-GATEWAY module can be snapped onto a standard 35 mm x 7.5 mm height DIN rail (Standard: CENELEC EN50022). They can be mounted either vertically or horizontally. Refer to the mechanical drawings that follow for proper mounting.

DIN rail mounting steps:

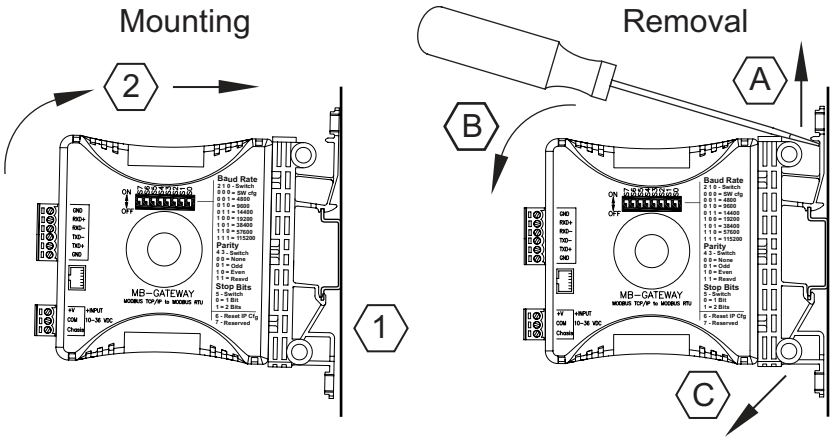
1. Hook bottom back of unit over the DIN rail.
2. Push top back onto the DIN rail until it snaps into place.

DIN rail removal steps:

A. Pull up on tab at the top of the mounting adapter with a screwdriver.

B. Rotate the bottom of the unit away from the DIN rail.

C. Pull unit down and away from DIN rail.



Agency Approvals

UL/CUL/CE Certification Numbers			
Name	**UL/CUL**	**UL508**	**CE**
MB-GATEWAY	E185989	E185989	Yes

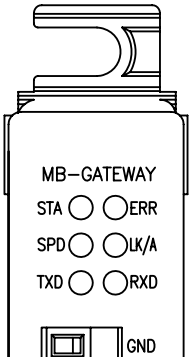
SPECIFICATIONS

In this Chapter...

Specifications

Specifications		
Ethernet Interface	Port	RJ-45
	Speed	10/100 Mbps
	Protection	Built-in 1.5 KV magnetic isolation
	Protocol Supported	Modbus TCP/IP Server (Slave)
	Clients (Masters) Supported	12 simultaneous Modbus TCP connections
	Cable Type	Autodetects Ethernet cable types (MDI/MDX)
Serial Interface	Port	6-position terminal strip (Phoenix #1863194) provided
	Supported Signal Lines	RS-422 (5-wire) Signals: TX+, TX-, RX-, RX+, GND RS-485 (3-wire) Signals: Data+, Data -, GND
	Supported Baud Rates	300*, 600*, 1200*, 2400, 4800, 9600, 14.4k, 19.2k, 38.4k, 57.6k, 115.2k **** Cannot be set with DIP switches.*** ***Must be set via web browser configuration.***
	Parity	Odd, Even, None
	Data Bits	8
	Stop Bits	1, 2
	Protocol Supported	Modbus RTU Client (Master)
	Servers (Slaves) Supported	128
	Termination	Permanently installed 120ΩΩ resistor between Data+ and Data -
Power Consumption		2W Use Class 2 power supply Use conductors rated 60/75 °C 3-position terminal strip (Phoenix #1863165) provided
Wire Range		16 - 28 AWG Solid or Stranded Conductor (1.5 mm^2)
Wire Strip Length		0.24 - 0.27 in (6 - 7 mm)
Screw Torque		1.7 lb-in (0.2 Nm)
Operating Temperature Range		0 to 60 °C (32 to 140 °F)
Storage Temperature Range		-20 to 70 °C (-4 to 158 °F)
Humidity		5 to 95% RH (non-condensing)
Environmental Air		For use in Pollution Degree 2 Environment. No corrosive gases
Vibration		MIL STD 810C 514.2
Shock		MIL STD 810C 516.2
Weight		0.2 lbs (0.09 kg)

LED Indicators



STA

The STA or STATUS LED is steady ON when the MB-GATEWAY has passed power-up diagnostics and is ready for use.

SPD

The SPD or SPEED LED is used to represent the Ethernet speed. The LED will be ON when the Ethernet speed is 100Mbps and OFF when the speed is 10Mbps.

TXD

The TXD or TRANSMIT DATA LED flashes to indicate that the MB-GATEWAY is sending data through the serial port.

ERR

If the MB-GATEWAY's ERR (ERROR) indicator is:

- ON - a critical error has occurred. The error may be in the card itself, or the result of a network problem. The ERROR indication can be caused by a faulty ground, an electrical spike or other types of electrical disturbances. Cycle power to the system to attempt clearing the error.
- Flashing once per second - a firmware update is in progress.
- Flashing randomly - a Modbus/RTU error. This could be a timeout or an actual error response. Check the Gateway Device Status page on the MB-GATEWAY configuration web page to see the quantity of Request Errors and the description of the Last Request Error.

A CRC error for an Automatic Reads table entry will flash the ERRor LED and set the Last Request Error to: MODBUS_ERROR_MEMORY_PARITY_ERROR.

For a direct request from a Modbus TCP server, a Modbus RTU parity error will return the error MODBUS_ERROR_MEMORY_PARITY_ERROR to the Modbus TCP server.

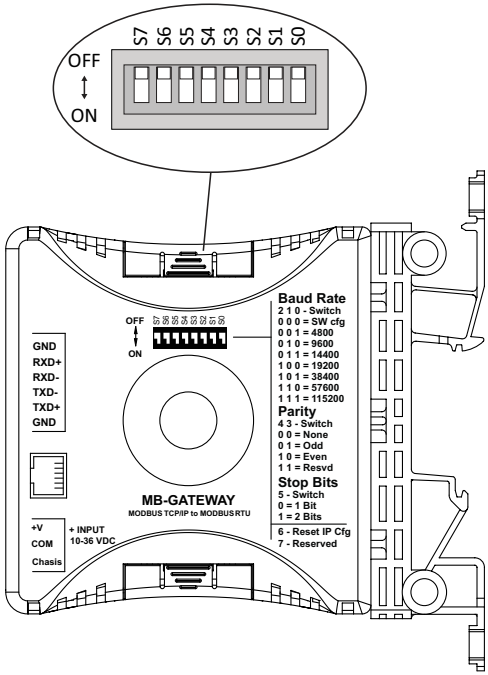
LK/A

The LK/A or LINK GOOD/ACTIVITY LED flashes to indicate that the card sees data traveling on the Ethernet network. If any network device is sending or receiving data, the LK/A LED will be flashing. During heavy communication loads, this indicator will be steady ON. If the LED is OFF, then a problem with the Ethernet connection has been detected.

RXD

The RXD or RECEIVE DATA LED flashes to indicate that the MB-GATEWAY is receiving data through the serial port.

Dip Switch Information

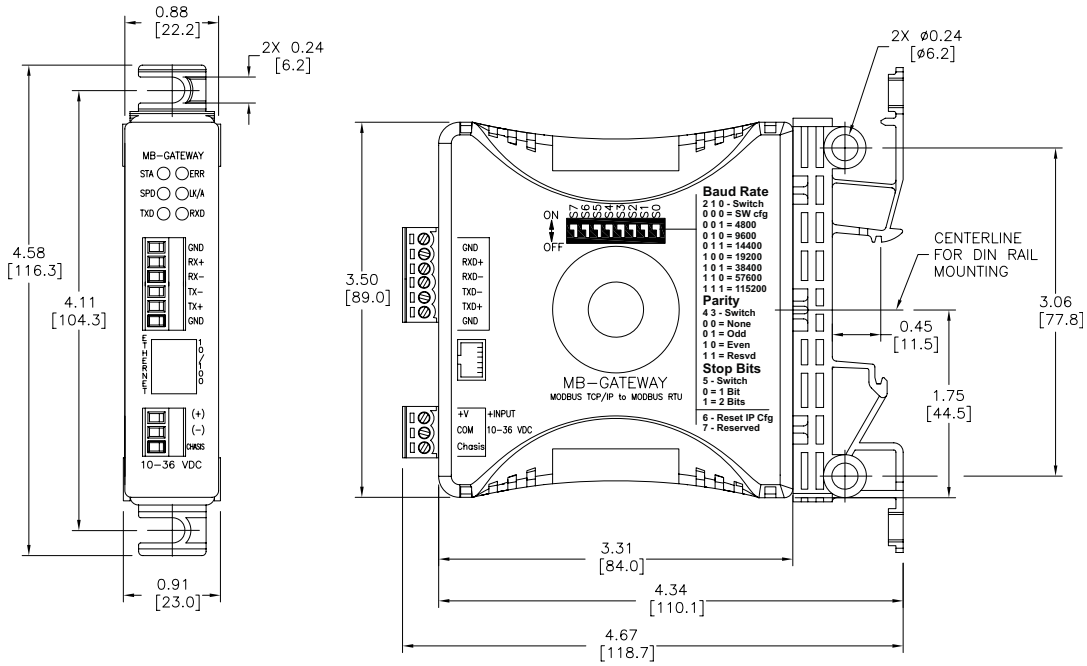


S7	S6	S5	S4	S3	S2	S1	S0	Switch setting	
					0	0	0	Software Config	Baud Rate
					0	0	1	4800	
					0	1	0	9600	
					0	1	1	14400	
					1	0	0	19200	
					1	0	1	38400	
					1	1	0	57600	
					1	1	1	115200	
			0	0				None	Parity
			0	1				Odd	
			1	0				Even	
			1	1				Reserved	
		0						1 Bit	Stop Bits
		1						2 Bits	
	1							*	Reset IP
Reserved								S7 reserved	

* Setting S6 to on will, on power cycle, set the IP address, subnet mask and gateway address in the MB-GATEWAY to 0.0.0.0

Dimensional Drawing

Inches [mm]



Installation, Wiring and Configuration

In this Chapter...

Safety Guidelines

WARNING: Providing a safe operating environment for personnel and equipment is your responsibility and should be your primary goal during system planning and installation. Automation systems can fail and may result in situations that can cause serious injury to personnel or damage to equipment. Do not rely on the automation system alone to provide a safe operating environment. You should use external electromechanical devices, such as relays or limit switches, that are independent of the PLC application to provide protection for any part of the system that may cause personal injury or damage. Every automation application is different, so there may be special requirements for your particular application. Make sure you follow all national, state, and local government requirements for the proper installation and use of your equipment.

Plan for Safety

The best way to provide a safe operating environment is to make personnel and equipment safety part of the planning process. You should examine every aspect of the system to determine which areas are critical to operator or machine safety. If you are not familiar with control system installation practices, or your company does not have established installation guidelines, you should obtain additional information from the following sources.

- NEMA — The National Electrical Manufacturers Association, located in Washington, D.C. publishes many different documents that discuss standards for industrial control systems. You can order these publications directly from NEMA. Some of these include:

  ICS 1, General Standards for Industrial Control and Systems

  ICS 3, Industrial Systems

  ICS 6, Enclosures for Industrial Control Systems

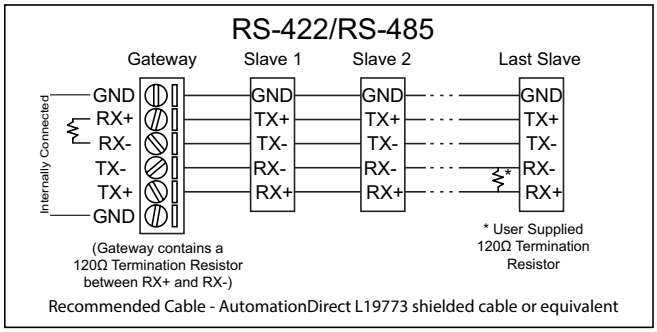
- NEC — The National Electrical Code provides regulations concerning the installation and use of various types of electrical equipment. Copies of the NEC Handbook can often be obtained from your local electrical equipment distributor or your local library.
- Local and State Agencies — many local governments and state governments have additional requirements above and beyond those described in the NEC Handbook. Check with your local Electrical Inspector or Fire Marshall office for information.

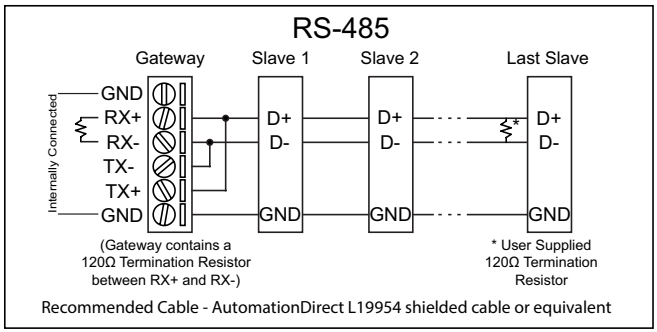
Security Considerations

When implementing any method of remote access to your equipment, you need to consider the security exposure in order to minimize the risks to your processes and your equipment. Security should always be carefully evaluated for each installation. Refer to "Appendix C: Security Considerations for Control Systems Networks" for more information.

Wiring Diagrams

The MB-GATEWAY module can be wired in either 4-wire or 2-wire mode.





MB-GATEWAY Configuration

The MB-GATEWAY supports 128 Modbus RTU nodes on the serial side. The RS-485 specification supports up to 32 devices before a repeater device is required. Proper cabling and termination is required. For RS-485 4-wire installations , a cable with the proper shielding and impedance should be used such as a Belden model 9843. For RS-485 2 wire installations, a cable such as the Belden model 9842 should be used. A 120 ohm resistor should be used for termination on each end of the network as shown in the previous wiring diagrams. The GATEWAY module has a termination resistor pre-installed so only one resistor needs to be added to the opposite end of the network away from the Gateway module.

The MB-GATEWAY module supports up to 12 simultaneous Modbus TCP connections. The MB-GATEWAY's TCP listening port is the standard Modbus TCP port 502 (not configurable).

One of the major features of the MB-GATEWAY module is the "Automatic Read" function. This feature utilizes the 'idle' time of the module while it is waiting for Ethernet requests. The Automatic Read function can be configured to poll specific Modbus data points of the serial nodes and place that data into a local 'data buffer'. If a Modbus Ethernet request comes in for one of those data points, the MB-GATEWAY module will immediately respond with the data from local buffer and thereby respond much faster than it would if it had to generate a new serial request. See Chapter 5 for more information.

The factory IP setting of the MB-GATEWAY module is to retrieve an IP address via DHCP. In order to see what IP address has been assigned and/or to change that setting the NetEdit software tool will be required to discover and configure the MB-GATEWAY TCP/IP settings. NetEdit is a free tool that is accessible at AutomationDirect's website or HOST engineering's website *(http://www.hosteng.com/SW-Products/SP_Demo_Utilites.htm#NetEdit3)*.

NOTE: NetEdit version 3.8 or later is required to support MB-GATEWAY

MB-GATEWAY Configuration continued on the next page

NetEdit Configuration

Using NetEdit is very simple. Once the software has been installed, follow the steps below to configure the settings of your MB-GATEWAY module.

- Start the software. It will scan automatically when you start it but if your MB-GATEWAY is inaccessible at the point of starting the software, you can press the "Scan Network" button at the top to make it scan again once the MB-GATEWAY has become accessible.

NOTE: If you are unable to see the MB-GATEWAY...

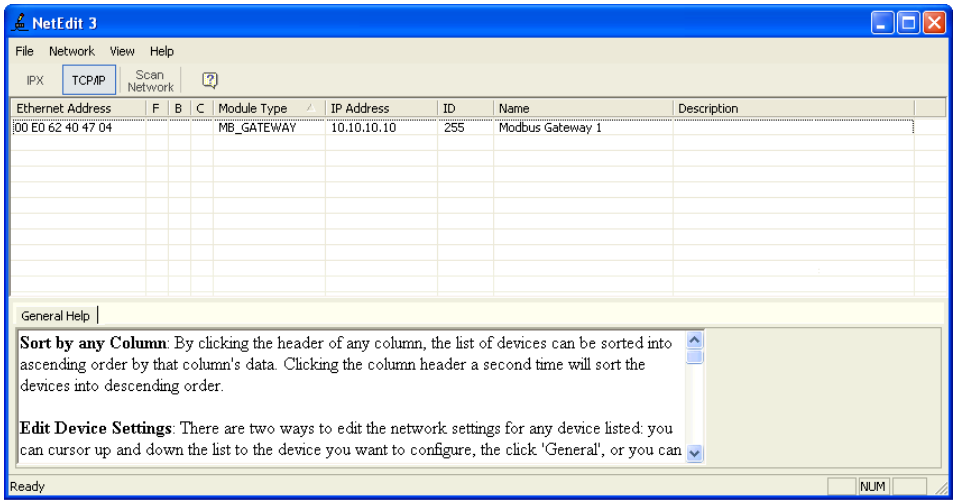
1) If your PC has more than one NIC (Network Interface Card), e.g. a wireless and a wired, then you may need to either disable the NIC(s) you are not using, or re-prioritize them such that the NIC you are using is top priority.

2) Verify the Network Interface on your PC is functioning properly

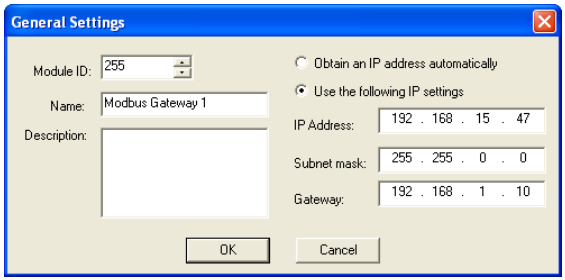
3) Verify all connections between the PC and the MB-GATEWAY are properly made

4) Disable your firewall or open TCP port 28787 to allow NetEdit.

5) NetEdit version 3.8 or later is required to support MB-GATEWAY.



- In the Main window, double click on the MB-GATEWAY module that you want to configure.



- Select "Use the following IP settings".
- Type in the settings that are compatible with your network and press the OK button and the MB-GATEWAY module's IP settings are now configured.

After the MB-GATEWAY module's IP settings have been configured to be compatible with the subnet of your PC, you can open Internet Explorer (or the Web browser of your choice) and continue the configuration for your application. You can also right click on the MB-GATEWAY in the main NetEdit window and choose "Start Web based config…" to start your default Web browser with the correct IP address pre-configured for you.

Function Codes Supported

The function codes supported by the MB-GATEWAY differ based upon whether the target from the Modbus Client is the MB-GATEWAY directly by utilizing the Gateway Modbus ID and the Automatic Read function or direct access to a Modbus serial slave by specifying the Unit ID of the Modbus Slave node itself.

Target = MB-GATEWAY Module (using Gateway Modbus ID and Automatic Read Function):

- Function Code 1 (Read Coils 0xxxxx)
- Function Code 2 (Read Input Bits 1xxxxx)
- Function Code 3 (Read Holding Registers 4xxxxx)
- Function Code 4 (Read Input Registers 3xxxxx)
- Function Code 8 (Read Diagnostics <Read Query Data Function>)

Target = MB-GATEWAY Modbus Slave Node (using Unit ID of Slave Node):

- Any function code supported by the Modbus Slave device

Log Modbus/TCP and/or RTU requests to SMTPViewer

Available in firmware 1.0.679 and later

Using the SMTPViewer (download from HostEng.com and install it in the \HAPTools folder), you can see the TCP and RTU requests that are being processed by the MB-GATEWAY. This logging feature will only send packets to the PC that requested the logging; therefore it is not using broadcast packets, and each Gateway can only log data to 1 PC at a time.

