

MANUAL

ICDM-RX/MOD Modbus Router User



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1. Overview

1.1. Introduction

This guide discusses ICDM--RX/MOD Industrial Gateway configuration for the ICDM--RX/MOD running the Modbus Router application.

The Modbus Router application provides enhanced connectivity from a wide variety of Modbus masters to a wide variety of Modbus slaves, advanced Master-to-Master connectivity, and connectivity from private Modbus serial networks to public Modbus networks.

Supported Modbus masters include:

- Modbus/TCP
- Modbus/RTU serial
- Modbus/ASCII serial
- Modbus/ RTU
- Modbus/ASCII over Ethernet TCP/IP

Supported Modbus slaves include:

- Modbus/TCP
- Public and private Modbus/RTU serial
- Public and private Modbus/ASCII serial

Connectivity can be easily achieved between any master(s) and any public slave(s) anywhere on an Ethernet network. Combined with a ICDM-RX/MOD running the Modbus/TCP application, both serial and Ethernet TCP/IP Raw/ ASCII devices can be accessed anywhere on a network from any Modbus master.

Modbus Router was designed to greatly enhance system maintenance capabilities. Included are comprehensive device and port specific diagnostic web pages that display status, message response timing, time-outs, other error counts, and overall message statistics. A serial log is also included to provide message level diagnosis for serial devices.

1.2. Terms and Definitions

This subsection defines terms and definitions used in this guide.

Term	Definition
Alias Device ID	The device ID that the original received ID is changed to when an Alias Device ID is configured.
Device ID	The Modbus device identification number. Device IDs include: 0 = Broadcast 1-247 = Standard device IDs 248-255 = Reserved device IDs (generally used for vendor specific gateway functions)
Device ID Offset	An offset applied at the slave serial port interface that changes the message device ID range to match the serial device(s) device ID range.

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Term	Definition
Ethernet TCP/IP	A form of Ethernet connectivity that provides a level of guaranteed delivery and data verification. This is used for many upper layer protocols such Modbus/TCP and can be also used for transferring Modbus/RTU and Modbus/ASCII messages.
Local Slave Device	A local slave device is one that is connected directly to a serial port on the gateway.
Master (or Client) Mode	The method of operation when a PLC, a gateway, or an application is operating as a <i>Master</i> or the message originator.
Modbus/ASCII	An ASCII, or character based, form of Modbus. The base message is the same as Modbus/RTU, but the format is somewhat different.
Modbus/RTU	The standard Modbus messages, in hexadecimal format, that are typically transmitted over serial lines but can also be transmitted over other communication methods such as wireless or Ethernet TCP/IP socket connections. Note: <i>Modbus/RTU over Ethernet TCP/IP is not the same as Modbus/TCP.</i>
Modbus/TCP	An Ethernet based form of Modbus communication. The base message is the same as Modbus/RTU, but a special Modbus header is included for packet identification and routing purposes.
Polling	The process where a PLC or Application requests data on a continual basis. In this operation the Master sends the request messages while the Slave responds to the messages.
Public Slave Device	A public slave device is one that can communicate to all master(s) on the Modbus network. Note: <i>If a device is not specifically specified as a “public” or “private” slave device, then it can be assumed to be a public device.</i>
Private Slave Device	A private slave device is one that can only communicate to a master that is connected on the same serial bus, such as RS-485 or RS-422. Private slave device cannot communicate to other masters on the Modbus network.
Received Device ID	The original device ID received in the Modbus message from a Modbus master.
Remote Slave Device	A remote slave device is either a slave Modbus/TCP device or a serial slave device attached to another gateway and accessed as a remote Modbus/TCP device.
Slave (or Server) Mode	The method of operation when a PLC, a gateway, or an application is operating as a <i>Slave</i> or the message receiver.
Sockets	The method used to communicate between devices while communicating over Ethernet TCP/IP.

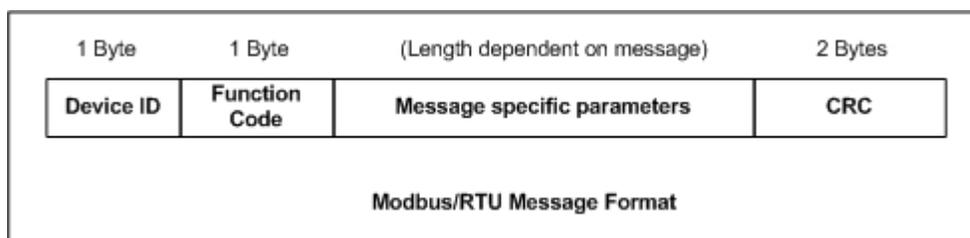
1.3. What is Modbus?

This subsection discusses:

- Modbus/RTU
- Modbus/ASCII on Page 7
- Modbus/TCP on Page 8

1.3.1. Modbus/RTU

Modbus/RTU is native Modbus in hexadecimal format. These are the base Modbus messages that contain simple read and write requests. The format is as follows:



Where:

- The terms **Master** or **Client** are used to identify the sender of the message.
- The terms **Slave** or **Server** are used to identify the devices responding to the message.

Modbus/RTU is used primarily for:

- Serial port connectivity
RS-485 is the most common serial mode, but RS-232 and RS-422 are also widely used. Commonly used by both Master and Slave devices.
- Ethernet TCP/IP socket connections
This is not the same as Modbus/TCP on Page 8, but does provide a very simple method of interfacing to remote devices. It is used by many applications and some OPC servers.

Note: This communication method typically is not supported by PLCs.

1.3.2. Modbus/ASCII

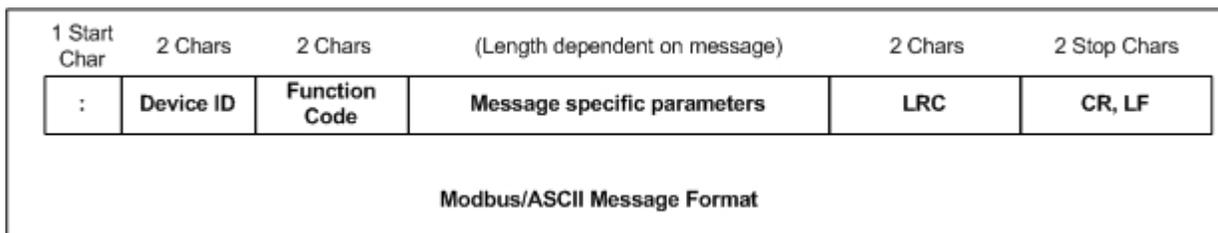
Modbus/ASCII is native Modbus in ASCII format. This protocol is used primarily by legacy devices and is no longer supported as widely as Modbus/RTU.

Like Modbus/RTU, Modbus/ASCII contains the base Modbus messages that contain simple read and write requests. The differences between Modbus/ASCII and Modbus/RTU are:

1. The message data is sent in ASCII format, so the message length is twice as long. It requires two ASCII characters for each byte of data.
2. An 8-bit LRC is attached to verify the message instead of a 16-bit CRC. The LRC is also transmitted in ASCII format.
3. There are defined starting and ending characters to determine a Modbus/ASCII messages.



The format is as follows:



Where:

- The terms **Master** or **Client** are used to identify the sender of the message.
- The terms **Slave** or **Server** are used to identify the devices responding to the message.

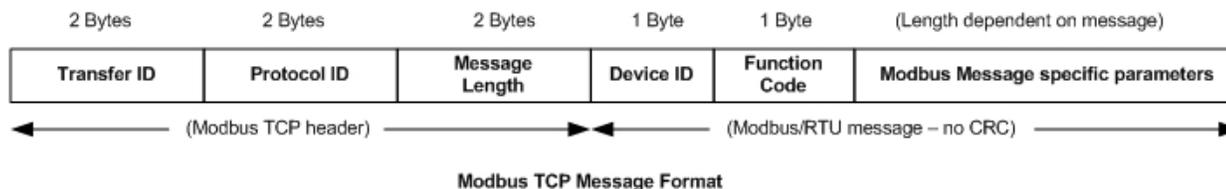
Modbus/ASCII is used primarily for:

- Serial port connectivity
RS-485 is the most common serial mode, but RS-232 and RS-422 are also used. Used primarily by legacy Slave devices.
- Ethernet TCP/IP socket connections
This is not the same as Modbus/TCP, but does provide a very simple method of interfacing to remote devices. It is used by some applications and some OPC servers.