To use logging, connect to MB_GATEWAY with SMTPViewer (UDP only; port 0x7272) and issue the following command:

'Log [req] [rsp] [rtu] [tcp] [dev #] [raw]'

req = Log requestsrsp = Log responsesrtu = Log RTU transactionstcp = Log TCP transactionsraw = Show raw bytes instead of decoding transactionsdev # = Ex 'dev 1' would show only transactions for device 1

For example, to see all Modbus/RTU transactions (requests and responses) to/from device 1 in a decoded form, the command is:'Log rtu req rsp dev 1'

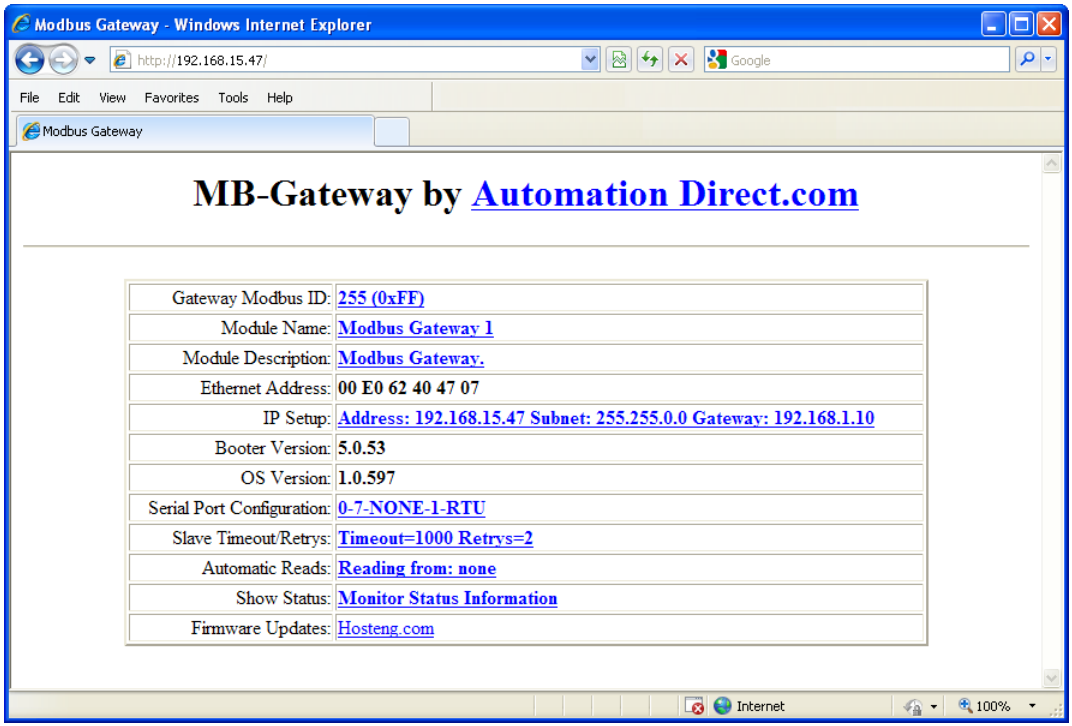
The command 'log' by itself defaults to 'log req rsp rtu tcp' which will show all requests and responses for all devices in a decoded form. All forms of the log command toggle from on to off, so you can issue the same command again to turn logging off.

Parameters

In this Chapter...

Home Page

The configuration of the MB-GATEWAY is accessed through a web browser at the well-known HTTP port 80 (not configurable). The image below shows the home page that will be displayed when the web server of the MB-GATEWAY module is accessed. From this page, all of the different setup screens can be accessed.



Gateway Modbus ID

The Gateway Modbus ID is used with the Automatic Read function. This is how the local data buffer is accessed by the Modbus Client device. The usage of this field will be explained in more detail in the Automatic Read Function section.

The Modbus ID used in this field should be unique to the serial network and not assigned to any real Modbus RTU device.

The Back, Send and Reset buttons that appear on these pages have the following behavior:

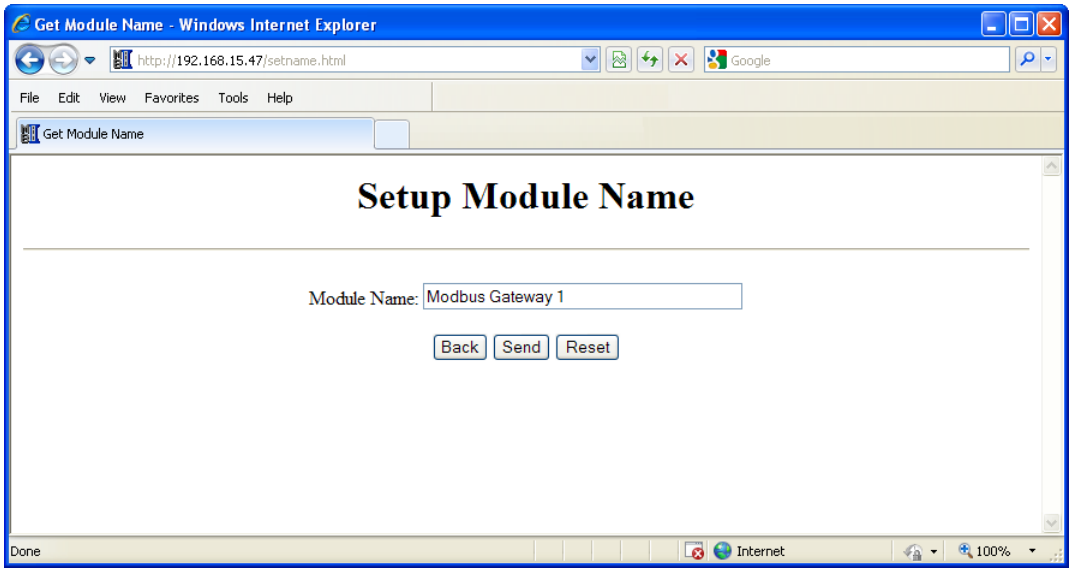
The Back button will browse back to the previous page viewed without saving any changes made on the current page.

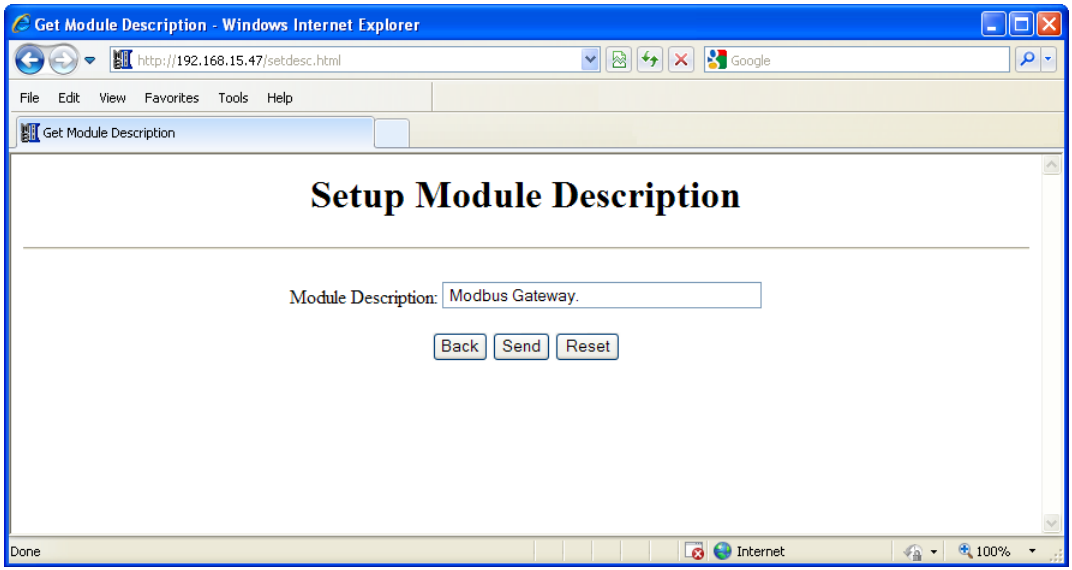
The Send button will Send any changes made on this page to the MB-GATEWAY, effectively saving those changes.

The Reset button will undo any changes made on this page, back to the values that have been Sent to the MB-GATEWAY previously.

Module Name and Module Description

These fields are used only for reference and identification when managing several different MB-GATEWAY modules on a network.

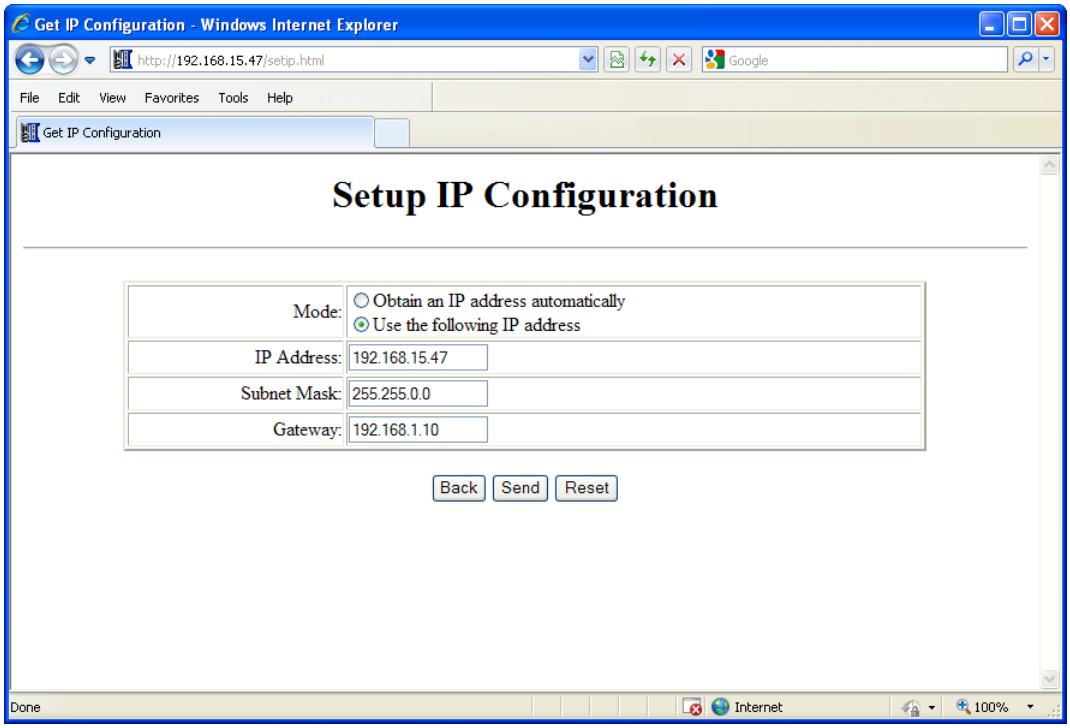




IP Setup Configuration Page

The IP address, Subnet Mask and Default Gateway address can be configured on this page.

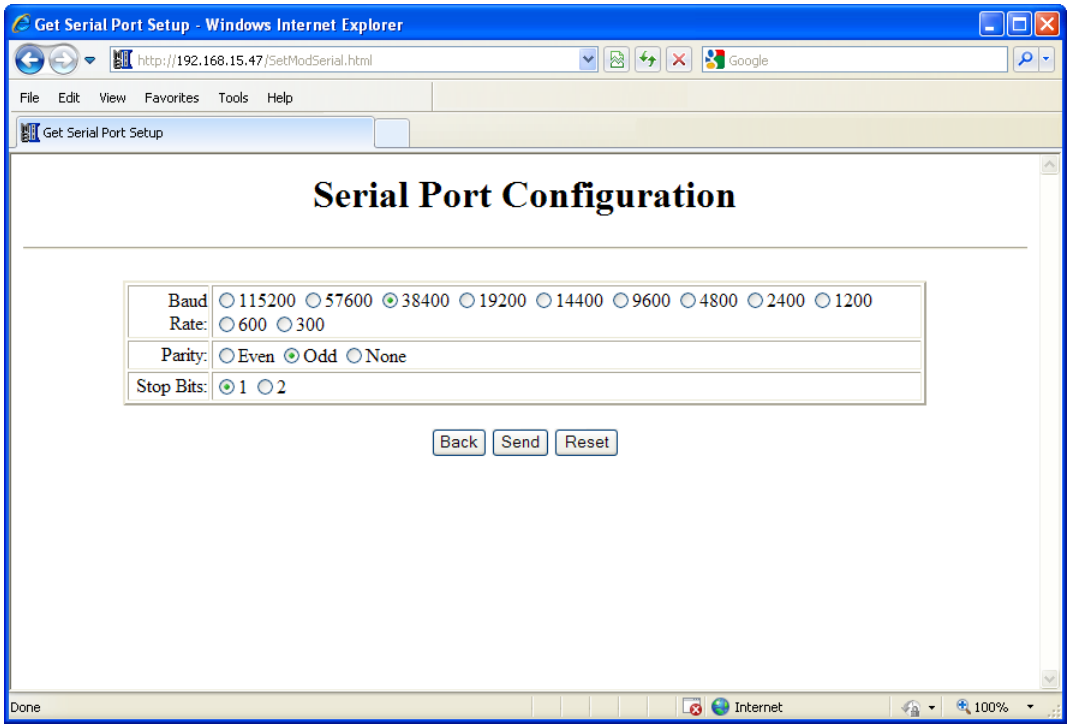
You may lose communications with the MB-GATEWAY module if you configure an IP address and/or Subnet Mask that is not compatible with the subnet of your PC's Network Interface Card. You may be required to change the subnet settings of your PC or use the NetEdit tool to regain communications in this situation.



Serial Port Configuration Page

This page is used to configure the serial port parameters if you do not want to use the dipswitch settings or if baud rates different than the dipswitch settings range are desired. The serial port settings should match the settings of the Modbus RTU serial nodes connected to the MB-GATEWAY module. In some situations, such as a high amount of electrical noise, poor cabling, etc., it may be necessary to reduce the baud rate on the MB-GATEWAY module AND serial devices on the network.

In order to use the software based configuration, switches S0, S1, and S2 must be turned OFF.

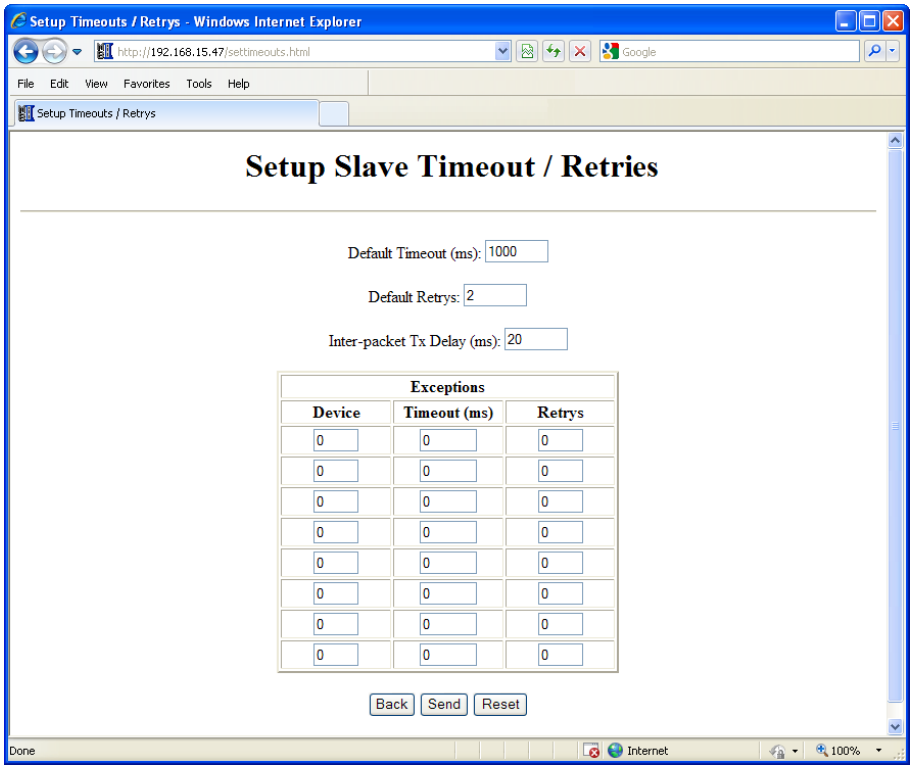


Set Up Slave Timeout / Retries Page

The "Set Up Slave Timeout/Retries" page is used to configure the timing on the serial side of the MB-GATEWAY module. By default, all serial requests will use the "Default Timeout" value and "Default Retries" value. If there are devices on the serial network that require different timing adjustments, those exception cases can be added to the table below. Simply specify the node ID, the timing value and retry count necessary for that device.

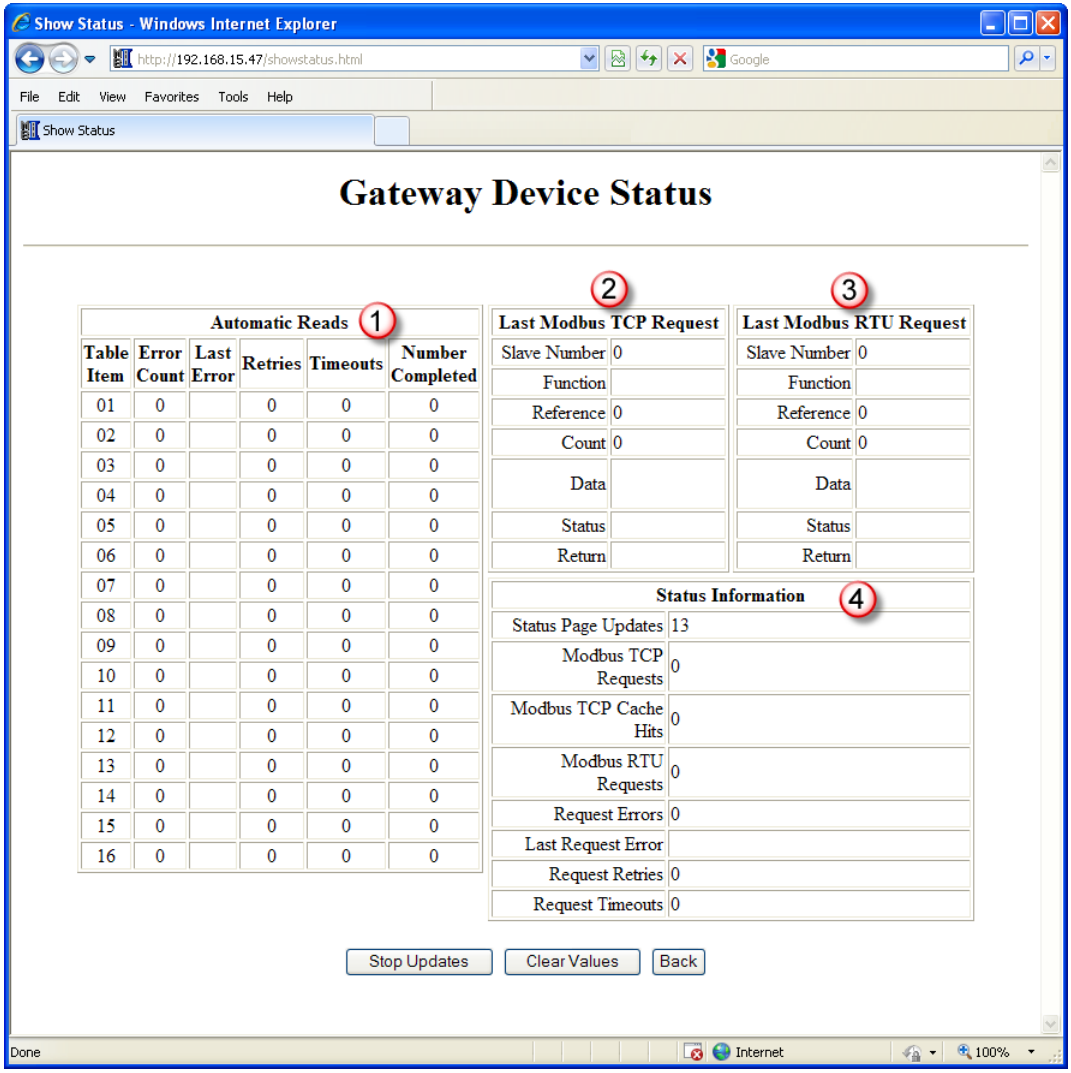
The way that the timeout and retry field is utilized is:
The MB-GATEWAY will send a request to the serial device, if there is no reply from the device within the Timeout value specified, the MB-GATEWAY will send another request and wait again. It will do this for the number of times specified in the Retry field. Once the MB-GATEWAY has attempted to access the device for the number of retry counts specified and no reply is forthcoming, the MB-GATEWAY will respond with an exception error: 04 (Slave device failure).

The "Inter-packet TX Delay" field specifies how long between serial requests the MB-GATEWAY module should wait . This applies to all serial requests to all serial devices on the serial side of the module.



Gateway Device Status Page

The Gateway Device Status page contains statistical information about the MB-GATEWAY module that can be used to gauge the performance of the communications and to troubleshoot communications.



Automatic Reads

Table Item	Error Count	Last Error	Retries	Timeouts	Number Completed
01	0		0	0	0
02	0		0	0	0
03	0		0	0	0
04	0		0	0	0
05	0		0	0	0
06	0		0	0	0
07	0		0	0	0
08	0		0	0	0
09	0		0	0	0
10	0		0	0	0
11	0		0	0	0
12	0		0	0	0
13	0		0	0	0
14	0		0	0	0
15	0		0	0	0
16	0		0	0	0

Last Modbus TCP Request

Slave Number	0
Function	
Reference	0
Count	0
Data	
Status	
Return	

Last Modbus RTU Request

Slave Number	0
Function	
Reference	0
Count	0
Data	
Status	
Return	

Status Information

Status Page Updates	13
Modbus TCP Requests	0
Modbus TCP Cache Hits	0
Modbus RTU Requests	0
Request Errors	0
Last Request Error	
Request Retries	0
Request Timeouts	0

❶ Automatic Reads

This table shows statistical information about the requests being sent when the Automatic Read function is being utilized. This information can help to indicate whether this table has been configured correctly or not.

Table Item: Corresponds to the position in the table of the "Set Up Automatic Reads" page.

Error Count: Indicates how many error requests have occurred for that table item. This could be a timeout error or an exception response.

Last Error: Indicates the error code from the last error request. If the device fails to respond (Timeout), the error "Slave Device Failure" will be shown in this field.

Retries: Indicates how many retries have occurred. It is a cumulative value and does not reset unless the module has been power cycled or the "Clear Values" button at the bottom has been pressed.

Timeout: Indicates how many times a request has not received a reply within the specified timeout period. It is a cumulative value and does not reset unless the module has been power cycled or the "Clear Values" button at the bottom has been pressed.

Number Completed: Indicates how many requests have been sent for that table item.

❷ Last Modbus TCP Request

This table shows statistical information about the last request that was received on the Modbus TCP side from a Modbus TCP Client device.

Slave Number: Indicates the "Unit ID" number within the Modbus TCP header of the Modbus TCP request.

Function: Indicates the Modbus function requested within the Modbus TCP request.

Reference: Indicates the starting address requested within the Modbus TCP request. The "Reference" value is the offset from 0. More information will be explained in the Automatic Read Function section as to how this Reference value corresponds to a Modicon style address that is found in many Modbus devices.

Count: Indicates the number of Registers, Coils or Bits requested within the Modbus TCP request.

Data: This field indicates the Data values written to the MB-GATEWAY module when a Write function has been sent from the Modbus TCP Client device.

Status: Indicates the action taken by the MB-GATEWAY module upon receiving the Modbus TCP Client request.

Found in cache = If the Modbus TCP Client request is targeted to the MB-GATEWAY Module's Modbus ID and the request corresponds with an address mapped in the Automatic Read Function, the MB-GATEWAY module will respond with the data from its local cache. The MB-GATEWAY module will also return the data from its local cache if the TCP Client request corresponds with a node number and address that has been configured in the Automatic Read function table.

Completed = If the request does not meet the criteria explained above, a serial request is created.

Return: This field will indicate whether an error has occurred or not. If this field displays "No Error", the request was successful. Otherwise, the Modbus error text will be shown. Refer to the Modbus specifications error code lists for detailed explanations of each error code.

❸ Last Modbus RTU Request

This table shows the last Modbus RTU request formed by the MB-GATEWAY module based upon the Modbus TCP Client request received on the Ethernet side.

Slave Number: This is the Node number that was targeted in the last Modbus RTU serial request.

Function: Indicates the Function Code sent to the Modbus serial device in the last request.

Reference: Indicates the starting address requested within the Modbus RTU request. The "Reference" value is the offset from 0. More information will be explained in the Automatic Read Function section as to how this Reference value corresponds to a Modicon style address that is found in many Modbus devices.

Count: Indicates the number of Registers, Coils or Bits requested within the Modbus RTU request.

Data: This field indicates the Data values written to the Modbus RTU device when a Write function has been sent.

Status: Indicates the action taken by the MB-GATEWAY module on the Modbus RTU side.

Waiting for Header = This indicates that the MB-GATEWAY module has sent a request and is waiting for the Reply.

Timeout = If a request was sent to a Modbus RTU device and no reply is received, this message will appear.

Completed = If the request was sent and a reply was received, this message will show in the Status field.

Return: This field will indicate whether an error has occurred or not. If this field displays "No Error", the request was successful. Otherwise, the Modbus error text will be shown. Refer to the Modbus specifications error code lists for detailed explanations of each error code.

❹ Status Information

This table shows a summary of the current session (since power cycle or Clear Values button selected). Comparing Requests to Cache Hits can help indicate whether the Automatic Reads are configured to maximize efficient communications. And total Error, Retry and Timeout data can indicate health of communications.

A CRC error for an Automatic Reads table entry will flash the ERRor LED and set the Last Request Error to: MODBUS_ERROR_MEMORY_PARITY_ERROR.

For a direct request from a Modbus TCP server, a Modbus RTU parity error will return the error MODBUS_ERROR_MEMORY_PARITY_ERROR to the Modbus TCP server.

Setup Automatic Read Page

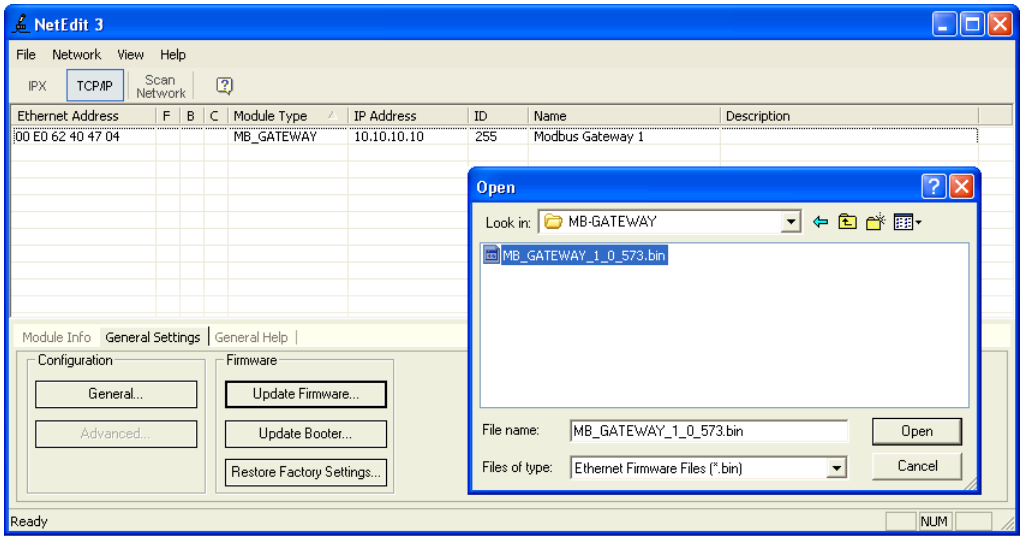
The Automatic Read Feature is explained in detail in **Chapter 5: Automatic Read Feature.**

Firmware Updates

This link sends you to Host Engineering's website to retrieve the latest firmware for the MB-GATEWAY module. The NetEdit tool is required to upgrade firmware in the MB-GATEWAY module. The steps are shown below:

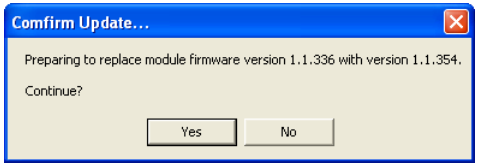
Open the NetEdit software. You may allow the NetEdit software to download the latest firmware for the MB-GATEWAY module by clicking on File-> Live Update.

Once you have the firmware file to load into the MB-GATEWAY module, click on the Scan Network button at the top left to browse for the MB-GATEWAY module that is in the subnet of the PC.

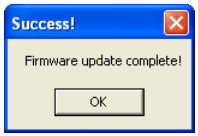


Click on the GATEWAY module that you wish to upgrade and then select the "General Settings" tab at the bottom of the screen. Click on the "Update Firmware" button in the "General Settings" tab. You will get a dialog box to select the firmware file that you wish to upgrade to. Select the correct file and click on the "Open" button.

Firmware Updates continued on the next page.



Confirm that you wish to perform the upgrade by clicking on the "Yes" button.



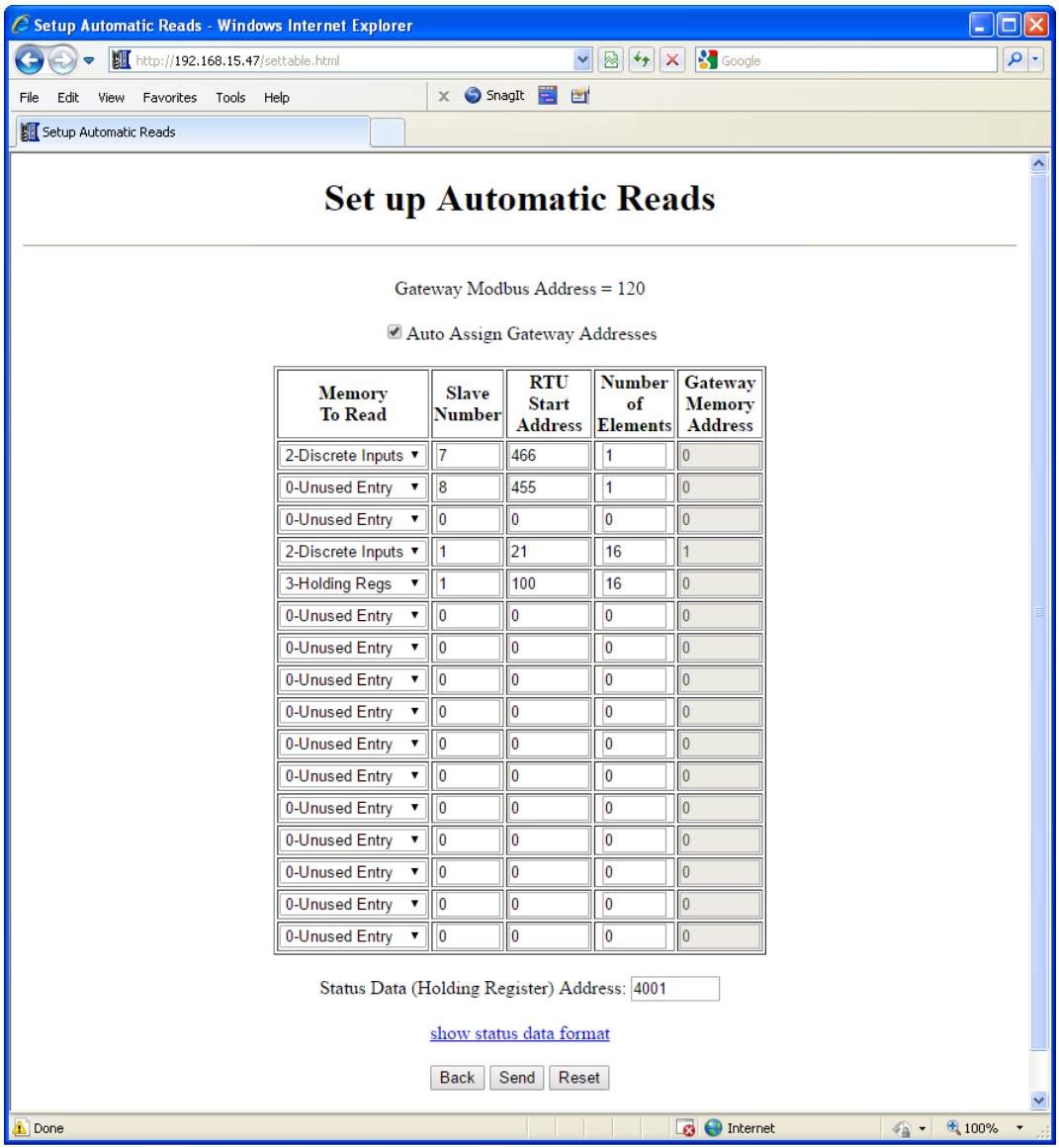
Once the process is complete, you will receive a dialog confirming success.

Automatic Read Feature

In this Chapter...

Automatic Read Feature

The Automatic Read Feature allows the MB-GATEWAY module to utilize some of the idle time that usually occurs between Modbus TCP requests from the Client device. Note that this feature only allows the reading of data from the serial devices and not writing to them. Up to 16 automatic read requests can be configured.

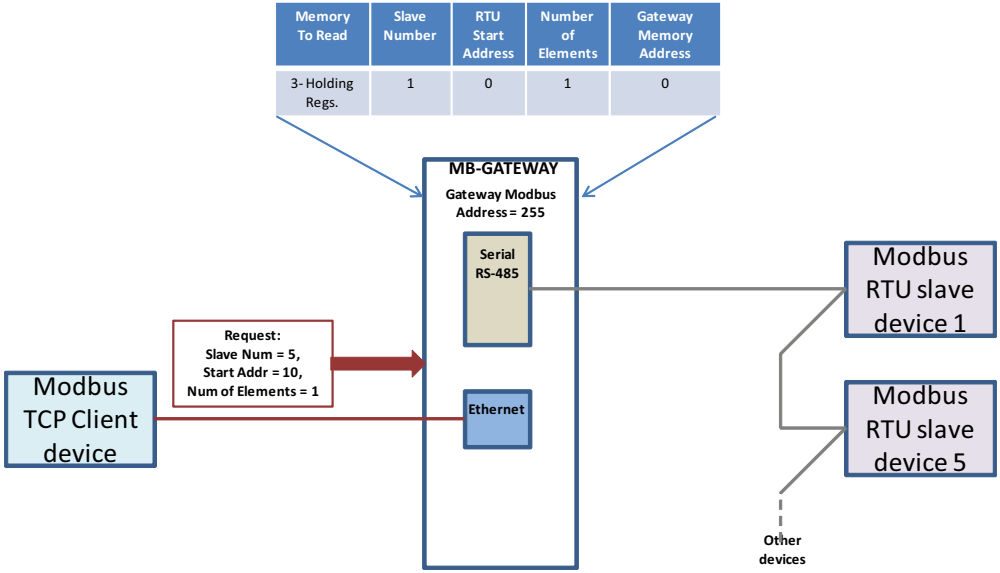


The MB-GATEWAY module can be assigned a Modbus Node address that corresponds with the "Unit ID" number that is sent within the Modbus TCP header that is typically used to target a Modbus RTU node that is on the serial side of the MB-GATEWAY. Therefore, the Node number that is assigned to the MB-GATEWAY module should be unique from any Modbus RTU nodes on the serial network. The Automatic Read function reads the specified registers, bits or coils from the Modbus RTU nodes and places that data into the specified MB-GATEWAY addresses that can be retrieved on the Ethernet side by specifying the MB-GATEWAY's Modbus address in the Unit ID field of the Modbus TCP client request. An example is shown below:

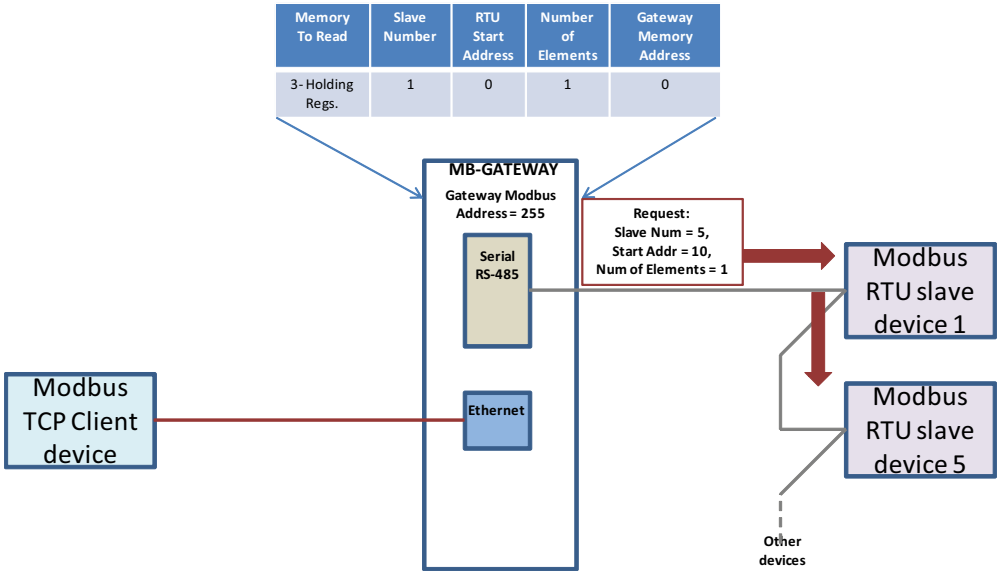
Situation 1:

Modbus TCP Client device sends a request for a device not configured in the Automatic Read table. This will, in turn, generate a fresh new request on the serial side of the MB-GATEWAY module.

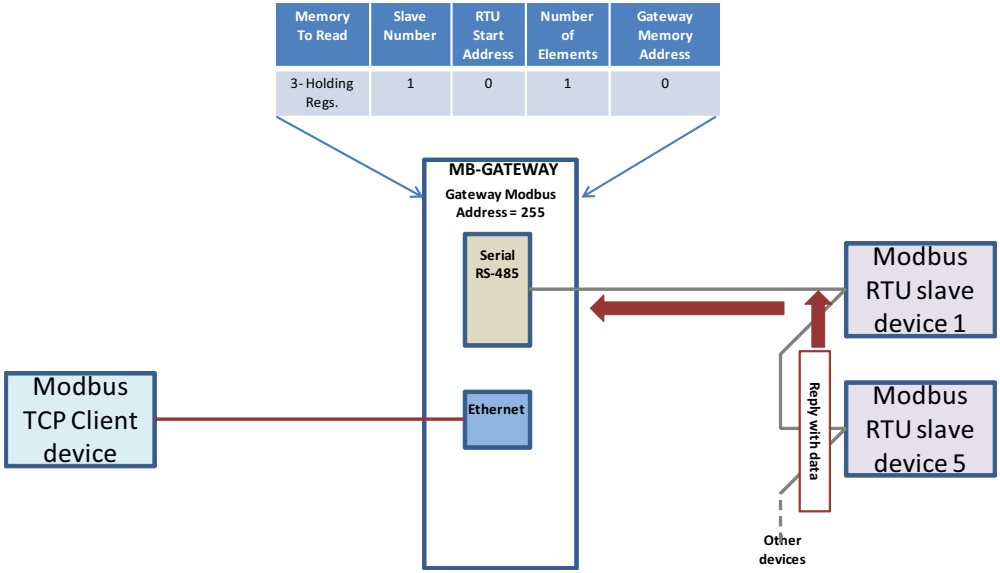
Memory To Read	Slave Number	RTU Start Address	Number of Elements	Gateway Memory Address
3- Holding Regs.	1	0	1	0



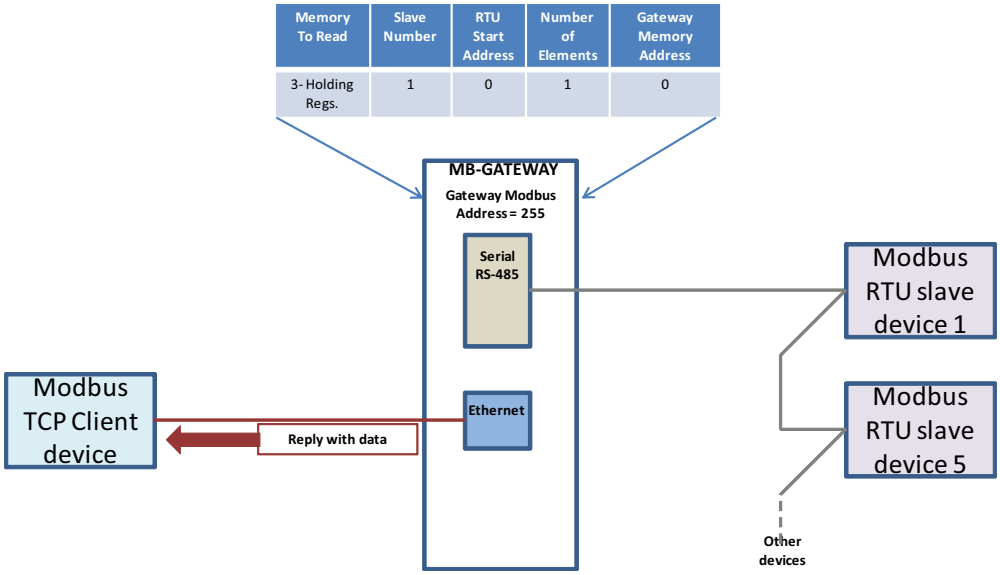
Step 1: Modbus TCP request is generated to Serial Slave Num 5 at Starting Address 10, size 1



Step 2: Request is then generated on the Serial side of the MB-GATEWAY.