Note: *This communication method typically is not supported by PLCs.*

1.3.3. Modbus/TCP

Modbus/TCP is an Ethernet network based protocol that contains a Modbus/RTU message, with the exception of the 2-byte CRC. The Modbus/TCP message contains a header with information designed to provide message identification and routing information. The format is as follows:



Where:

- The terms **Master** or **Client** are used to identify the sender of the message.
- The terms **Slave** or **Server** are used to identify the devices responding to the message.
- Modbus/TCP messages are typically sent to and received on a defined Ethernet TCP/IP socket of 502.
- Modbus/TCP implementations provide more capability, but also require more processing than simpler Modbus/RTU implementations.

Modbus/TCP is used for connecting advanced Ethernet based devices, such as PLCs, HMIs, SCADA Systems, and most OPC Servers to:

- Other Ethernet devices supporting Modbus/TCP.
- Remote serial Modbus/RTU and/or Modbus/ASCII devices through gateways (such as the ICDM-RX/MOD running the Modbus Router or Modbus/TCP applications).
- Remote serial or Ethernet TCP/IP ASCII devices (barcode scanners, printers, RFID readers, visions systems, etc) through a gateway (such as the ICDM-RX/MOD running the Modbus/TCP application).

1.4. Modbus Router Functionality

The Modbus Router application provides the following functionality:

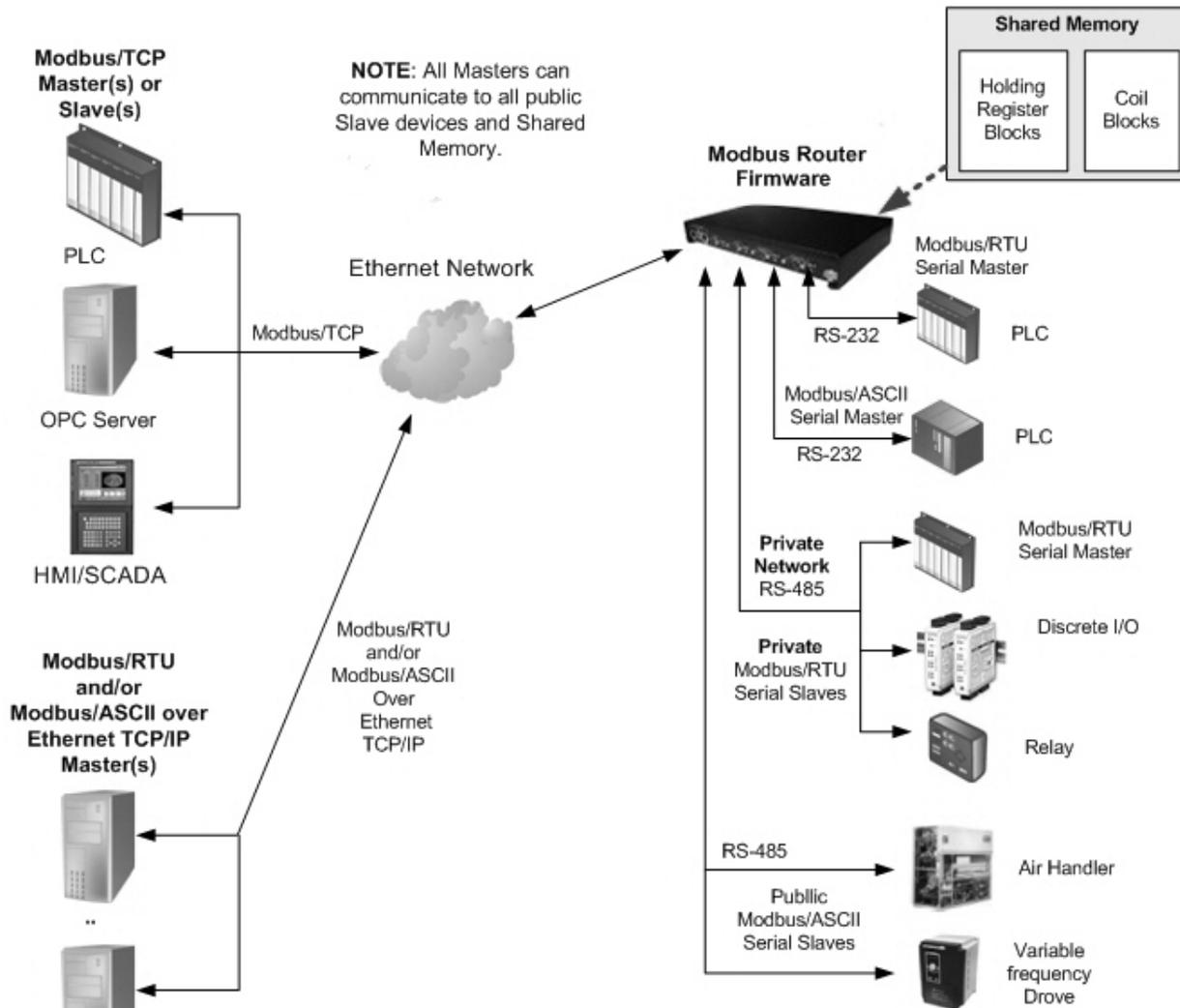
- Provides robust connectivity from all supported master devices to all supported slave devices:
 - Supported Masters:
 - Modbus/TCP Master - accepts Modbus/TCP messages on up to eight TCP/IP ports. This includes 502 and seven configurable ports.
 - Modbus/RTU Serial Master
 - Modbus/ASCII Serial Master
 - Modbus/RTU over Ethernet TCP/IP Master
 - Modbus/ASCII over Ethernet TCP/IP Master
 - Supported Slaves:
 - Modbus/RTU Serial Slaves
 - Modbus/RTU ASCII Slaves
 - Remote Modbus/TCP Slaves (addressable to device ID and IP address/port)
 - Remote Modbus/RTU Serial Slaves (via Modbus/TCP using another gateway)
 - Remote Modbus/ASCII Serial Slaves (via Modbus/TCP using another gateway)
- Multiple ICDM-RX/MOD chassis can be used together to form a Modbus network.
- Supports up to 255 public Modbus devices per gateway and/or Modbus network. Both standard, (1-247), and reserved, (248-255), device IDs are supported.
- All Modbus devices not configured remotely are assumed to be locally connected to the gateway.
- The locations of all local Modbus devices are determined automatically.
- Modbus Device ID Aliasing. Modbus message device ID can be *aliased* when messages are received from a Modbus master.
- Device ID Offset. At the serial port interface, device IDs can have a positive or negative offset applied to change the device ID range.
- Supports up to 96 Modbus/TCP connections. This can include any combination of slave and master connections.
- Modbus/RTU and Modbus/ASCII over Ethernet TCP/IP Master specific:
 - Can support up to six TCP/IP connections per serial port configuration.
 - All messages received from any Ethernet TCP/IP Master connection enter the routing functionality and can be routed to any local or remote device.
 - Combined with a serial port redirector, such as the Pepperl+Fuchs Control Secure Port Redirector, can provide COM port functionality from a computer to the Modbus network.
- Supports connectivity to private Modbus serial buses, such as a serial master and slave(s) on a RS-485 loop:
 - The Modbus master is provided connectivity to the public Modbus network.
 - Only the master has direct access to the serial devices on the private serial network.
 - Private slaves are protected from intrusion by other master(s).
 - Both slave device specific and port level diagnostics are provided for private network communication.
- Advanced Master-to-Master connectivity is provided via the Shared Memory sub-system. Features are:
 - Eight Holding Register blocks containing 200 registers each.
 - Eight Coil blocks containing 160 coils each.
 - Read access to all master(s) on the Modbus network.