Step 3: Serial Node replies with data

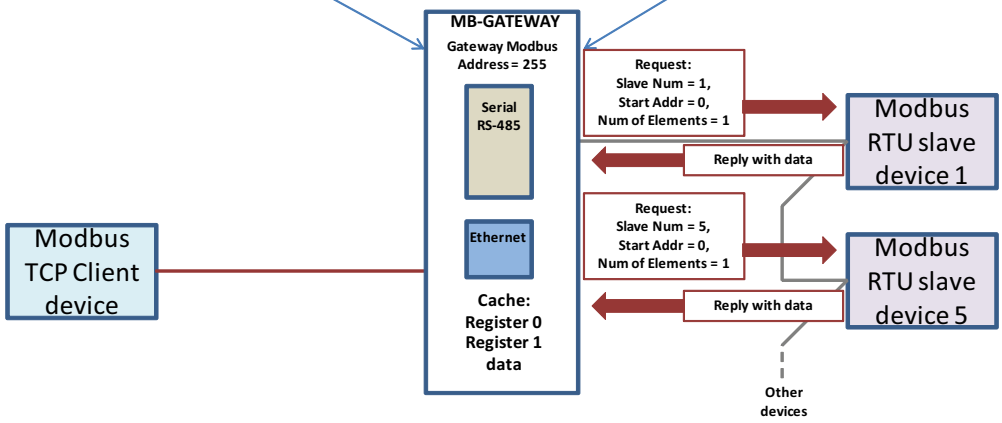


Step 4: Gateway generates TCP reply and sends back to Client device.

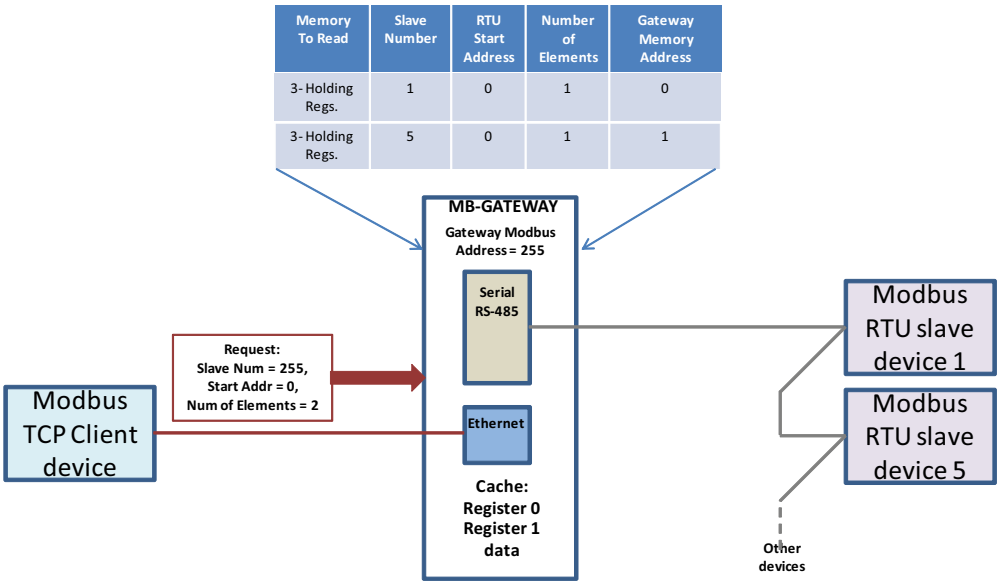
Situation 2:

In this example, the Modbus TCP Client device is sending a request directly to the MB-GATEWAY itself that spans multiple entries in the Automatic Read table.

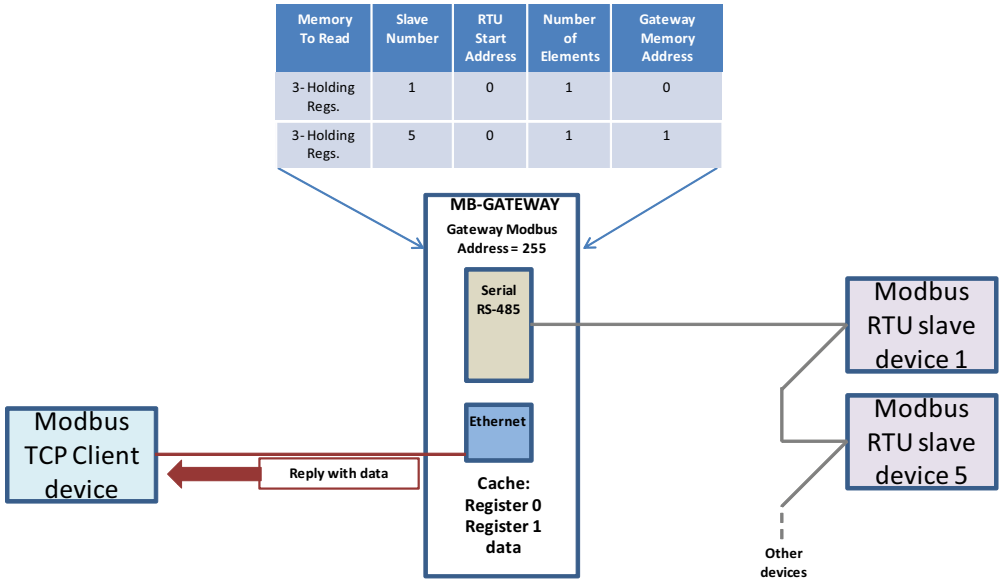
Memory To Read	Slave Number	RTU Start Address	Number of Elements	Gateway Memory Address
3- Holding Regs.	1	0	1	0
3- Holding Regs.	5	0	1	1



Step 1: Before a request even comes in on the Ethernet side, the MB-GATEWAY is reading data from the serial slaves at the "Inter-packet TX Delay" rate and placing that data into its local cache.



Step 2: Modbus TCP Request is generated to Serial Slave Num 255 at Starting Address 0, size 2.



Step 3: MB-GATEWAY immediately generates TCP reply and sends back to Client device from local cache without generating a new serial request.

The response time for the TCP request will be significantly faster when the request is targeted at an address in the Automatic Read table. This can be advantageous if the Modbus TCP Client is a device that is busy doing numerous other tasks, such as a PLC.

Additional Optimization

An additional method of optimization is used in the MB-GATEWAY. If a request is sent to the MB-GATEWAY from the Modbus TCP Client targeted at a Node number and starting address that is equivalent to an entry in the Automatic Read table, the MB-GATEWAY will treat the request as if it had been targeted at the MB-GATEWAY Modbus address and will respond from its local data cache since the data is the same.

Shown below are some more detailed explanations of the different fields that can be configured in the Automatic Read Function table.

Memory to Read:

There are 5 options:

0 – Unused Entry = Disables this entry in the table.

1 – Coils = Configures this entry to read "Modbus Coils" (Read/Write bits).

2 –Discrete Inputs = Configures this entry to read "Modbus Input Bits" (Read Only bits).

3 – Holding Regs = Configures this entry to read "Modbus Holding Registers" (Read/Write 16 bit registers).

4 – Input Regs = Configures this entry to read "Modbus Input Registers" (Read Only 16 bit registers).

Slave Number:

The network address of the Modbus RTU device to be read on the serial network.

RTU Start Address:

The starting address (based at 0) to be read in the targeted Modbus RTU device on the serial network.

Number of Elements:

The Number of elements to read from the targeted Modbus RTU device on the serial network. If the Read is from Coils or Discrete Inputs, the number specified will be the number of bits from 1 - 2000. If the Read is from Holding or Input Registers, the number specified will be the number of words (16 bit) from 1 - 125.

Gateway Memory Address:

The starting address in the GATEWAY module's local data cache to place the data that has been read from the Modbus RTU device on the serial network.

Gateway Modbus Address:

Displays the Modbus address that the GATEWAY module has been configured for (done in the "Gateway Modbus ID" section of the home page).

Auto Assign Gateway Addresses:

Selecting this option will allow the configuration software to automatically choose the best local addresses to place the data that has been read from the Modbus RTU devices.

When the Auto Assign Gateway Addresses option is NOT selected, care must be taken so the data from different Automatic Reads doesn't overlap in the Gateway's internal memory. If you specify an Automatic Read that will create overlapping data, the value in the Gateway Memory Address field for that Read will be red.

By default the Gateway will store the data from the individual automatic reads for the same memory types in consecutive locations in the Gateway's internal memory. Storing this data in consecutive data locations in the Gateway's internal memory allows reads to be optimized into as few requests as possible.

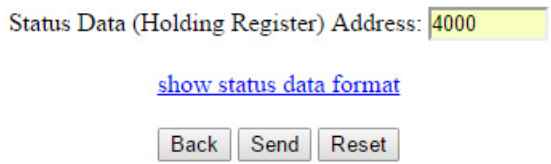
There are several different ways of addressing when communicating to Modbus devices. The method of specifying a Function Code and offset that is utilized in the Automatic Read function is a very common way. Another way that is very common and is seen often in AutomationDirect products is the use of the Modicon style addressing. This method employs a PLC style address that contains a Modbus memory type in the highest digit of the address followed by the offset from 1. A table is provided below that shows comparable addresses for both of these addressing styles.

*Modbus Function Type		Address Range	Equivalent Modicon Style Addressing	Number of Elements
1.	Coils	0 - 65535	00001 - 065536	1 - 2000
2.	Discrete Inputs	0 - 65535	100001 - 165536	1 - 2000
3.	Holding Regs	0 - 65535	400001 - 465536	1 - 125
4.	Input Regs	0 - 65535	300001 - 365536	1 - 125
*** NOTE: "Memory to Read" column on Setup Automatic Reads web page**				

Automatic Read Status Data

Available in firmware 1.0.679 and later

The final selection on this page is the Status Data (Holding Register) Address which allows the user to map a data area into the Gateway's Modbus Holding Register memory which will report the health of each of the automatic read operations. These 17 consecutive Holding Registers area can then be read from the Modbus Gateway (using the Gateway Modbus Address as Unit ID in the MRX instruction) to monitor the Automatic reads by the Modbus/TCP Client.



Click the "show status data format" link to display a page that explains the layout of the data. The first register contains 1 Bit for each of the possible 16 Automatic Reads. Bit 0 = 1st Automatic Read Operation, Bit 1 = 2nd Automatic Read Operation, ... Bit 15 = 16th Automatic Read Operation.

A value of 1 in a Bit location means the last Automatic Read operation that corresponds to that Bit worked and the resulting data is valid.

A Value of 0 in a Bit location means the last Automatic Read operation that corresponds to that Bit DID NOT work, and the Error Count for that Read Operation was incremented.

For example, if the Status Data Address is set to 4000, the data layout will be:

Holding Register	Description	
4000	Bit 0	If set, 1st auto read entry is valid and communicating.
	Bit 1	If set, 2nd auto read entry is valid and communicating.
	...	...
	Bit 15	If set, 16th auto read entry is valid and communicating.
4001	Error count for 1st auto read entry	
4002	Error count for 2nd auto read entry	
...	...	
4016	Error count for 16th auto read entry	

Application Examples

In this Appendix...

A

Example 1:
Using Modbus Poll to MB-GATEWAY with DL06 Slave

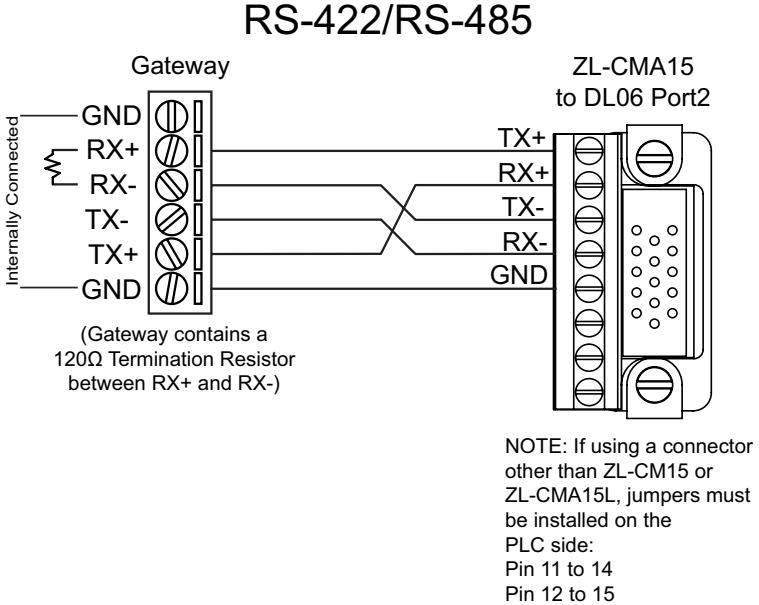
This example will illustrate how to use Modbus Poll, which is a PC based Modbus Master simulator tool, to connect through the MB-GATEWAY to a DL06 PLC via 2 wire RS-485.

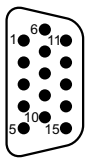
Items needed for this example:

- MB-GATEWAY
- DirectLogic 06 PLC (any model)
- PC with Modbus Poll installed (free demo is available at *www.modbustools.com*)
- Small length of Belden 9842 or equivalent cable
- ZL-CMA15 ZipLink communication port adapter, 15-pin high density female to terminal block
- Ethernet switch and cables to connect from the PC to MB-GATEWAY

Step 1: Connect the MB-GATEWAY serial port to the DL06 secondary communications port.

Using the short length of Belden 9842, connect the MB-GATEWAY to the DL06 Port 2 as shown:



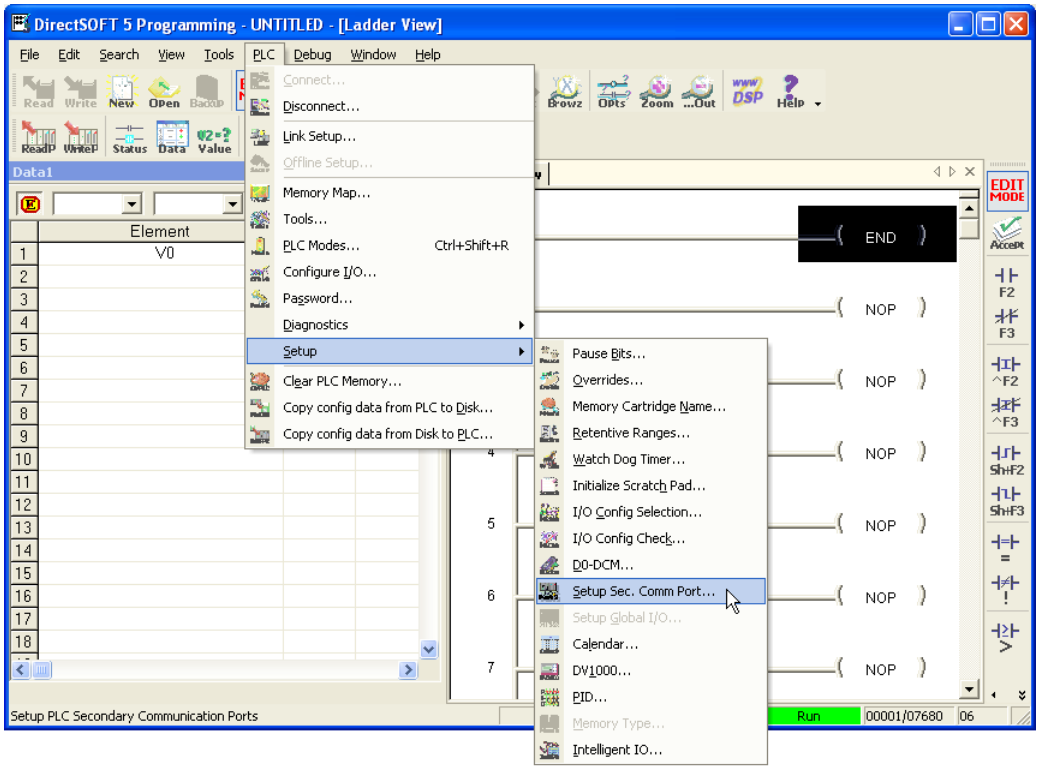


15-pin Female
D Connector

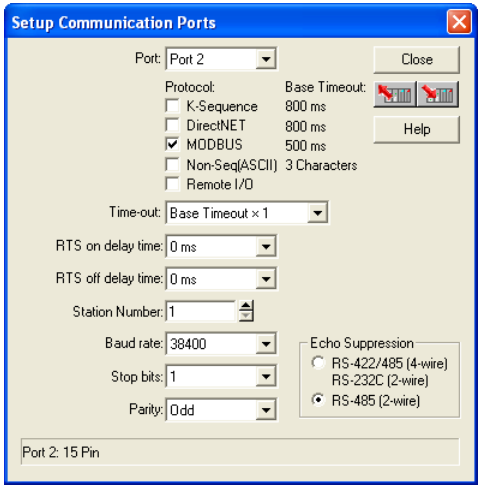
DL06 Port 2 Pin Descriptions		
1	5V	Power (+) connection
2	TXD	Transmit data (RS-232C)
3	RXD	Receive data (RS-232C)
4	RTS	Ready to send (RS-232C)
5	CTS	Clear to send (RS-232C)
6	RXD	Recieve data (-) (RS-422/485)
7	0V	Power (-) connection (GND)
8	0V	Power (-) connection (GND)
9	TXD+	Transmit data (+) (RS-422/485)
10	TXD-	Transmit data (-) (RS-422/485)
11	RTS+	Ready to send (+) (RS-422/485)
12	RTS-	Ready to send (-) (RS-422/485)
13	RXD+	Recieve data (+) (RS-422/485)
14	CTS+	Clear to send (+) (RS-422/485)
15	CTS-	Clear to send (-) (RS-422/485)

Step 2: Configure the DL06 PLC serial port and MB-GATEWAY serial port.

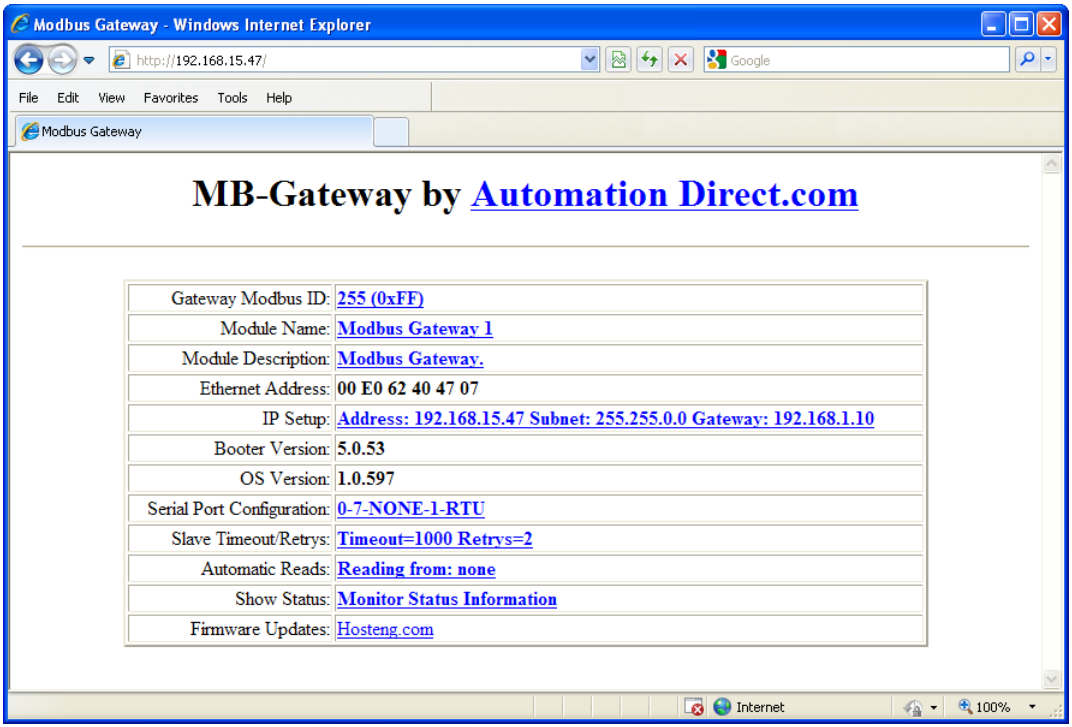
Connect to the DL06 PLC with DirectSoft. Go to the PLC pulldown and select Setup > Setup Secondary Comm. Port as shown:



Setup the port as shown for Modbus protocol, 38400 baud rate, Odd parity, 1 Stop bit and Station Number 1. Match everything else as shown. Note the Station Number configured in the PLC. Once this has been done, click on the icon on the upper right hand side with the arrow pointing to the PLC to save the settings in the PLC.

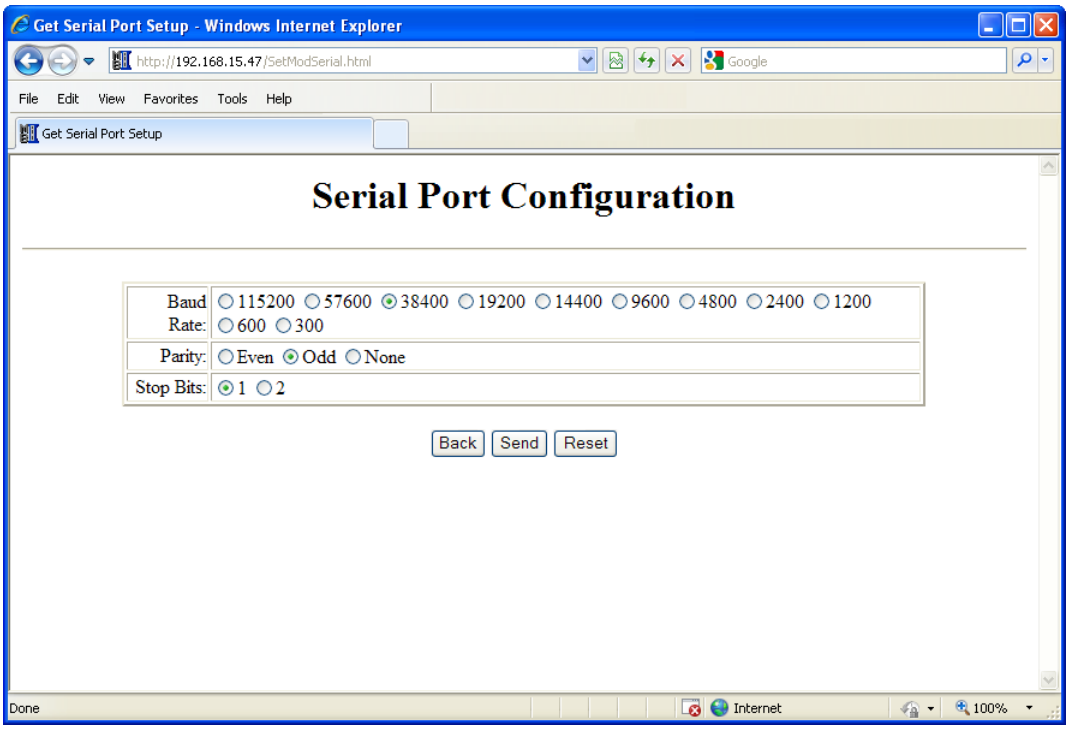


In order to match the serial port settings of the DL06 to the MB-GATEWAY open up a web browser, such as Internet Explorer, and enter in the IP address of the MB-GATEWAY to access the main screen as shown:



For instructions on connecting with a web browser see NetEdit Configuration section in Chapter 3.

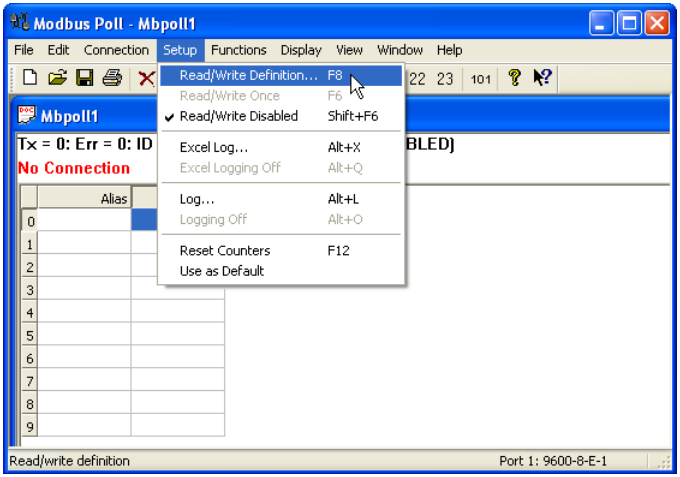
Click on the link to the right of "Serial Port Configuration" and set up the window to match the DL06 PLC port and then click on the Send button to save the settings:



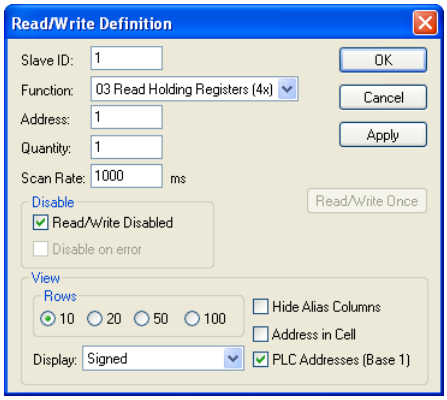
Step 3: Connect to the MB-GATEWAY using the Modbus Poll simulator software.

Once the software has been obtained from *www.modbustools.com* and installed according to the directions provided from their website, open up the Modbus Poll software.

Click on the Setup pulldown menu and select Read/Write Definition as shown:



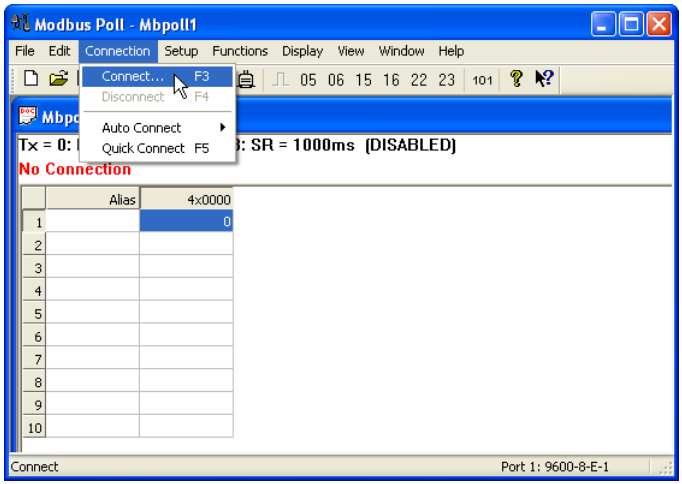
Configure the Read/Write definition for a simple read of the register 400001, which equates to V0 in the DirectLogic PLCs.
(see *http://support.automationdirect.com/docs/Modbus_xref.pdf* for more information on Modbus addressing to DirectLogic PLC addressing equivalents).



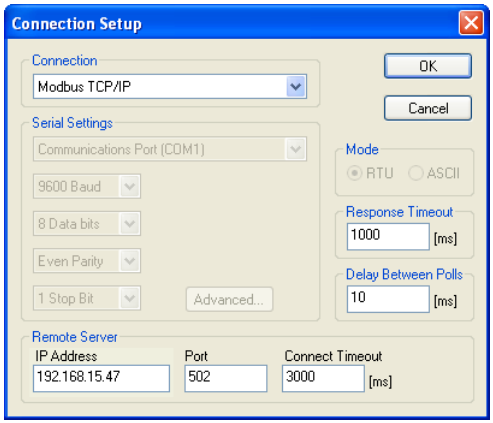
Enter in 1 for the Slave ID. This matches the Unit ID in the protocol that will determine which Modbus Serial Slave will be targeted on the serial side of the MB-GATEWAY. Entering 1 here will match up to the Station Number configured above in DirectSoft for the DL06 PLC.

Choosing Function 3 sets up the read for 4xxxxx registers. Checking the "PLC Addresses (Base 1)" in the lower right corner matches the addressing to the cross reference chart mentioned above. Once this windows has been configured as shown above, click on OK.

Now click on the Connection pulldown menu and select Connect:

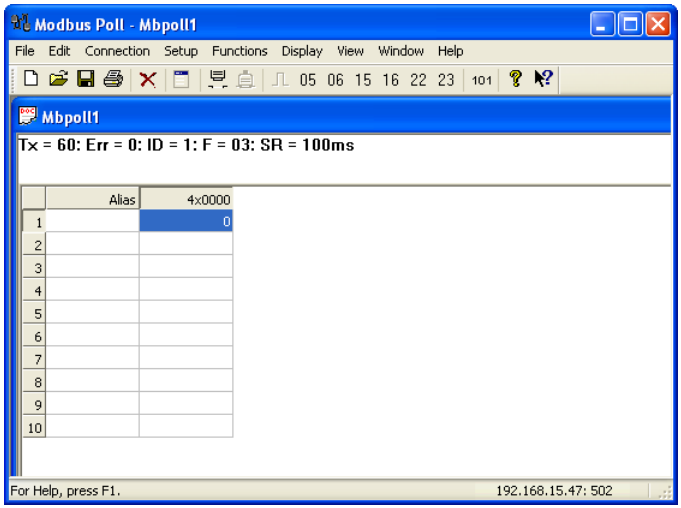


In the Connection Setup window, choose the Modbus TCP/IP connection type. Enter the IP address of your MB-GATEWAY module in the lower left hand corner. Match everything else as shown:

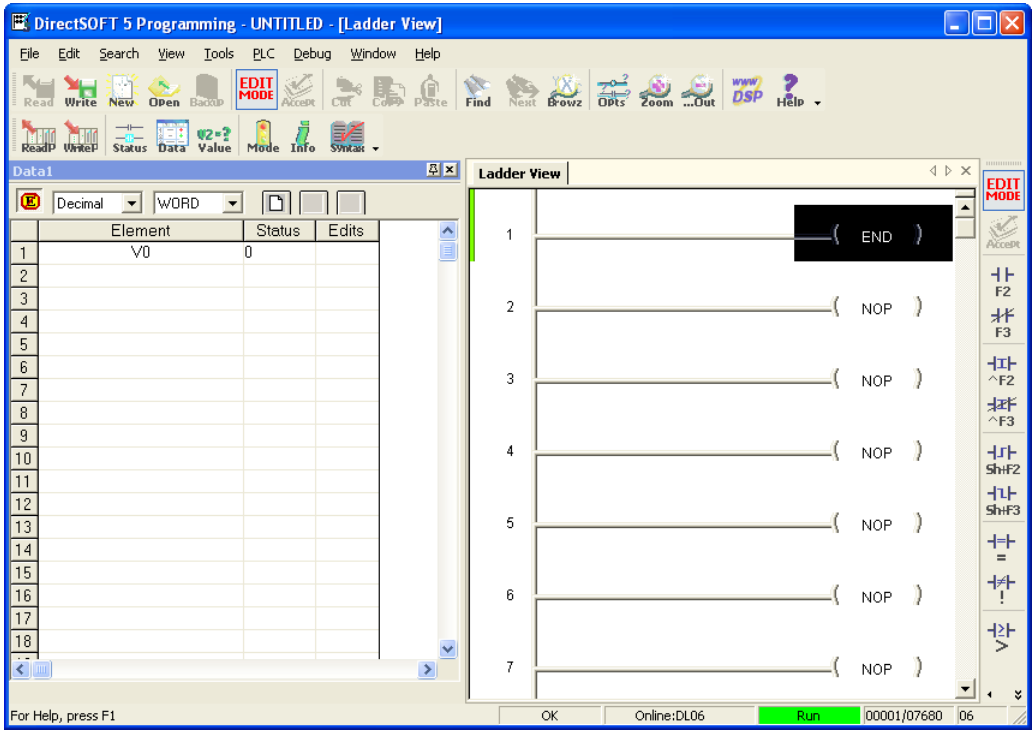


Click on OK to connect to the MB-GATEWAY.

If everything has been configured correctly, the counter next to "TX =" will increment rapidly and the counter next to "Err =" will not increment. If the Error counter is incrementing, go back and verify that all the steps prior to this one have been followed. If you get an error that says, "Modbus TCP connection failed", verify that the IP address of the PC and the IP address of the GATEWAY are in compatible subnets and can communicate.



Once Modbus Poll is communicating to the PLC, go into DirectSoft, open up a Data View window and enter in V0 and change the display type to “Decimal” to match the Modbus Poll software:



Change the value in data view for V0 to various values and watch the value change in Modbus Poll to match.

Example 2:
Using Modbus Poll to MB-GATEWAY with CLICK Slave

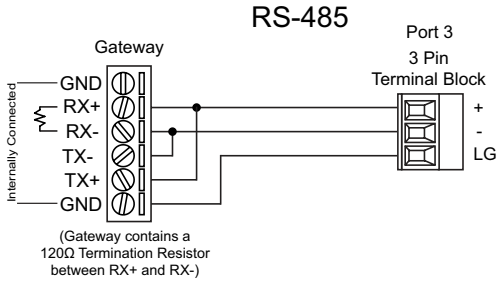
This example will illustrate how to use Modbus Poll, which is a PC based Modbus Master simulator tool, to connect through the MB-GATEWAY to a CLICK PLC via 2 wire RS-485.

Items needed for this example:

- MB-GATEWAY
- CLICK PLC (any C0-01xx-x or C0-02xx-x PLC with 3 pin terminal RS-485 port)
- PC with Modbus Poll installed (free demo is available at *www.modbustools.com*)
- Small length of Belden 9842 or equivalent cable
- Ethernet switch and cables to connect from the PC to MB-GATEWAY

Step 1: Connect the MB-GATEWAY serial port to Port 3 of the CLICK PLC.

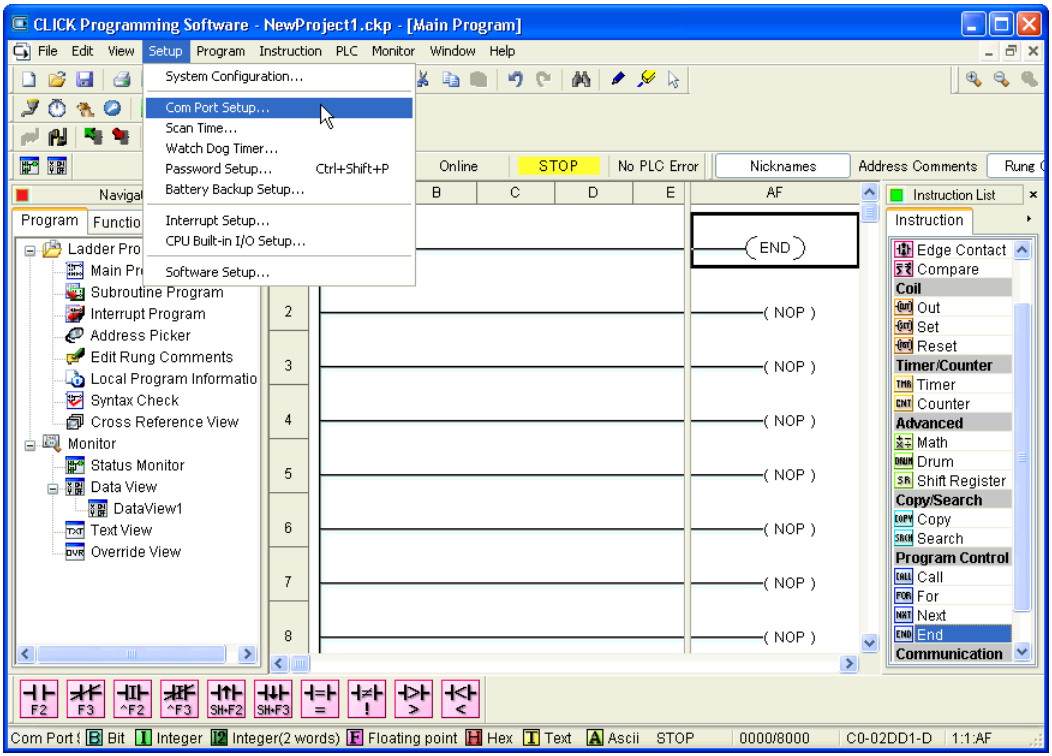
Using the short length of Belden 9842, connect the MB-GATEWAY to CLICK's Port 3 as shown:



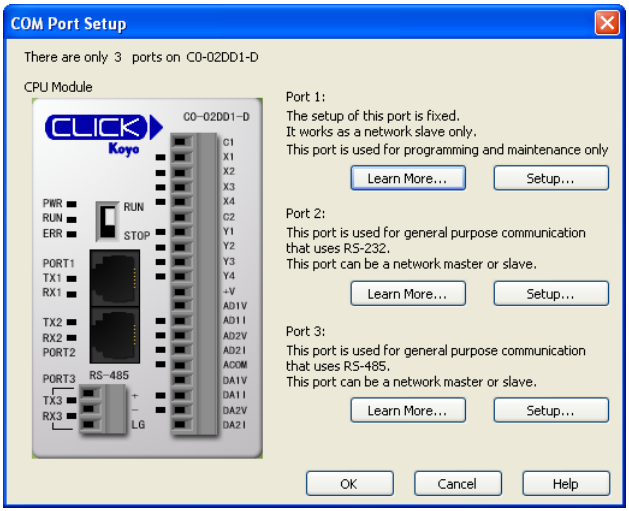
Port 3 Pin Descriptions		
1	+ (plus)	Signal A (RS-485)
2	- (minus)	Signal B (RS-485)
3	LG	Logic Ground (0V)

Step 2: Configure the CLICK serial port and MB-GATEWAY serial port.

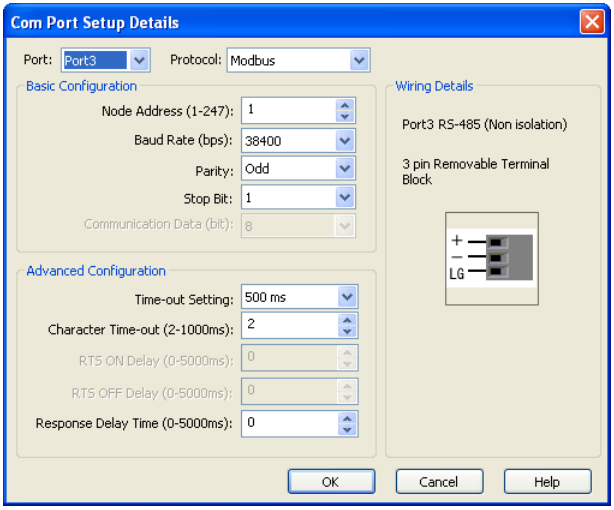
Connect to the CLICK PLC with CLICK programming software. Go to the Setup pulldown and select Com Port Setup... as shown:



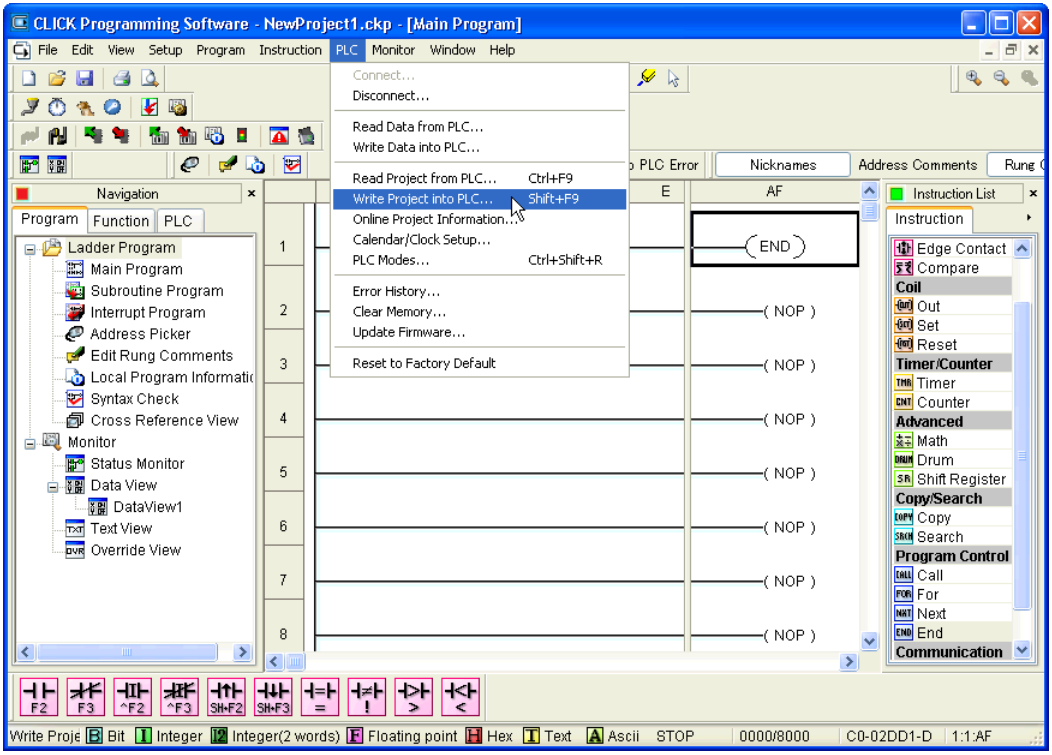
Click the Port 3: Setup... button to configure Port 3 of the PLC.