- Block-specific configurable write-access control. For each block, writes can be enabled for all master(s) or restricted to a specific serial, Modbus/TCP, or Ethernet TCP/IP master.
- Web pages provide configuration, diagnostics, display of block contents and shared memory clearing capabilities.
- Modbus specific message handling:
 - CRC verification of all messages received on the TCP/IP and serial Modbus/RTU interfaces.
 - LRC verification of all messages received on the TCP/IP and serial Modbus/ASCII messages.
 - Timing out of responses from slave Modbus devices.
 - Transfer ID verification of all remote Modbus/TCP messages.
 - Parameter checking of all slave responses.
 - Broadcast message handling.
- System monitoring to ensure gateway operation:
 - Gateway busy.
 - Application message time-outs
 - Message validity checking.
- Advanced diagnostics web pages:
 - Modbus device specific statistics, response timing, and status. Up to 255 Modbus devices, both attached and remote, can be monitored simultaneously.
 - Modbus/TCP diagnostics, connection(s) status, error messages
 - Serial port specific statistics and status.
 - Serial port message logging.



Supported Connectivity includes:

Modbus Router Connectivity Grid		Masters				
		Modbus/TCP Master	Modbus/RTU Serial Master	Modbus/ASCII Serial Master	Modbus/RTU Master over Ethernet TCP/IP	Modbus/ASCII Master over Ethernet TCP/IP
Slave Devices	Modbus/TCP Slave (remote gateway or slave Modbus/TCP device)	X	X	X	X	X
	Local Public Modbus/RTU Serial Slave	X	X	X	X	X
	Local Public Modbus/ASCII Serial Slave	X	X	X	X	X
	Remote Modbus/RTU Serial Slave (via remote gateway)	X	X	X	X	X
	Remote Modbus/ASCII Serial Slave (via remote gateway)	X	X	X	X	X
	Local Private Modbus/RTU Serial Slave		X			
	Local Private Modbus/ASCII Serial Slave			X		



Note: A total of up to 255 public slave devices can be supported per gateway and/or Modbus network. This can be any combination of Modbus/RTU or Modbus/ASCII serial and/or Modbus/TCP devices.

1.5. Multiple Gateway Modbus Networks

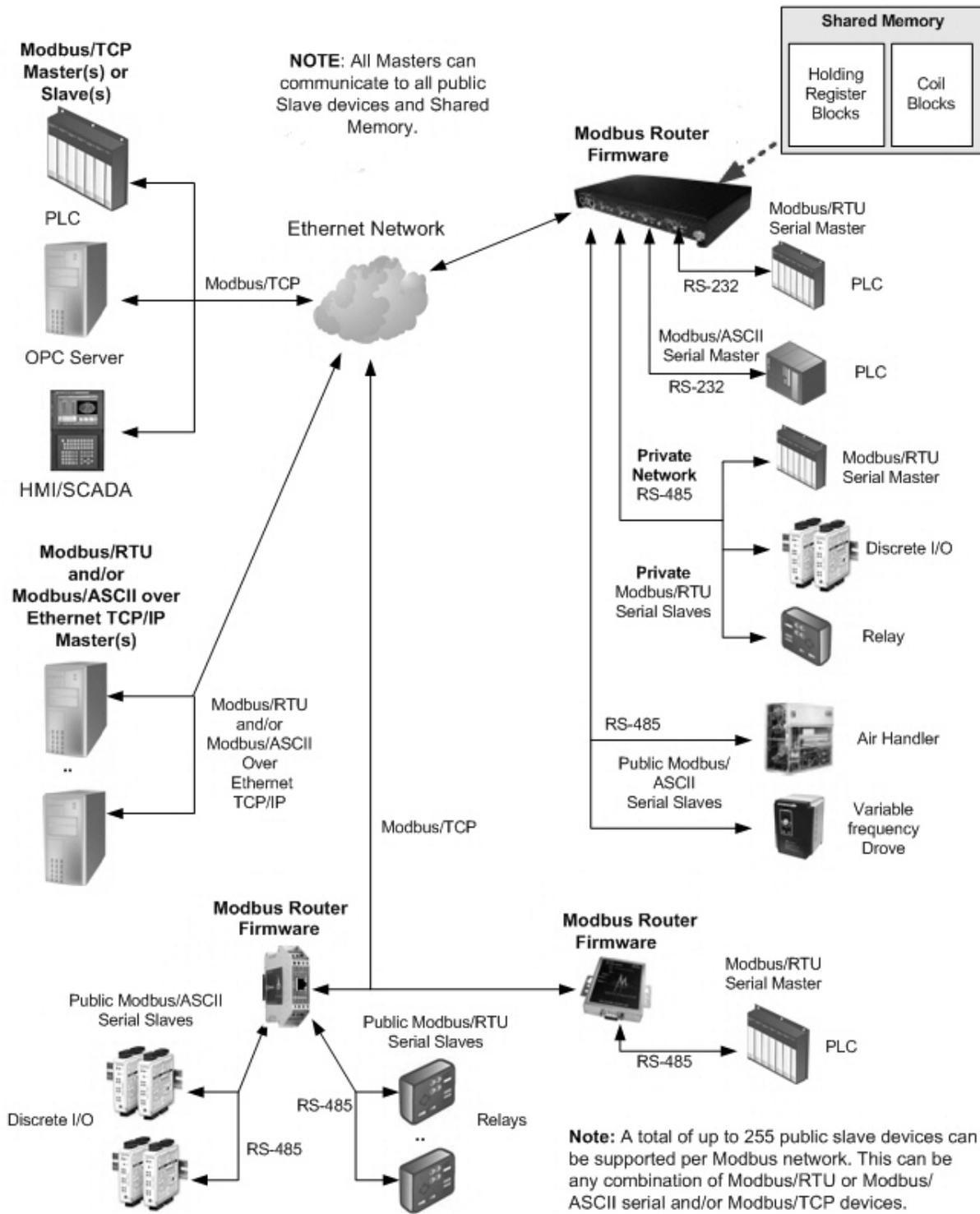
A multiple gateway Modbus Network is created by combining two or more Modbus slave(s) and master(s) with two or more ICDM-RX/MODs running the Modbus Router and/or Modbus/TCP firmware applications.

- Typically, at least one chassis will be running the Modbus Router firmware application.
- The Modbus/TCP application can provide connectivity to local or remote serial and Ethernet TCP/IP Raw/ASCII devices such as barcode scanners, RFID readers, printers, vision systems, and weigh scales.
- All Modbus masters connected to a ICDM-RX/MOD running Modbus Router can communicate to all public slaves.

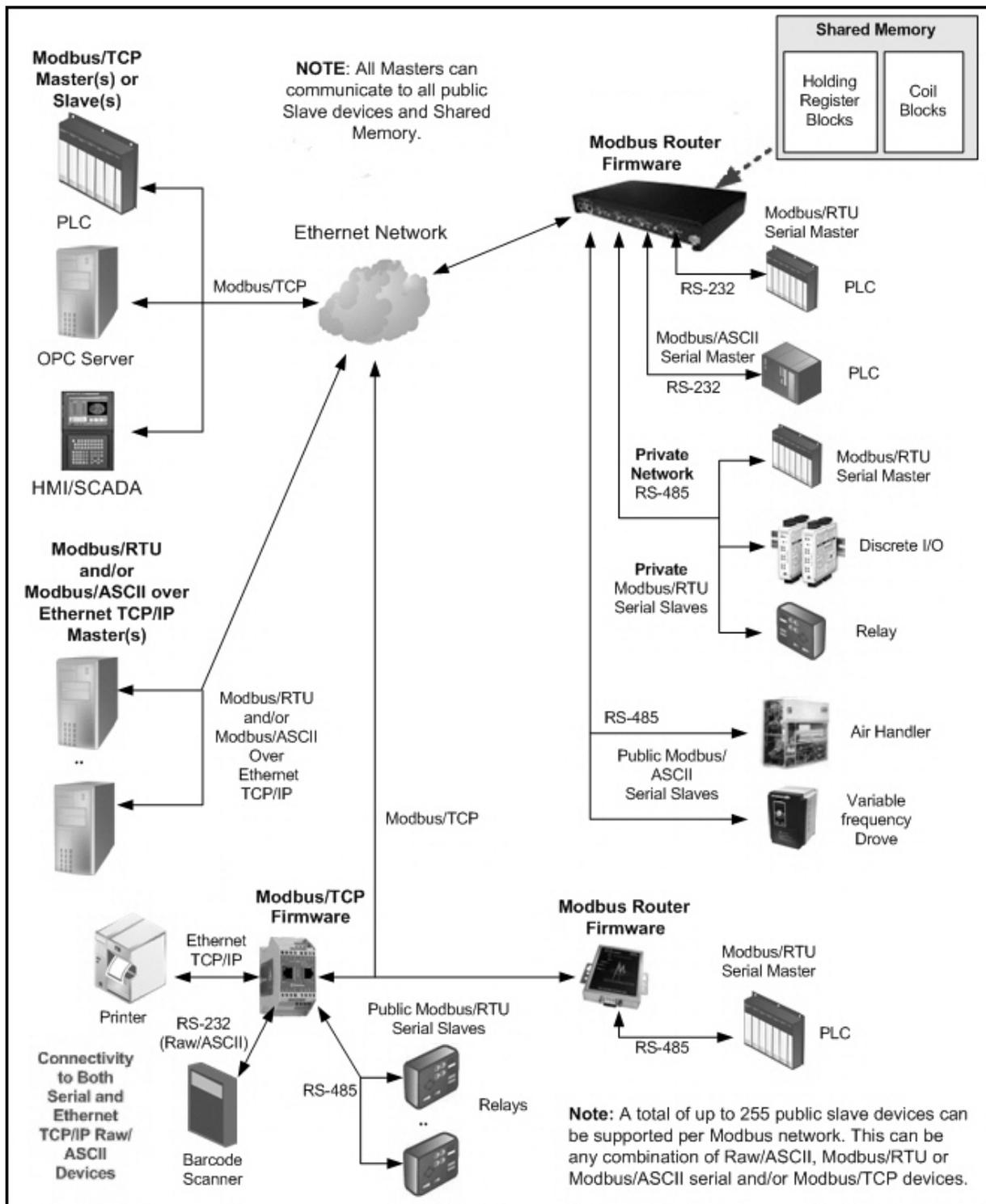
The following connectivity can be provided in a Modbus network when using multiple ICDM-RX/MOD chassis with Modbus Router and Modbus/TCP firmware applications:

Modbus Network Connectivity Grid		Masters				
		Modbus/TCP Master	Modbus/RTU Serial Master	Modbus/ASCII Serial Master	Modbus/RTU Master over Ethernet TCP/IP	Modbus/ASCII Master over Ethernet TCP/IP
Slave Devices	Modbus/TCP Slave (remote gateway or slave Modbus/TCP device)	X	X	X	X	X
	Local Public Modbus/RTU Serial Slave	X	X	X	X	X
	Local Public Modbus/ASCII Serial Slave	X	X	X	X	X
	Remote Modbus/RTU Serial Slave (via remote gateway)	X	X	X	X	X
	Remote Modbus/ASCII Serial Slave (via remote gateway)	X	X	X	X	X
	Serial Raw/ASCII Devices (remote or local)	X	X	X	X	X
	Ethernet TCP/IP Raw/ASCII Devices (remote or local)	X	X	X	X	X
	Local Private Modbus/RTU Serial Slave		X			
	Local Private Modbus/ASCII Serial Slave			X		

The following diagram demonstrates a multiple gateway Modbus network utilizing Modbus Router firmware.



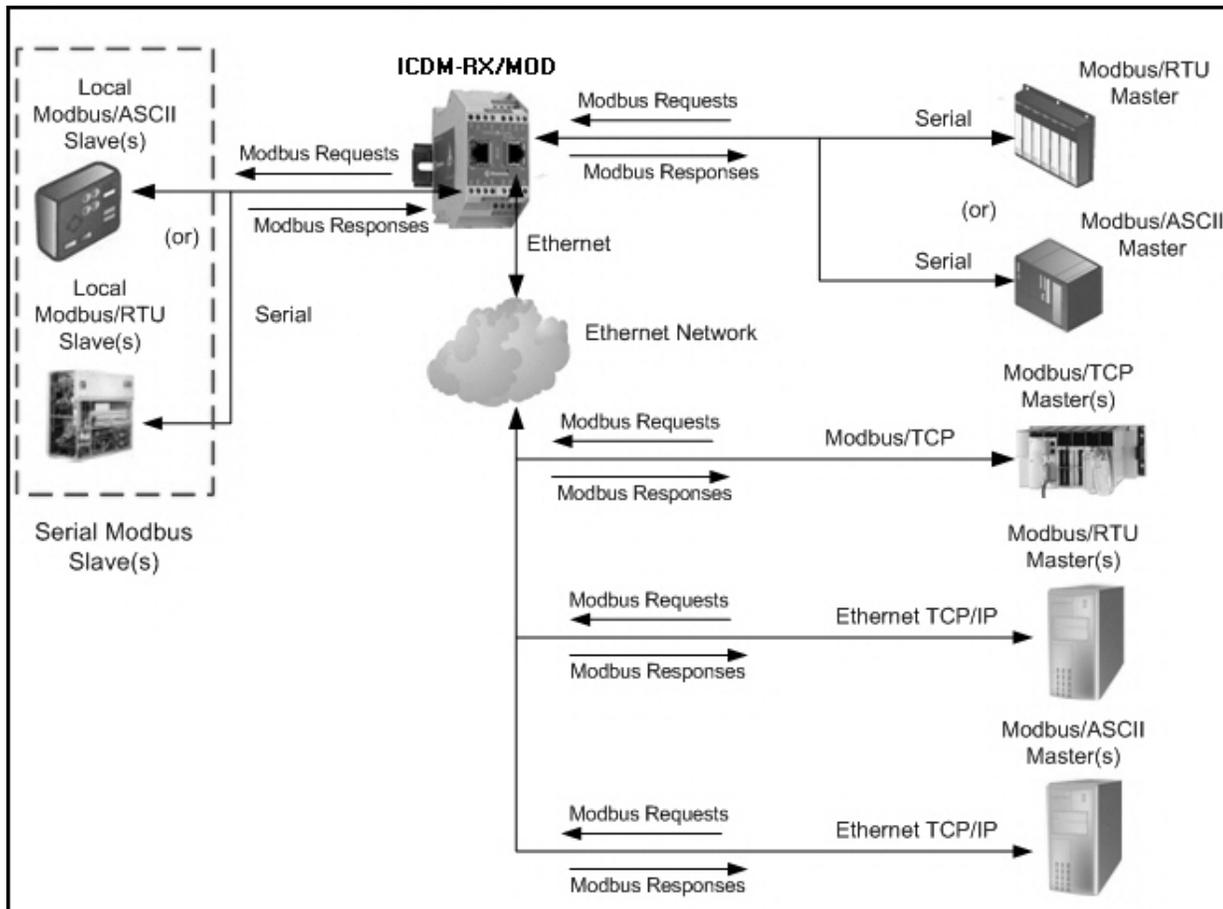
The following diagram demonstrates a multiple gateway Modbus network utilizing both Modbus Router and Modbus/TCP firmware.



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1.6. Modbus/RTU and Modbus/ASCII To-Slaves Interface

The ICDM-RX/MOD provides access to serial Modbus/RTU and Modbus/ASCII slave devices. Modbus master messages are translated to appropriate Modbus slave messages, public slave devices are automatically located, and appropriate responses are returned to the Modbus master.



Modbus Master(s) to Public Modbus Slave(s)

1.6.1. Communication Methodology

The ICDM-RX/MOD translates various Modbus formats and forwards them to public slave devices attached to the Modbus To-Slaves configured serial ports. Each Modbus message is transmitted and a response is expected. The ICDM-RX/MOD times out the Modbus messages if there is no response returned within the configured timeout period.

The following diagram displays the Modbus message transfer. The following apply to Modbus To-slaves serial ports.

- All valid Modbus messages are translated to the appropriate format for serial port or Modbus/TCP transmission.
- Local public Modbus slave devices are automatically located on a ICDM-RX/MOD 2-port or 4- port.
- Local and remote public Modbus slave devices can be accessed from a Modbus master as if they were of that master's protocol type.
- Messages are timed out if no response is returned within the configured timeout period.

- Appropriate Modbus responses are returned to the Modbus master.
- Broadcast Modbus messages, those with a unit identifier of zero, are transmitted out all Modbus To-slaves serial ports on the ICDM-RX/MOD. Depending on the remote device configuration(s), remote slave devices may or may not receive broadcast messages.