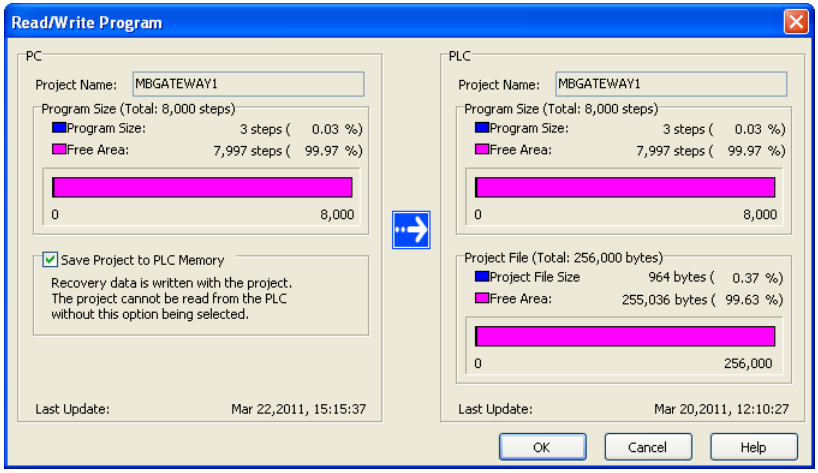
Configure the port for 38400 baud rate, Odd parity, 1 Stop Bit and Node Address 1. Leave the other settings as shown below. Note the Node Address number configured here. Once the settings are configured, Click on the Ok button.



Next, transfer the project to the PLC for the Port 3 settings to take effect. Select the PLC pulldown menu and choose Write Project into PLC...

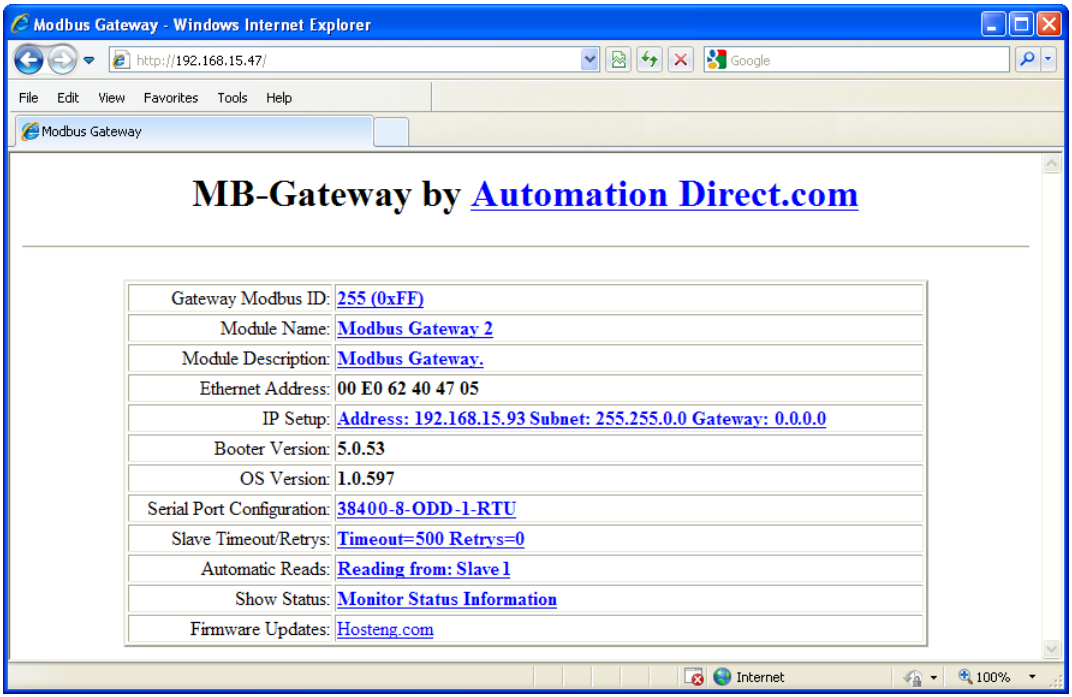


Choose Ok and follow the steps when prompted to transfer the project to the PLC.

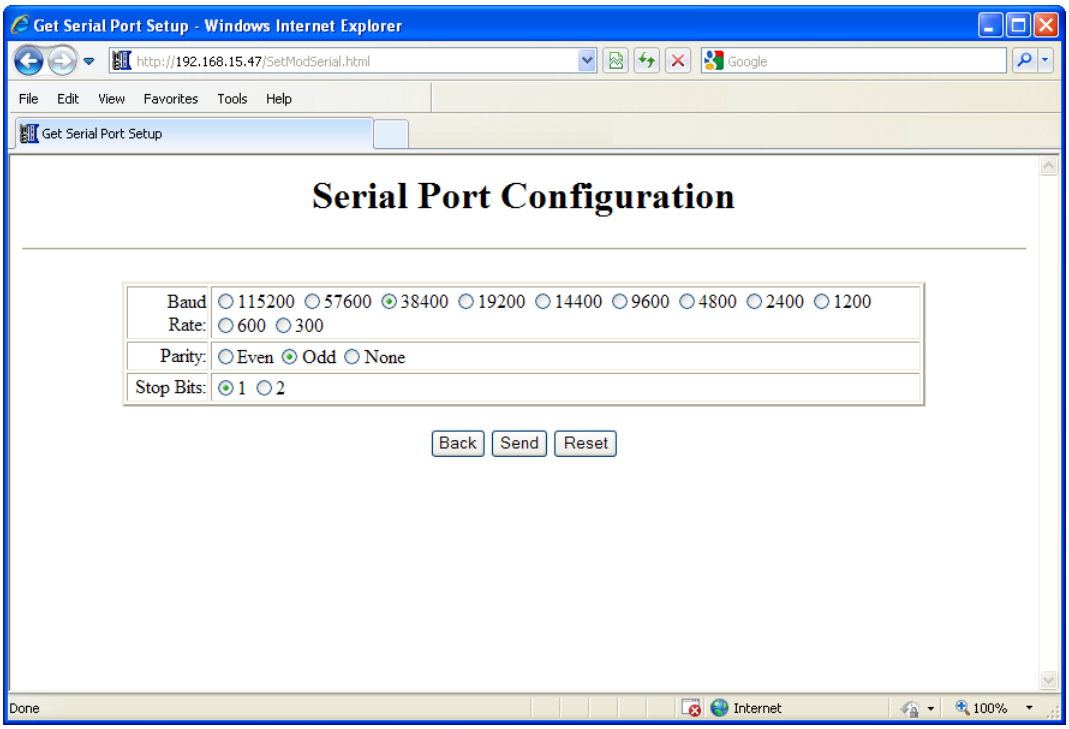


Now go into the MB-GATEWAY configuration and match the serial port settings to the PLC Port 3 settings.

Open up a web browser, such as Internet Explorer, and enter in the IP address of the MB-GATEWAY to access the main screen as shown.



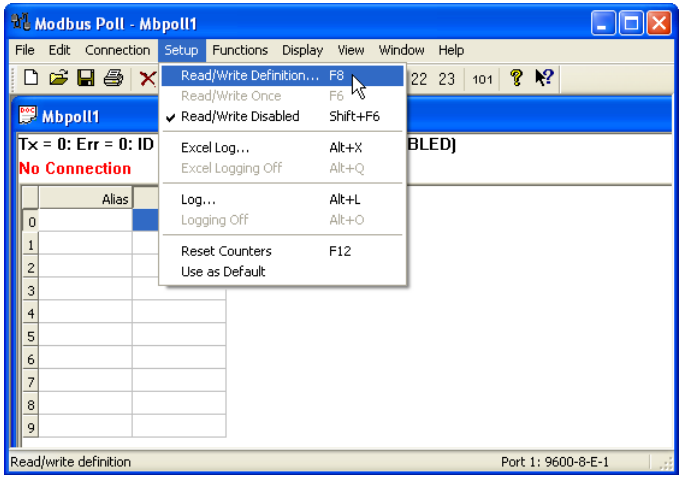
Click on the link to the right of "Serial Port Configuration" and set up the window to match the CLICK PLC port and then click on the Send button to save the settings:



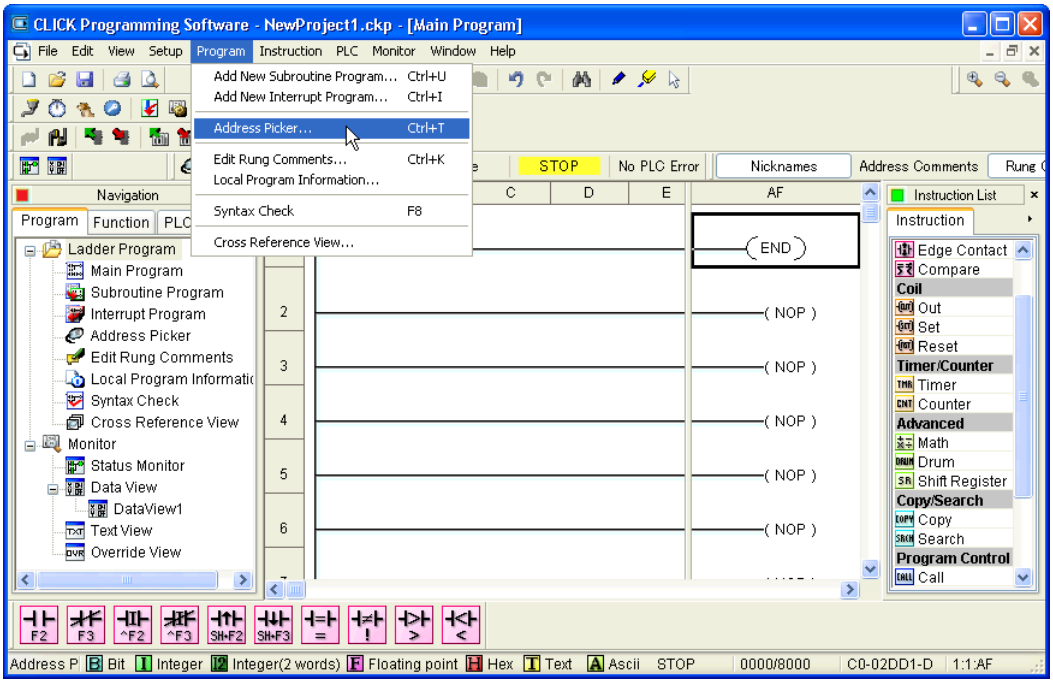
Step 3: Connect to the MB-GATEWAY using the Modbus Poll simulator software.

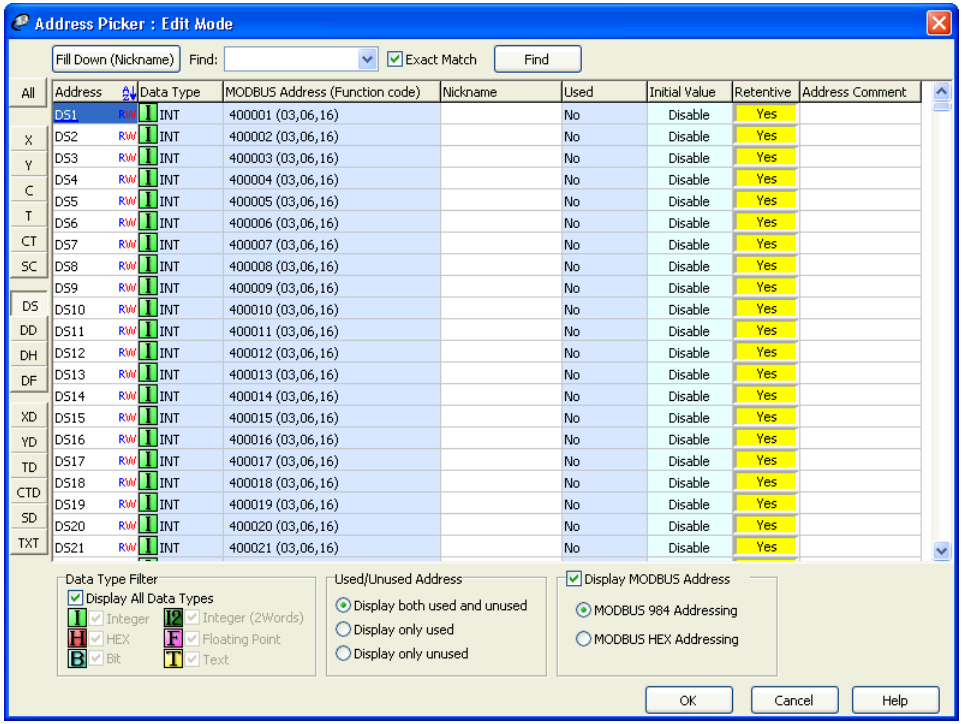
Once the software has been obtained from *www.modbustools.com* and installed according to the directions provided from their website, open up the Modbus Poll software.

Click on the Setup pulldown menu and select Read/Write Definition as shown:

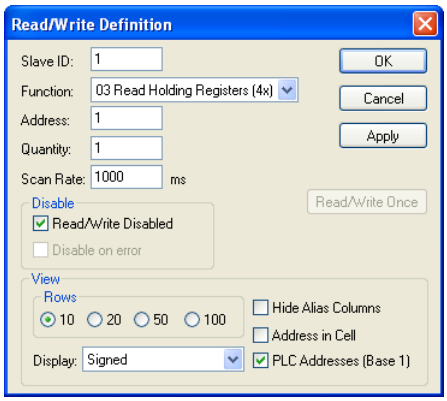


Configure the Read/Write definition for a simple read of the register 400001, which equates to DS1 in the CLICK PLC as shown.




Address Picker : Edit Mode
Fill Down (Nickname)
Find:
Exact Match
Find
All
X
Y
C
T
CT
SC
DS
DD
DH
DF
XD
YD
TD
CTD
SD
TXT
Address
Data Type
MODBUS Address (Function code)
Nickname
Used
Initial Value
Retentive
Address Comment
DS1 RW INT 400001 (03,06,16) No Disable Yes
DS2 RW INT 400002 (03,06,16) No Disable Yes
DS3 RW INT 400003 (03,06,16) No Disable Yes
DS4 RW INT 400004 (03,06,16) No Disable Yes
DS5 RW INT 400005 (03,06,16) No Disable Yes
DS6 RW INT 400006 (03,06,16) No Disable Yes
DS7 RW INT 400007 (03,06,16) No Disable Yes
DS8 RW INT 400008 (03,06,16) No Disable Yes
DS9 RW INT 400009 (03,06,16) No Disable Yes
DS10 RW INT 400010 (03,06,16) No Disable Yes
DS11 RW INT 400011 (03,06,16) No Disable Yes
DS12 RW INT 400012 (03,06,16) No Disable Yes
DS13 RW INT 400013 (03,06,16) No Disable Yes
DS14 RW INT 400014 (03,06,16) No Disable Yes
DS15 RW INT 400015 (03,06,16) No Disable Yes
DS16 RW INT 400016 (03,06,16) No Disable Yes
DS17 RW INT 400017 (03,06,16) No Disable Yes
DS18 RW INT 400018 (03,06,16) No Disable Yes
DS19 RW INT 400019 (03,06,16) No Disable Yes
DS20 RW INT 400020 (03,06,16) No Disable Yes
DS21 RW INT 400021 (03,06,16) No Disable Yes
Data Type Filter
Display All Data Types
Integer
Integer (2Words)
HEX
Floating Point
Bit
Text
Used/Unused Address
Display both used and unused
Display only used
Display only unused
Display MODBUS Address
MODBUS 984 Addressing
MODBUS HEX Addressing
OK
Cancel
Help

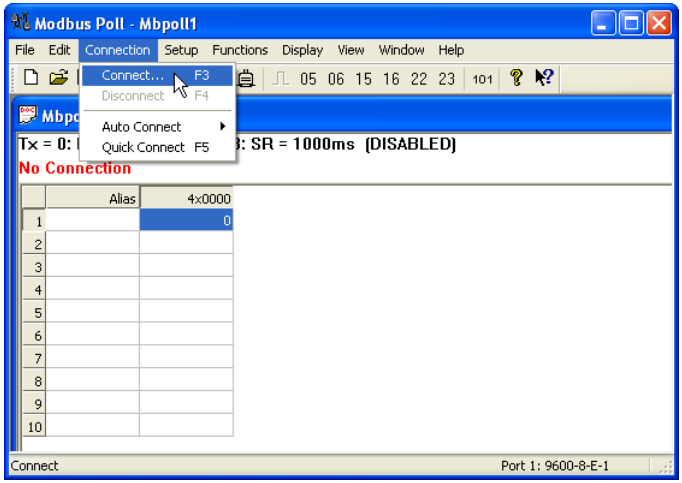
Enter in 1 for the Slave ID. This matches the Unit ID in the protocol that will determine which Modbus Serial Slave will be targeted on the serial side of the MB-GATEWAY. Entering 1 here will match up to the Node Address configured above in the CLICK programming software for Port 3.



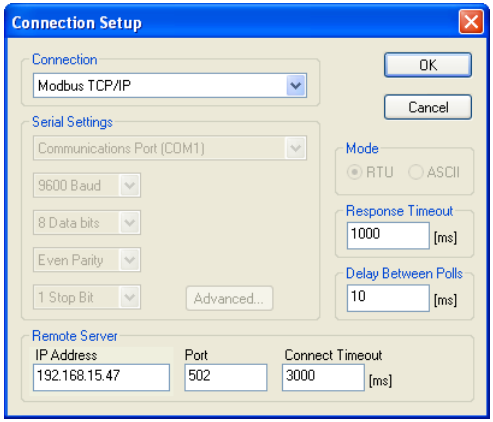
Enter in 1 for the Slave ID. This matches the Unit ID in the protocol that will determine which Modbus Serial Slave will be targeted on the serial side of the MB-GATEWAY. Entering 1 here will match up to the Station Number configured above in the CLICK software.

Choosing Function 3 sets up the read for 4xxxxx registers. Checking the "PLC Addresses (Base 1)" in the lower right corner matches the addressing to the cross reference chart mentioned above. Once this windows has been configured as shown above, click on OK.

Now click on the Connection pulldown menu and select Connect:

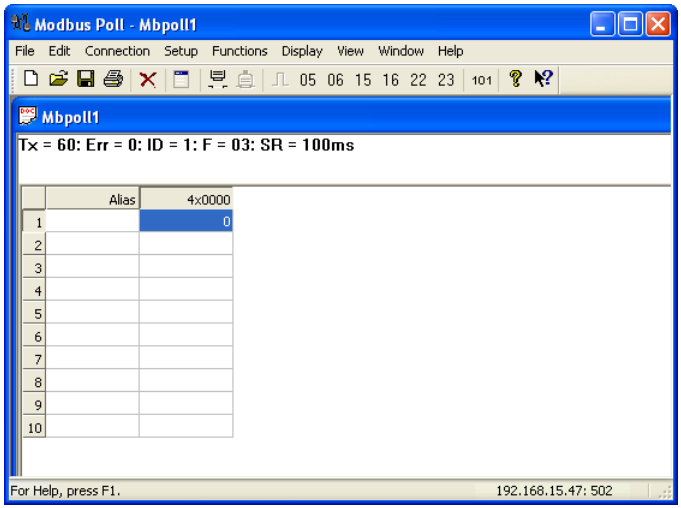


In the Connection Setup window, choose the Modbus TCP/IP connection type. Enter the IP address of your MB-GATEWAY module in the lower left hand corner. Match everything else as shown:

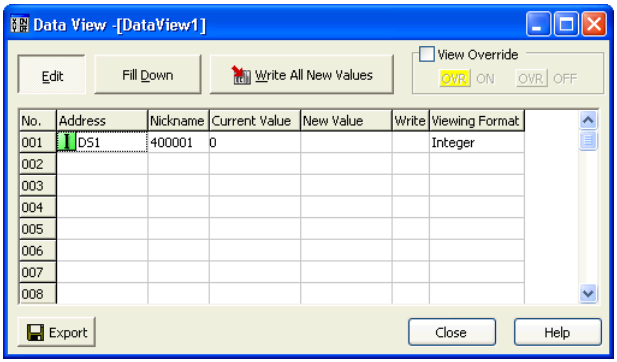


Click on OK to connect to the MB-GATEWAY.