From a message routing standpoint, all local and remote public Modbus slave devices attached to a ICDM-RX/MOD gateway (1, 2, or 4-port) must be addressed with unique Unit Identifiers. Valid Unit Identifiers are 1 to 255 and the Broadcast Identifier is zero. However, the Device ID Offset functionality can be configured to change the addressing of serial connected slave devices to allow multiple slave devices with the same unit ID to be connected to the same gateway, but addressed differently. For more information, see section on Alias and Device ID Offset functionality.

To communicate to local Modbus slave device(s) through a ICDM-RX/MOD, perform the following steps.

1. Select the **Serial** menu and then select the appropriate port.
2. Under *Serial Configuration*, configure the serial port parameters such as the **Mode**, **Baud rate**, **Data Bits**, and so forth.
3. Under *Modbus Settings*, set the *Serial Port Protocol* to **Modbus/RTU-To-Slaves** or **Modbus/ASCII-To-Slaves**.
4. Under *Modbus Slaves To-Slaves Settings*, set the **Response Timeout** to the desired value.

Note: *2- and 4-Port only: Set the **Lost Device Search Enable** setting. See *Local Public Modbus Slave Device Search Methodology*.(below) for more information.*

5. If desired, configure the **Device ID Offset Mode** and **Device ID Offset**.

To communicate to remote Modbus slave device(s) through a ICDM-RX/MOD, perform the following steps.

1. Select the **Modbus** menu and then the *Remote Modbus Configuration* page.
2. Click the **Add Remote Configuration** button.
3. Configure each remote device as needed and click **Save**.

To enable the Alias Device ID capability for one or more device Ids, perform the following steps.

1. Select the **Modbus** menu and then the *Alias Configuration* page.
2. Click the **Add Alias Configuration** button.
3. Configure each alias device ID as needed and click **Save**.

1.6.2. Local Public Modbus Slave Device Search Methodology

Locating a local Modbus slave device on a ICDM-RX/MOD 1-port is relatively simple. Either the Modbus slave device is connected to the port or it is not. However, if more than one port is configured for Modbus To-Slaves on a ICDM-RX/MOD 2- or 4-port, the device must be found. The following is an explanation of how the search algorithm works on a ICDM-RX/MOD 2- or 4-port.

Locating a Local Modbus slave device after a reboot or port reset: When the ICDM-RX/MOD receives a message for a public Modbus slave device for the first time since reboot or port initialization, it will transmit the Modbus message out all Modbus To-Slaves serial ports and wait for a response to be returned. Once the response is returned, the device port is known and all messages sent to the device will be routed through the serial port.

Lost Devices: Lost devices, or devices that time out, are a special case. The ICDM-RX/MOD provides two methods for handling lost devices via the **Lost Device Search Enable** option on the web page.

- Disabling this option on a Modbus To-Slaves port:
 - Prevents the ICDM-RX/MOD from searching for a lost device on other Modbus To-Slaves ports.
 - Prevents lost devices known to have been on other ports from being searched for on this port.

Note: *This is the recommended setting whenever it is desired to prevent timeout delays on other Modbus To-Slaves ports in the event that a device times out.*

- Enabling this option on a Modbus To-Slaves port:

- Allows the ICDM-RX/MOD to search for lost devices on all Modbus To-Slaves ports with the **Lost Device Search Enable** option turned on.
- This will cause timeout delays on all Modbus To-Slaves ports with the **Device Search Enable** option turned on until the device is found.

Note: *This can be useful for locating devices if a device has been moved onto another port by moving the serial cable or, perhaps, by moving the device onto a different Modbus To-Slaves serial bus.*

1.7. Alias Device ID and Device ID Offset Functionality

One of the most common challenges people face when setting up Modbus systems are the problems caused by the limited device ID range. The Alias Device ID and Device ID Offset functionality have been developed to help solve those problems.

The Modbus specification has the following limitations:

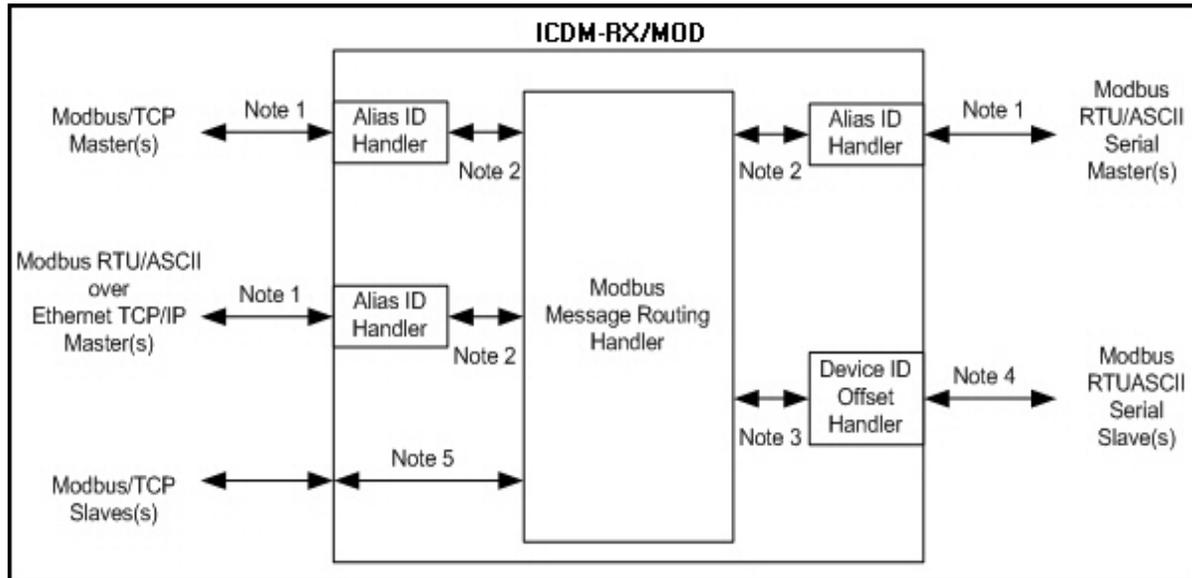
- Requires all public devices attached to gateway to be addressed by a device ID.
- Allows only 256 device IDs with a range of 0 to 255.
- Not all device IDs can be used for addressing devices.
 - Device ID 0 is reserved for broadcast messages
 - 1-247 are for device addressing
 - 248 to 255 are reserved for such things as gateway functions. Depending on your environment, these device IDs may or may not be available for assignment to devices.

The following are common problems that can occur as a result of the device ID limitations:

- A gateway must route Modbus messages based on the device ID. Therefore, it cannot route to multiple Modbus devices with the same device ID.
- It is not always possible or practical to change the device ID of serial Modbus slave devices.
- Serial and Ethernet TCP/IP Modbus RTU/ASCII masters with one connection may need to access multiple devices with the same device ID. Furthermore, these devices may be located locally or remotely.
- It is not always possible or practical to modify the device IDs on existing Modbus master programs. This is often true when adding a SCADA system to an existing PLC controlled system.

The Alias Modbus Device ID and Device ID Offset functionality has been developed to solve these problems.

This functionality is described in the following diagram:



Alias Device ID and Device ID Functionality

- Note 1:**Originally received Modbus messages. All responses will be returned with the original device ID.
- Note 2:**Modbus messages sent to and responses received from Modbus Message Routing Handler. Depending on the Alias ID configuration, these messages may contain the originally received device ID or the alias device ID.
- Note 3:**Modbus messages received from the Modbus Message Routing Handler. Depending on the Alias ID configuration, these messages may contain the originally received device ID from the Modbus master or the alias device ID. All responses contain the device ID as received from the Modbus Message Routing Handler.
- Note 4:**Modbus messages sent to Modbus serial slaves. Depending on the Device ID Offset configuration for the serial port, these messages may be the same as those received from the Modbus Message Routing Handler or have a device ID that has been either incremented or decremented to match the serial device ID range.
- Note 5:**Modbus messages received from the Modbus Message Routing Handler. Depending on the Alias ID configuration, these messages may contain the originally received device ID from the Modbus master or the alias device ID. Device ID Offset functionality does not apply to Modbus/TCP slaves.

1.7.1. Alias Modbus Device ID Functionality

The Alias Modbus Device ID functionality allows modification of device IDs only when messages are received from Modbus masters. When configured, a Modbus message from a master with the specified device ID is converted to the alias device ID, the message is then routed internally using the alias device ID. All responses are returned to the master with the original received message device ID.