If everything has been configured correctly, the counter next to "TX =" will increment rapidly and the counter next to "Err =" will not increment. If the Error counter is incrementing, go back and verify that all the steps prior to this one have been followed. If you get an error that says, "Modbus TCP connection failed", verify that the IP address of the PC and the IP address of the GATEWAY are in compatible subnets and can communicate.



Once Modbus Poll is communicating to the PLC, go into the CLICK programming software, open up a Data View window and enter in DS1 as shown.



Change the value in data view for DS1 to various values and watch the value change in Modbus Poll to match.

A

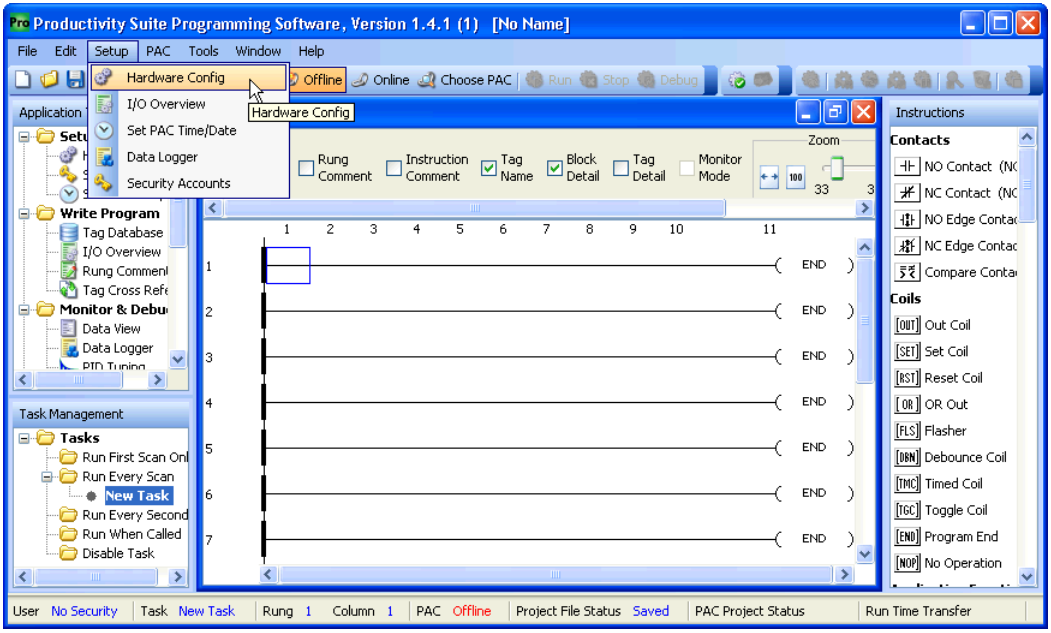
Example 3:
Using P3000 as Master (Client) to MB-GATEWAY with CLICK Slave.

Step 1: Connect CLICK to the MB-GATEWAY as shown in example 2.

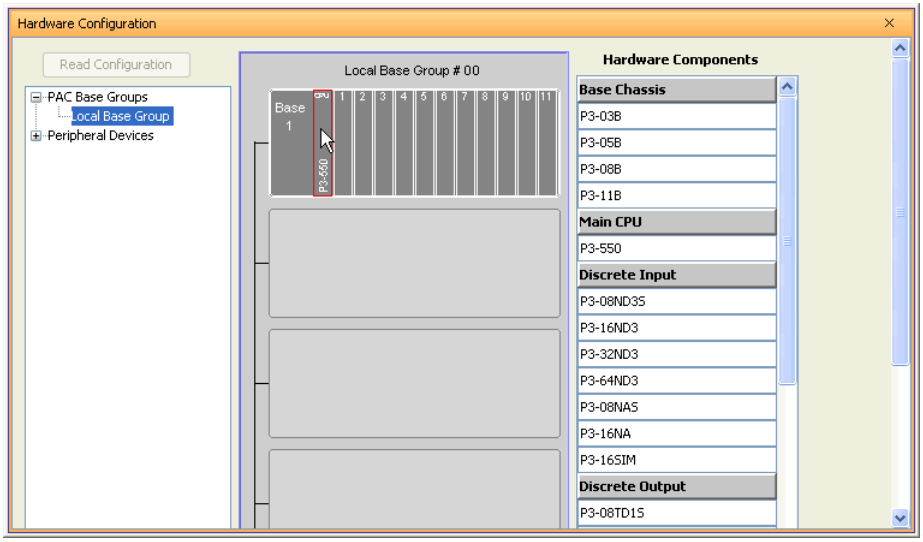
Step 2: Connect P3000 CPU (P3-550) to MB-GATEWAY via Ethernet Switch and Two Ethernet Cables.

Configure the IP address of the P3 CPU and the MB-GATEWAY to be compatible subnets. Steps to configure the IP address of the P3-550 CPU areas follows:

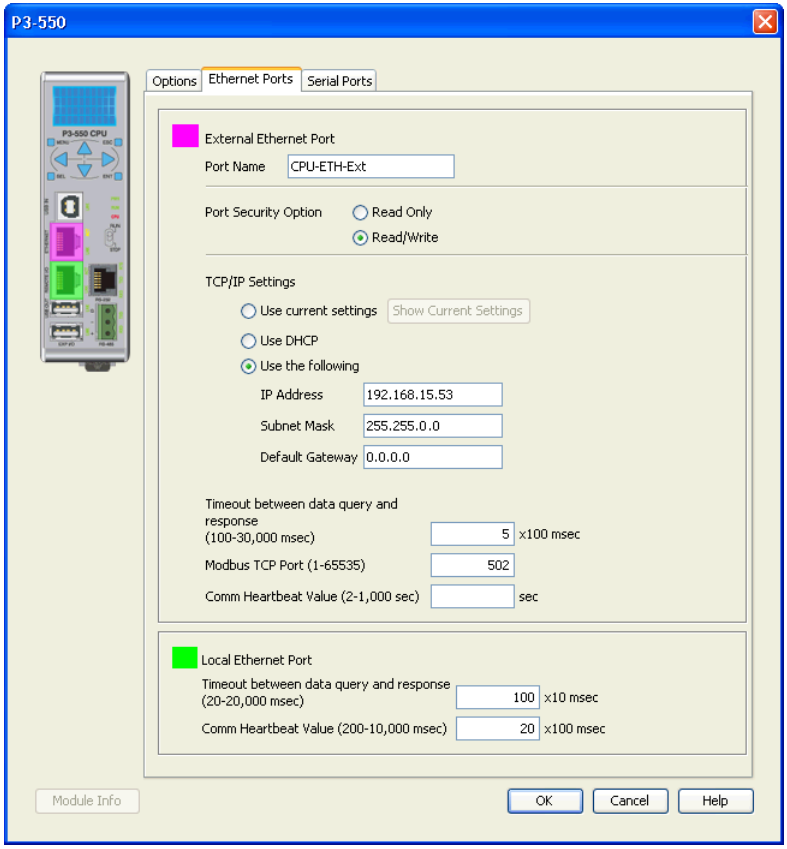
Click on Setup on the top menu bar and choose “Hardware Configuration”.



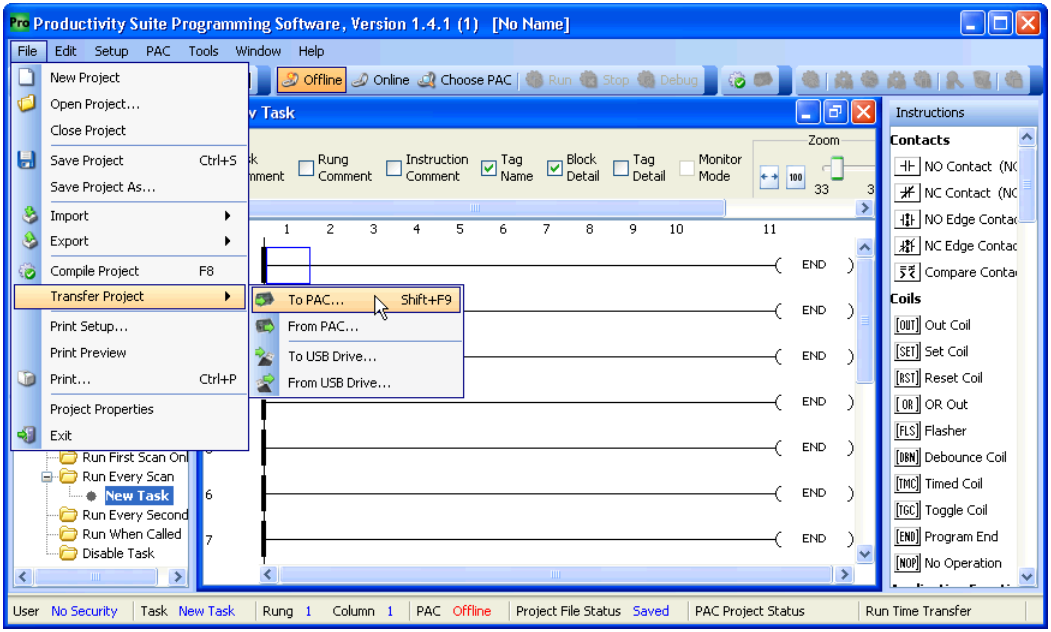
Double click on the image of the P3-550 in the center of the hardware configuration.



Click on the "Ethernet Ports" tab and configure the IP address in the "Use the Following:" IP address field. Once the correct IP address and Subnet Mask is entered, click on the OK button and close the hardware configuration window.

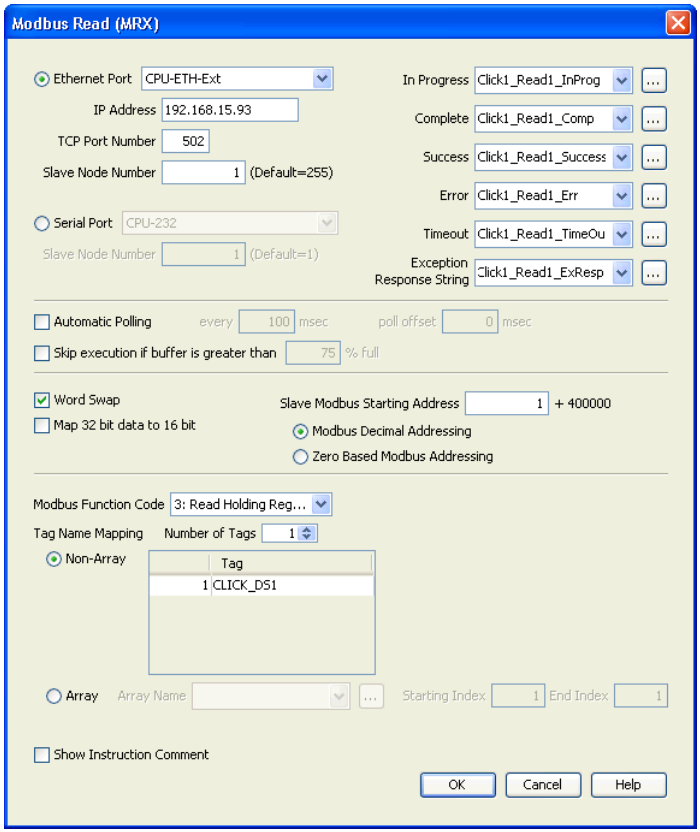


Transfer the project to the PAC in order to have the new settings take effect. To do this, select File from the pulldown menu and then Transfer Project >To PAC…



Step 3: Configure the MRX instruction to read data from the MB-GATEWAY.

Double click on the instruction MRX Read to configure the MRX instruction as shown.



IP Address: address of the GATEWAY.

TCP Port Number: Leave at default 502.

Slave Node Number: This should match the Node address of Port 3 of the CLICK PLC. Leave at 1 in this case.

Slave Modbus Starting Address: Set to 1 to read address DS1 in the CLICK PLC.

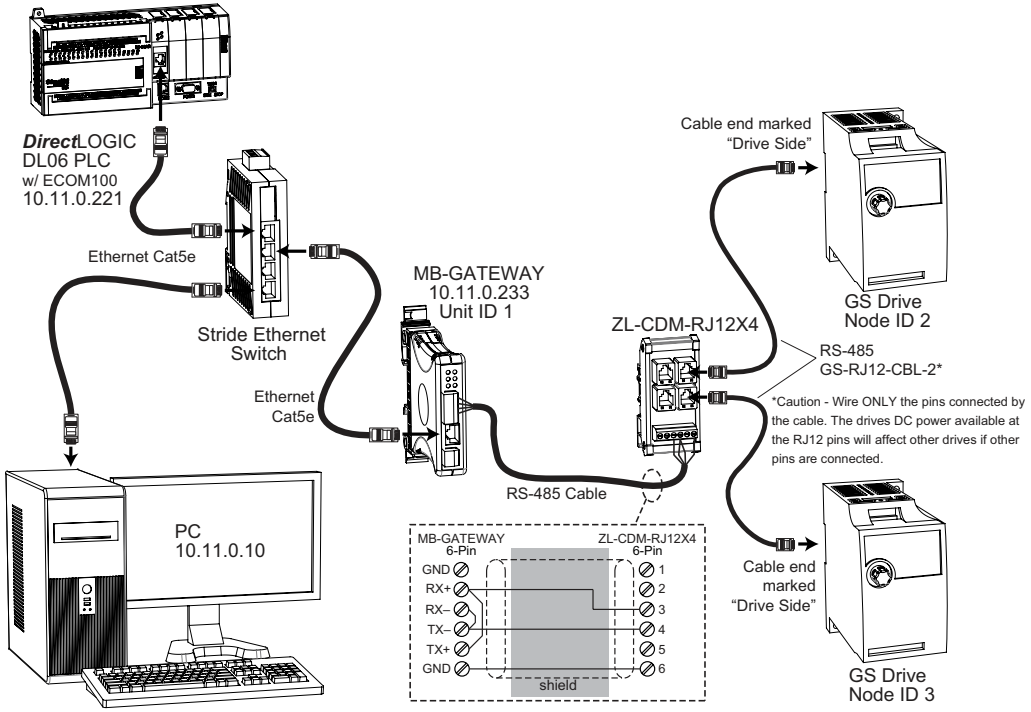
Tag Name Mapping: Create a Tag called CLICK_DS1 as an Signed Int 16 Tag to read in DS1 from the CLICK PLC.

Use the status bits and Exception Response String to verify whether communications were successful or not. If the Error bit comes on, look at the Exception Response String to see which error occurred. If the Timeout Bit comes on, check the IP address settings of the P3-550 and the GATEWAY and make sure that they are in compatible subnets.

If the Successful Status bit comes on, add the CLICK_DS1 tag to the Data View at the bottom of the Productivity Suite Programming Software and check the values. Change the values in the CLICK data view for DS1 and verify that the CLICK_DS1 tag matches.

A

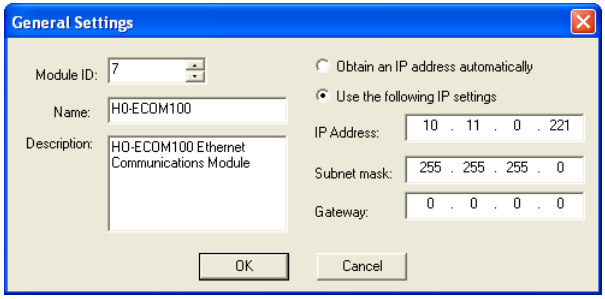
Example 4:
DirectLogic 06 (H0-ECOM100) as Master (Client) to MB-GATEWAY with Mulitple GS Drives as Slaves.



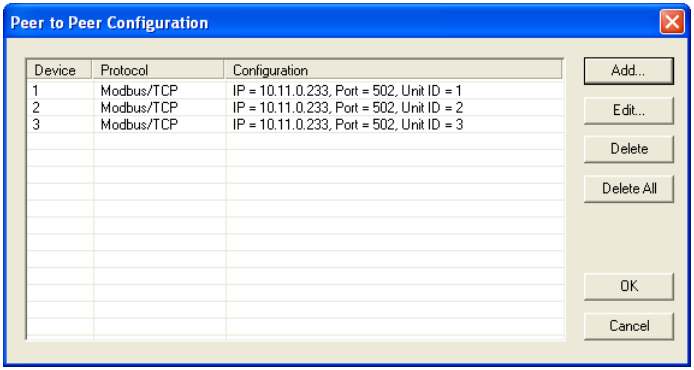
Step 1: Set up Peer to Peer Configuration

In NetEdit, Scan Network to find your H0-ECOM100.

Set the Module ID, IP address and Subnet Mask as appropriate for your network. In our example, we use 7, 10.11.0.221 and 255.255.255.0 respectively.



In the ECOM Settings tab, click the Peer to Peer Config button. Add the Devices appropriate for your project.



In our example we have added three devices that are the MB-GATEWAY:

Device 1 is the Automatic Reads table that resides in the MB-GATEWAY, so it is configured with the MB-GATEWAY IP address and the MB-GAEWAY Unit ID.

Device 2 is the first drive. It is configured with the MB-GATEWAY IP address and the first drive Unit ID.

Device 3 is the second drive. It is configured with the MB-GATEWAY IP address and the second drive Unit ID.

Step 2: Set the Serial Port Configuration

In the NetEdit Module List, select your MB-GATEWAY. Set the IP address and subnet mask as appropriate for your network. In our example, we use 10.11.0.233 and 255.255.255.0.

Click Start Web Based Config... To set the Gateway Modbus ID as appropriate for your network. In our example, we use 1.

Set the Serial Port Configuration as appropriate for your network. For our example, we use:

Baud rate = 19200

Parity = Odd

Stop bit = 1

Step 3: Set the Communication Parameters

Set the communication parameters in the drives as appropriate for your network.