The following table demonstrates several device ID aliasing examples:

Received Device ID	Alias Device ID	Routed Message Device ID	Description
1	10	10	Convert messages with received device ID 1 to 10. Route message with device ID 10.
50	5	5	Convert messages with received device ID 50 to 5. Route message with device ID 5.
100	254	254	Convert messages with received device ID 100 to 254. Route message with device ID 254.
10	10	10	Invalid configuration attempt. No change to device ID is performed.

1.7.2. Device ID Offset Functionality

The Device ID Offset functionality allows modification of device IDs when messages are transmitted to serial Modbus slave devices. When configured, the Device ID Offset functionality will modify the device ID received in the message to match the actual device ID range of the serial device(s). The device ID range is effectively either increased or decreased depending on the serial port Device ID Offset configuration.

The following table demonstrates several Device ID Offset examples:

Device ID Offset Mode	Device ID Offset	Valid Message Device ID Range	Valid Serial Device ID Range	Description
Off	0	1-255	1-255	Default mode. Device IDs are unchanged.
Add-to-Msg-ID	50	1-205	51-255	Increase device ID range by 50. <i>Examples:</i> Device ID 1 is converted to 51 Device ID 10 is converted to 60 Device ID 120 is converted to 170
Subtract-from-Msg-ID	100	101-255	1-155	Decrease device ID range by 100. <i>Examples:</i> Device ID 101 is converted to 1 Device ID 150 is converted to 50 Device ID 225 is converted to 125

It is highly recommended to take great care when configuring the Device ID Offset functionality. Verify the following when configuring the Device ID Offset:

- Check for Device ID overlaps. Be certain that no two devices can have same device ID as recognized by the internal Modbus Message Routing Handler.
- Check for conflicts with the Alias device ID configuration. The Device ID Offset configuration must coincide with any Alias device ID configurations.

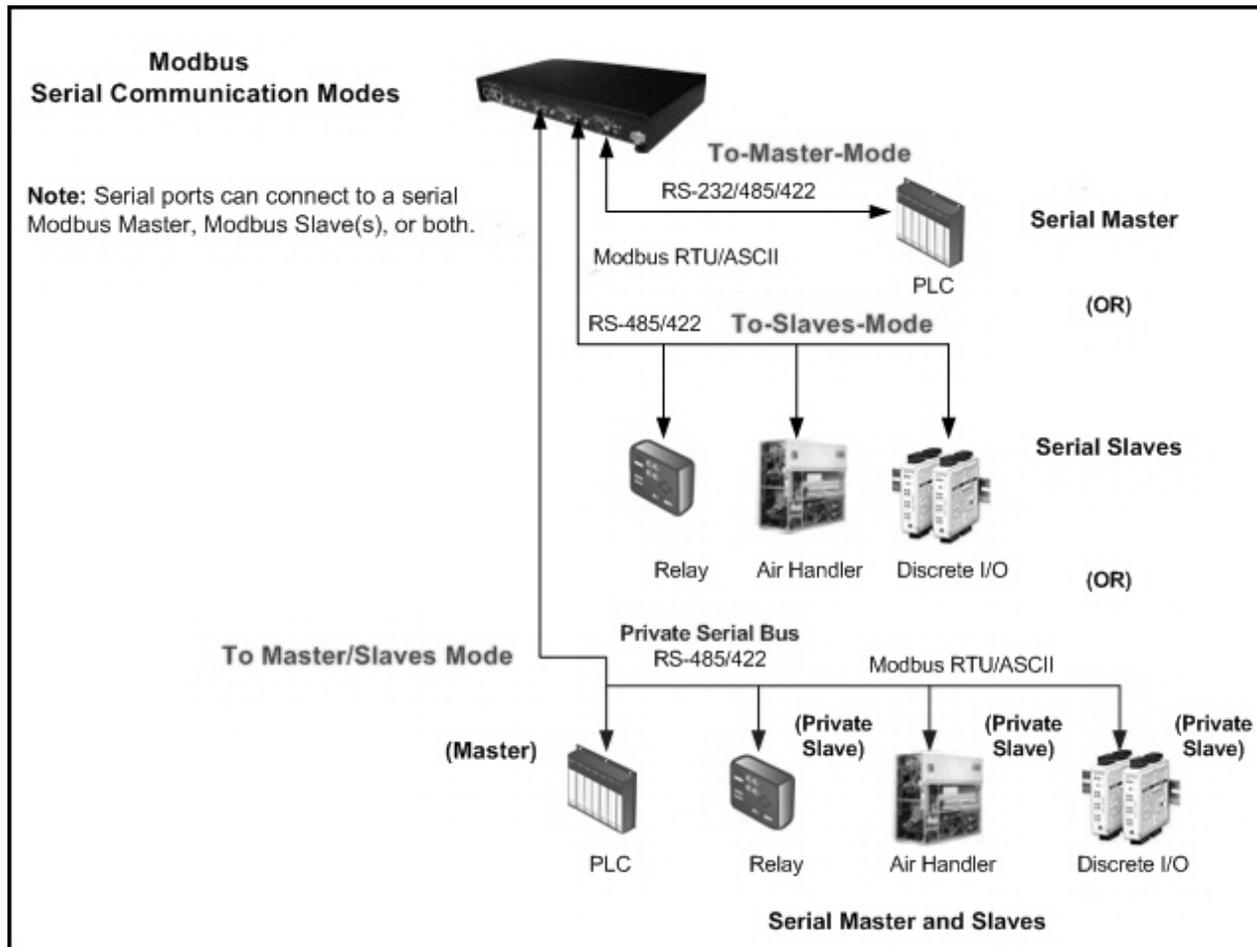
- Verify the valid device ID ranges are sufficient to address all serial devices.

1.8. Modbus Master/Slaves Serial Port Mode (Private Serial Bus)

As of Modbus Router v5.10, Modbus masters and slave(s) can be connected together on the same serial port. This provides the following benefits:

1. A serial Modbus master can communicate to slaves on its' own private serial bus as well as public slaves on a Modbus network. In this configuration, a serial master can communicate to:
 - a. Modbus RTU/ASCII slave(s) on its own serial bus.
 - b. Public Modbus RTU/ASCII serial slave(s) connected to the same ICDM-RX/MOD.
 - c. Modbus/TCP slaves.
 - d. Remote public Modbus RTU/ASCII serial slave(s) via an Ethernet attached Modbus gateway.
 - e. All other Modbus master(s) on the Modbus network via the Shared Memory functionality.
2. The Modbus slaves on the serial bus are *private* to the master on that serial bus.
 - a. The slave device(s) are affectively protected from all other Modbus masters on the Modbus network.
 - b. The master has total control of communication to the slaves on its own serial bus.
 - c. The master can provide data to/from the slave(s) to the Modbus network, and other Modbus masters, via the Shared Memory functionality.
3. Deployment can be greatly simplified.
 - a. An existing serial bus can be left intact, thusly reducing the rewiring effort.
 - b. The only wiring change is to attach the ICDM-RX/MOD to the bus anywhere there is access.
4. The system can be more fault-tolerant.
 - a. In the event the ICDM-RX/MOD is powered off, the master and slaves on the serial bus can still communicate.
 - b. By preventing other masters from communicating to the slave devices on the serial bus:
 - Other masters cannot cause disruptions in communications between the master and slaves on the serial bus by overloading the gateway.
 - Message latency time between the master and slaves is minimized.
5. Maintenance and downtime costs can be minimized with detailed diagnostics web pages provided by the ICDM-RX/MOD.

The following diagram demonstrates the To-Master/Slaves mode compared to the To-Master and To-Slaves modes.



1.8.1. Master/Slaves Message Routing

On a serial port configured to Master/Slaves, only the master on the private serial bus has access to the serial slaves on that serial bus. However, the master can also communicate to public devices and shared memory anywhere on the Modbus network.

The *Serial Interface Configuration* web page contains two configuration settings that determine how the serial bus routing is controlled.

1.8.1.1. Forward Broadcasts From Master Option

If this option is selected, all broadcast messages received on this port will be forwarded to the Modbus network. If this option is not selected, all broadcast messages received on this serial port will be dropped and only the private slave devices will receive them.

Note: Make sure that broadcasts should be forwarded before selecting this option. If this option is selected, all public slave devices on the local Modbus network will receive the broadcast messages and that may cause unpredictable results.

1.8.1.2. Private Device ID Range Setting

This range defines the expected private slave device ID range on the serial bus.

- Modbus request messages received on this port that are within this device ID range will not be forwarded to the Modbus network.
- All communication to device(s) in that range must occur between the Modbus master and slave(s) on that serial bus.
- The private device ID range must not include public device(s) addressed by the serial master. Loss of communication errors will result if this occurs. It is recommended to use either the Alias and/or the Device ID Offset functionality to address those cases where a public device ID falls into the private device ID range.
- All received Modbus request messages that are not within the private device ID range or have been previously detected on the serial bus, will be forwarded to the Modbus network via the ICDM-RX/MOD.
- Responses, including error messages such as timeouts, received from the Modbus network will be forwarded to the serial master.
- The ICDM-RX/MOD has a built-in auto-detect algorithm for detecting private slave device(s) with ID(s) not defined within the private device ID range. If a response from such a device is received on the serial bus, the ICDM-RX/MOD will add that device ID to the private device list and will no longer route those messages to the Modbus network.

Note: *There is a potential race condition if a slave device ID is not within the private device ID range and exists both as a public device on the Modbus network and as a private device on the serial bus. If this situation occurs and the public device responds before the private serial device, the master would receive two responses for that request, with the first response coming from the public device. If the public and private device responded at the same time, the Modbus master could detect a corrupted response. However, once the private slave device responds with a valid response, the auto-detect algorithm will prevent forwarding of additional requests to the Modbus network.*

1.9. Shared Memory Functionality

The Shared Memory functionality has been added to provide a simple and robust method for master-to-master communication.

- The Shared Memory interface contains eight 200 Holding Register blocks and eight 160 Coil blocks.
- All Modbus masters, (Modbus/TCP, serial Modbus RTU/ASCII, and Modbus RTU/ASCII over Ethernet TCP/IP), can read the contents of the Shared Memory blocks.
- Write access can be controlled to each Holding Register and Coil block. Each block can be configured to provide all masters write access or be restricted to a port-specific serial master, a Modbus/TCP master or an Ethernet TCP/IP master.
- The Shared Memory contents can be displayed and cleared via the embedded web pages.
- Diagnostics for each block include read, write and blocked write message counts.
- Blocked write messages are recorded in the *Write Violation Log*.

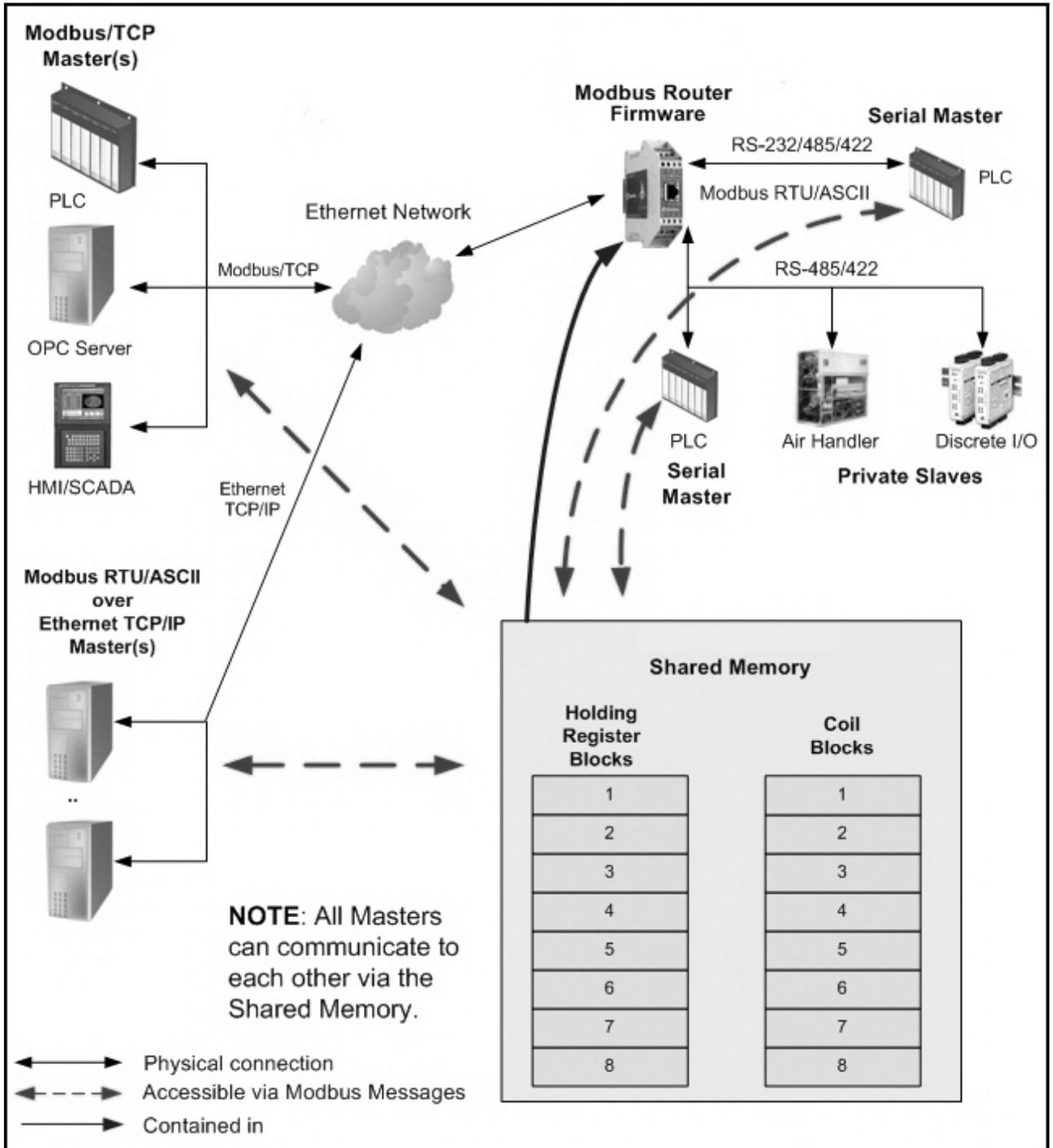
This table displays the supported Holding Register Block Function Codes.

Function Code	Description
3	Read Holding Registers
6	Write Single Register
16	Write Multiple Registers
22	Write Mask Register
23	Read Write Registers



This table shows the supported Coil Block Function Codes.

Function Code	Description
1	Read Coils
5	Write Single Coil
15	Write Multiple Coils



Modbus Router Shared Memory Functionality

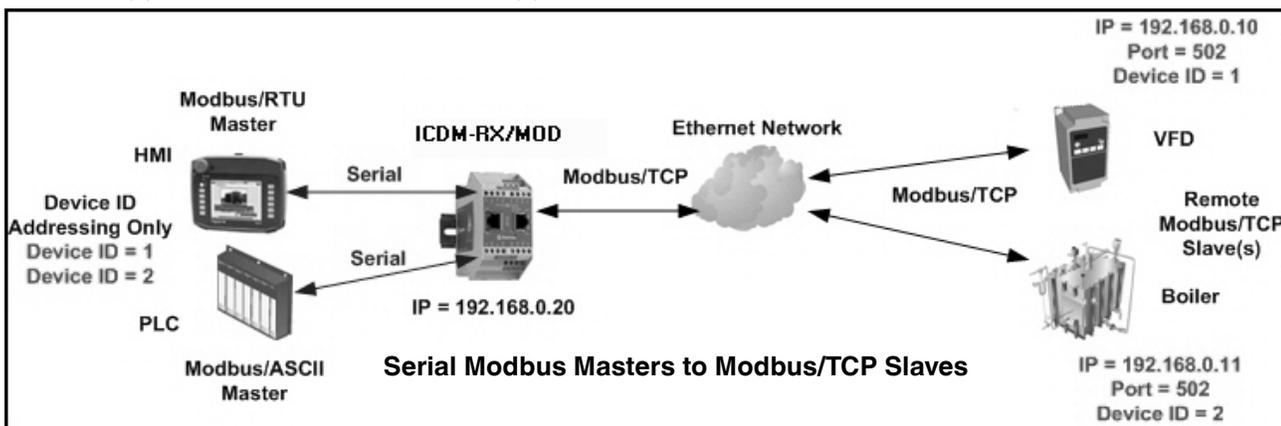


1.10. Remote Modbus Routing Capabilities

The Modbus Router firmware provides a wide variety of routing options. Combining those options for a specific installation requires proper configuration of the ICDM-RX/MOD and a thorough understanding of the Modbus master(s) and slave(s) communication capabilities and requirements.