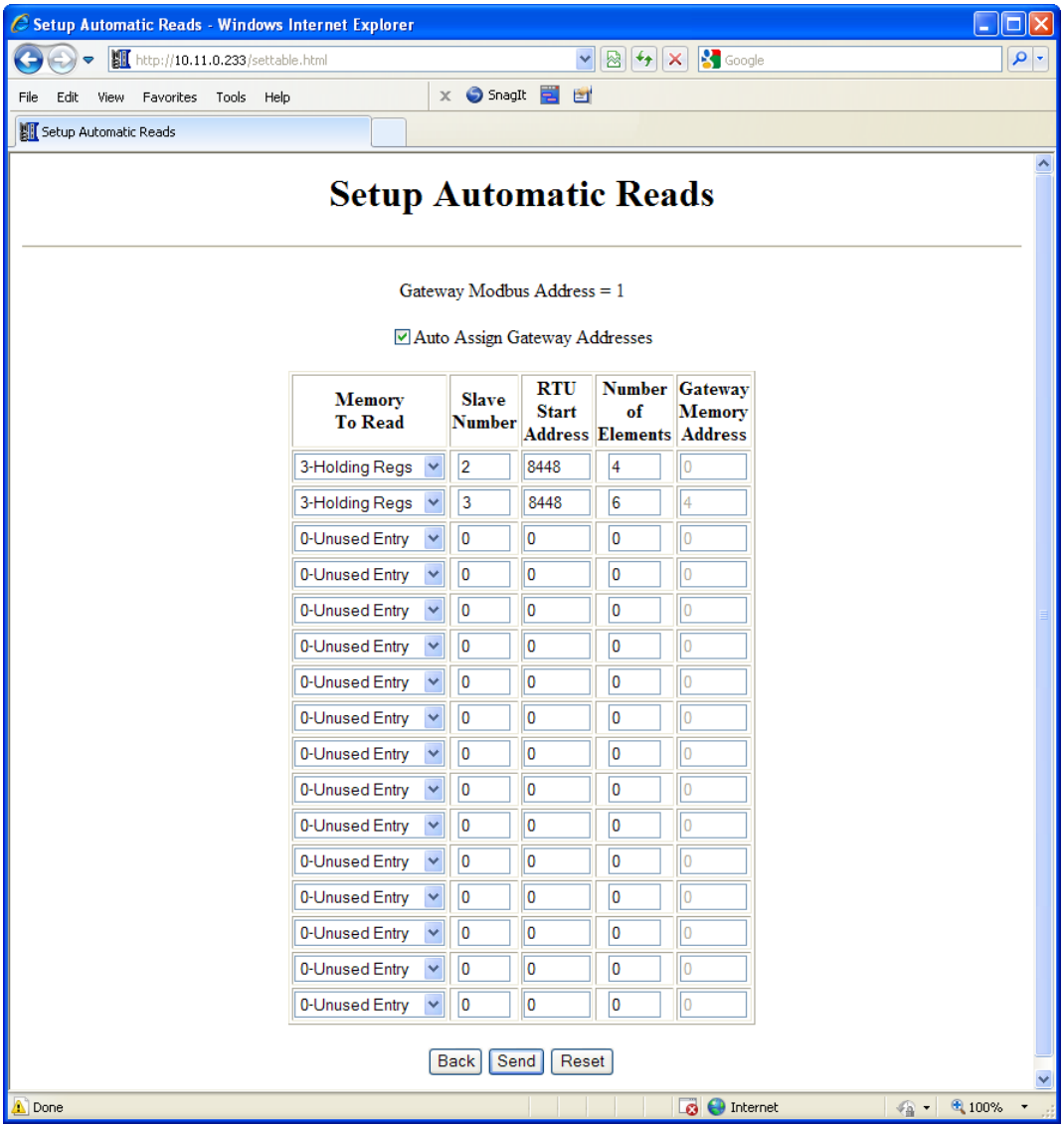
In our example:

Parameter Number	Parameter Description	First Drive	Second Drive
P9.00	Drive ID	02	03
P9.01	Baud Rate	02	02
P9.02	Modbus RTU, 8-Odd-1	05	05
P3.00	RS-485 interface, Keypad STOP disabled	04	04
P4.00	Frequency determined by RS-485 interface	05	05

Step 4: Using Automatic Reads

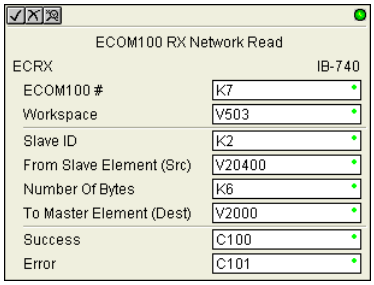
In the MB-GATEWAY browser configuration utility, click the Automatic Reads link. Slave number 2 is the first drive and Slave number 3 is the second drive in our example. Configure the lines as appropriate.

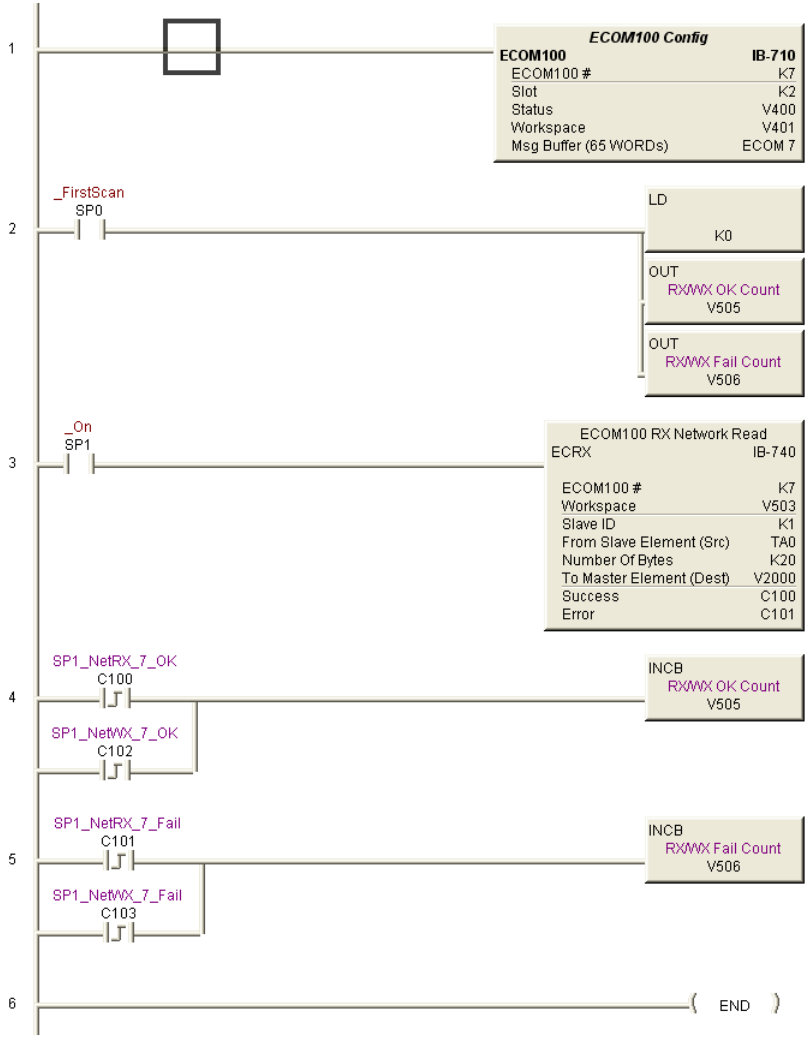
For our example, we will read the status registers for each drive:



Step 5: Access the Automatic Read Data

The ECRX iBox is used since the data will be read by the ECOM100, rather than a serial connection





ECOM100# = defined for this DL program in the ECOM100 iBox in our Rung 1

Workspace = an internal, private register used by this iBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Slave ID = The MB-GATEWAY Modbus Gateway ID, 1, since we are reading the Automatic Read data stored in the MB-GATEWAY

From Slave Element (Src) = the Gateway Memory Address identified on the MB-GATEWAY Setup Automatic Reads config page. Note that the address in the MB-GATEWAY, "0" should be entered here as "V0" and DirectSoft software will change the name to TA0. This is a naming convention for addresses internal to the PLC and will not

affect either the targeted address or the use of Timer 0 in the DL program.

Number of Bytes = 20. Since our addresses for both example drives are contiguous, we can read all 10 elements with one iBox. Each element is a word, 2 bytes, so we want to read 20 bytes to get all 10 elements.

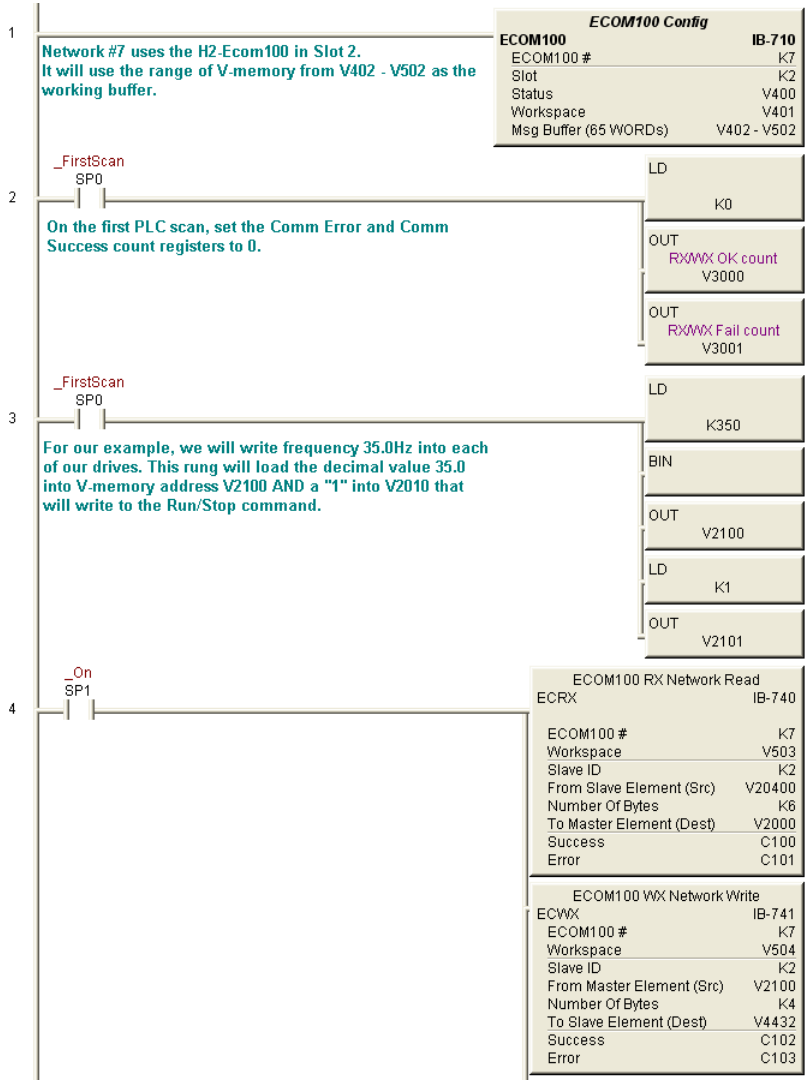
To Master Element (Dest) = the location where the slave data will be placed in the master ECOM100 PLC

Success = a bit that will turn on once the request is completed successfully

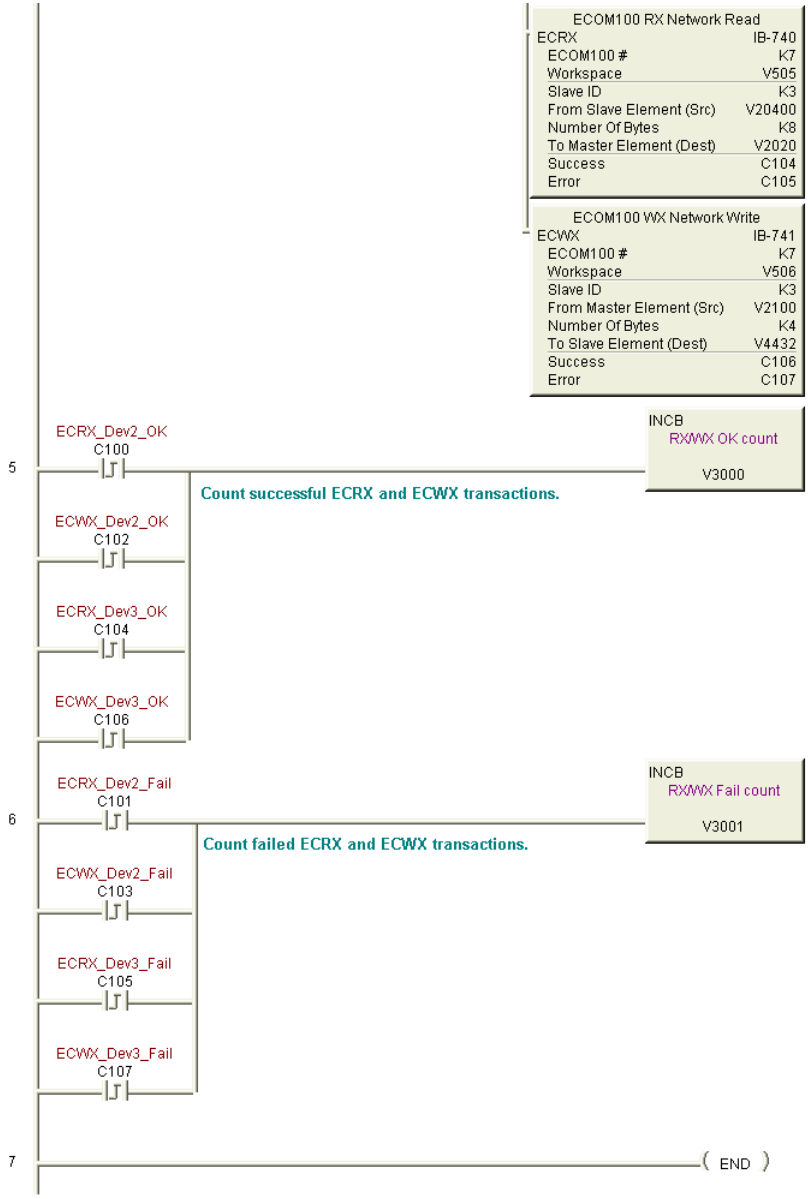
Error = a bit that will turn on if the instruction is not successfully completed

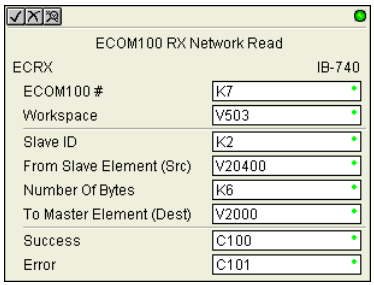
Step 6: Read and Write from the DL06

To Read data from a drive instead of using of the Automatic Read feature of the MB-GATEWAY, and to Write data to the drive, the Slave ID in the ECRX and/or ECWX iBoxes will be the Drive ID. The From Slave Element and/or To Slave Element values will be the addresses in the drive



continued


ECOM100 RX Network Read
ECRX IB-740
ECOM100 # K7
Workspace V505
Slave ID K3
From Slave Element (Src) V20400
Number Of Bytes K8
To Master Element (Dest) V2020
Success C104
Error C105
ECOM100 WX Network Write
ECWX IB-741
ECOM100 # K7
Workspace V506
Slave ID K3
From Master Element (Src) V2100
Number Of Bytes K4
To Slave Element (Dest) V4432
Success C106
Error C107
5
ECRX_Dev2_OK
C100
ECWX_Dev2_OK
C102
ECRX_Dev3_OK
C104
ECWX_Dev3_OK
C106
INCB
RX/WX OK count
V3000
Count successful ECRX and ECWX transactions.
6
ECRX_Dev2_Fail
C101
ECWX_Dev2_Fail
C103
ECRX_Dev3_Fail
C105
ECWX_Dev3_Fail
C107
INCB
RX/WX Fail count
V3001
Count failed ECRX and ECWX transactions.
7
END



In our example ECRX boxes:

ECOM100# = defined for this DL program in the ECOM100 iBox in our Rung 1.

Workspace = an internal, private register used by this iBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Slave ID = The GS Drive Node ID, 2 or 3, depending on which drive we target

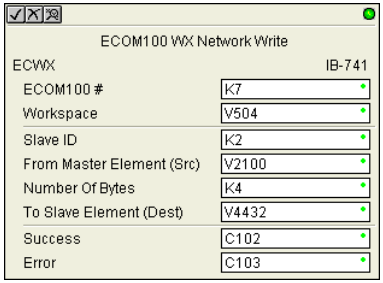
From Slave Element (Src) = V20400 equates to Status Monitor 1 in the GS Drive (Hex 2100 and Modbus Decimal 48449). See GS Drive manual for details.

Number of Bytes = Each Modbus register (element) that we want to read is a word, 2 bytes; in our example we will read 3 status registers.

To Master Element (Dest) = the location where the slave data will be placed in the master ECOM100 PLC

Success = a bit that will turn on once the request is completed successfully

Error = a bit that will turn on if the instruction is not successfully completed



In our example ECWX boxes:

ECOM100# = Module ID, set in NetEdit and defined for the DL program in the ECOM100 iBox in our Rung 1

Workspace = an internal, private register used by this iBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Slave ID = The GS Drive Node ID, 2 or 3, depending on which drive we target

From Master Element (Src) = the location of data in the Master PLC that will be written to the drive

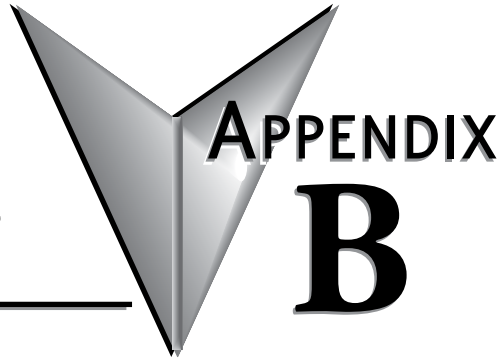
Number of Bytes = 4. In our example, we will write the speed (2 bytes) to the Comm Speed Reference register and set the next register to RUN (2 bytes)

To Slave Element (Dest) = the Modbus register where the data will be written in the drive. In this case, V4432 equates to P9.26 Comm Speed Reference. See GS Drive manual for more details.

Success = a bit that will turn on once the instruction is completed successfully

Error = a bit that will turn on if the instruction is not successfully completed

Modbus Error Codes



In this Appendix...

Modbus Error Codes

MB-GATEWAY Modbus Error Codes		
Error Code	**Name**	**Explanation**
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the slave. If a Poll Program Complete command was issued, this code indicates that no program function preceded it.
02	ILLEGAL DATA ADDRESS	The data address received in the queryis not an allowable address for the slave.
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the slave.
04	SLAVE DEVICE FAILURE	An unrecoverable error occurred while the slave was attempting to perform the requested action.
05	ACKNOWLEDGE	The slave has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the master. The master can next issue a Poll Program Complete message to determine if processing is completed.
06	SLAVE DEVICE BUSY	The slave is engaged in processing a long–duration program command. The master should retransmit the message later when the slave is free.
07	NEGATIVE ACKNOWLEDGE	The slave cannot perform the program function received in the query. This code is returned for an unsuccessful programming request using function code 13 or 14 decimal. The master should request diagnostic or error information from the slave.
08	MEMORY PARITY ERROR	The slave attempted to read extended memory, but detected a parity error in the memory. The master can retry the request, but service may be required on the slave device.

Security Considerations for Control Systems Networks

In this Appendix...

Security Considerations for Control Systems Networks

Manufacturers are realizing that to stay competitive, their Automation and Control Systems need to be more integrated within their plant. The systems often need to be integrated with upstream Enterprise Data Systems, and even further integrated to allow information to be accessible across multiple plants, or even through the Internet. This convergence of the IT world with the Automation World creates challenges in maintaining secure systems and protecting your investments in processes, personnel, data and intellectual property.

While Automation Networks and Systems have built-in password protection schemes, this is only one very small step in securing your systems. Automation Control System Networks need to incorporate data protection and security measures that are at least as robust as a typical business computer system. We recommend that users of PLCs, HMI products and SCADA systems perform your own network security analysis to determine the proper level of security required for you application. However, the Department of Homeland Security's National Cybersecurity and Communications Integration Center (NCCIC) and Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) has provided direction related to network security and safety under an approach described as "Defense in Depth", which is published at https://www.us-cert.gov/sites/default/files/recommended_practices/NCCIC_ICS-CERT_Defense_in_Depth_2016_S508C.pdf.

This comprehensive security strategy involves physical protection methods, as well as process and policy methods. This approach creates multiple layers and levels of security for industrial automation systems. Such safeguards include the location of control system networks behind firewalls, their isolation from business networks, the use of intrusion detection systems, and the use of secure methods for remote access such as Virtual Private Networks (VPNs). Further, users should minimize network exposure for all control system devices and such control systems and these systems should not directly face the internet. Following these procedures should significantly reduce your risks both from external sources as well as internal sources, and provide a more secure system.

It is the user's responsibility to protect such systems, just as you would protect your computer and business systems. AutomationDirect recommends using one or more of these resources in putting together a secure system:

- ICS-CERT's Control Systems recommended practices at the following web address: https://ics-cert.us-cert.gov/Recommended-Practices
- Special Publication 800-82 of the National Institute of Standards and Technology – Guide to Industrial Control Systems (ICS) Security https://csrc.nist.gov/publications/detail/sp/800-82/rev-2/final
- ISA99, Industrial Automation and Control Systems Security http://www.isa.org/MSTemplate.cfm?MicrositeID=988&CommitteeID=6821 (please note this is a summary and these standards have to be purchased from ISA)

The above set of resources provides a comprehensive approach to securing a control system network and reducing risk and exposure from security breaches. Given the nature of any system that accesses the internet, it is incumbent upon each user to assess the needs and requirements of Security Considerations for Control Systems Networks their application, and take steps to mitigate the particular security risks inherent in their control system.

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