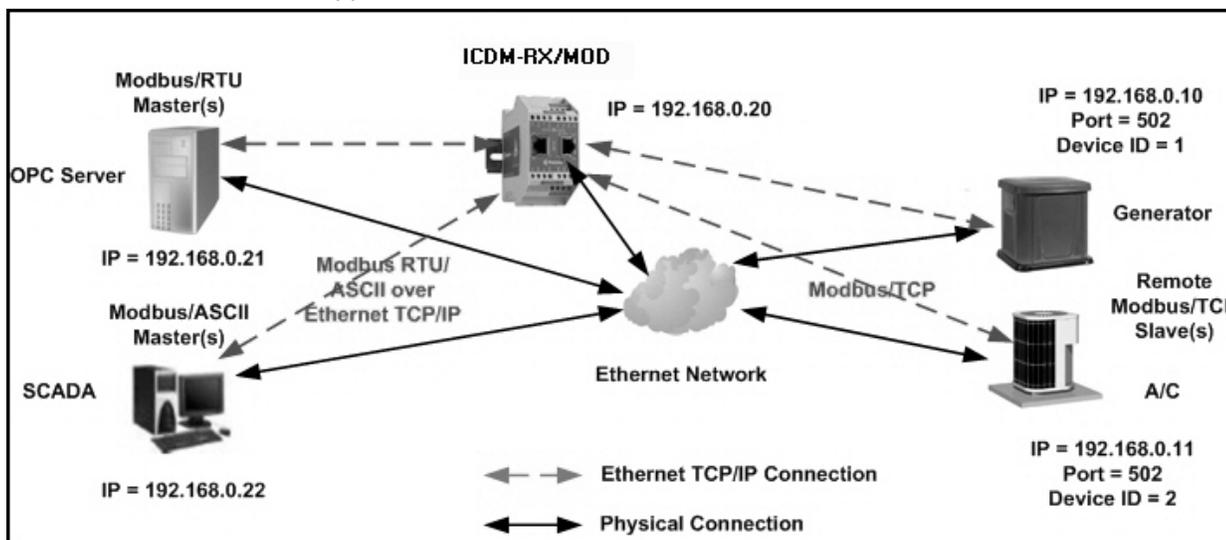
1.10.1. Serial Modbus Master(s) to Modbus/TCP Slave(s)

This routing configuration provides serial Modbus master(s) connectivity to Modbus/TCP slave(s). This is applicable when Modbus master(s) are limited to serial port connectivity and require connectivity to Modbus/TCP slave(s) or remote Modbus serial slave(s).



1.10.2. Modbus over Ethernet TCP/IP Master(s) to Modbus/TCP Slave(s)

The Modbus router application provides Modbus RTU/ASCII over Ethernet TCP/IP master(s) connectivity to Modbus/TCP slave(s). This is especially useful when deploying Modbus masters, such as many SCADA, HMI or OPC servers, that do not support Modbus/TCP.



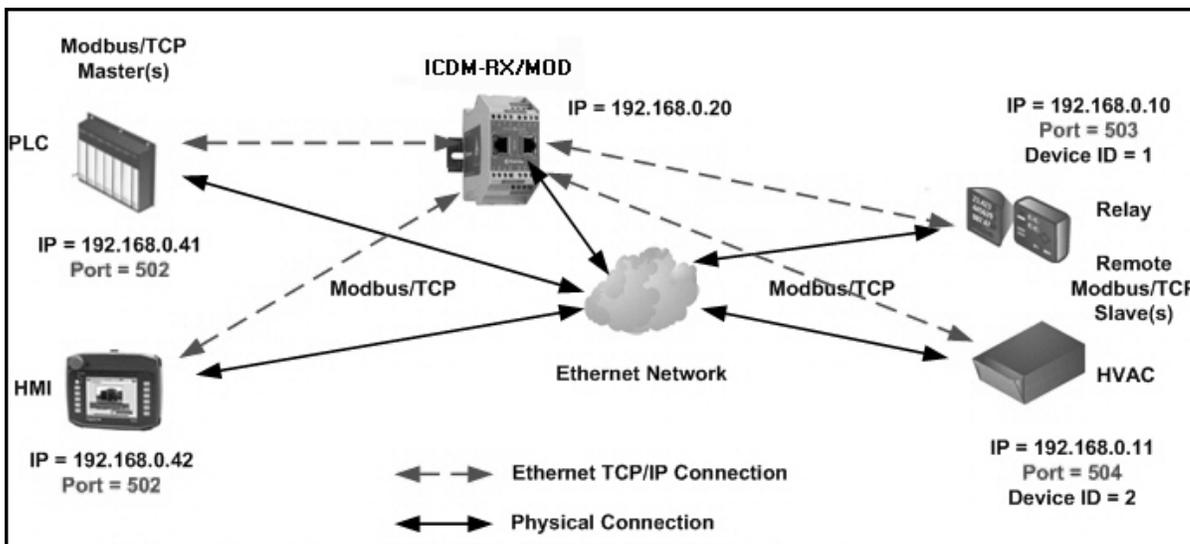
Modbus over Ethernet TCP/IP Masters to Modbus/TCP Slaves

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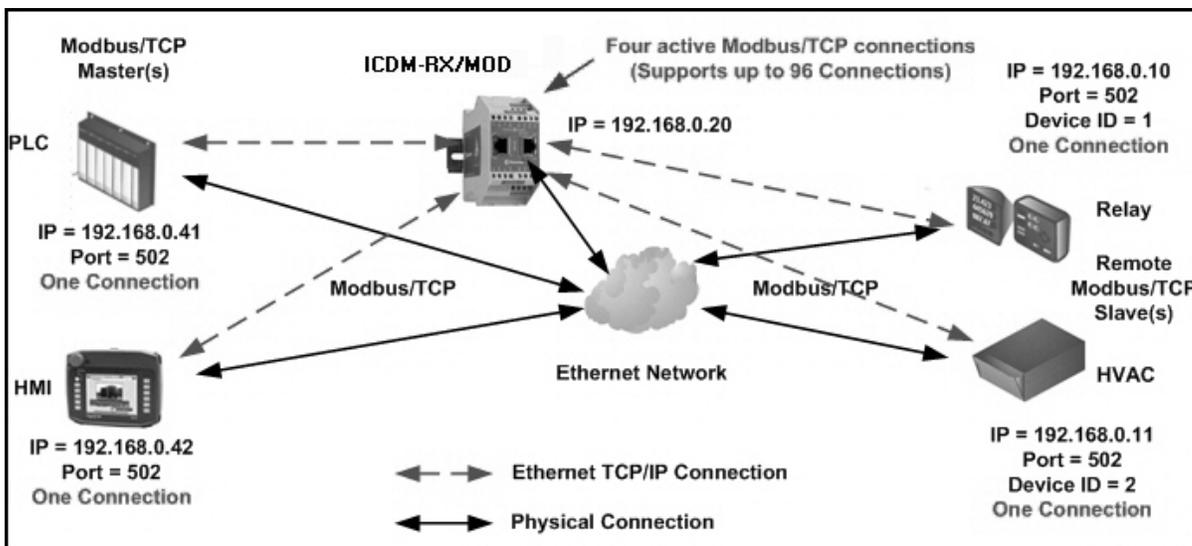
1.10.3. Modbus/TCP Master(s) to Modbus/TCP Slave(s)

This involves providing Modbus/TCP master(s) connectivity to Modbus/TCP slave(s). This is especially useful when:

- Modbus/TCP master(s), that can open only one or a very limited number of Modbus/TCP connections, requires connectivity to multiple Modbus/TCP slaves.
- Multiple Modbus/TCP masters require connectivity to Modbus/TCP slave(s) that can accept only one or a very limited number of Modbus/TCP connections.
- Modbus/TCP master(s), that can send messages only to the standard Modbus/TCP port of 502, require connectivity to Modbus/TCP slave(s) that accept messages on non-standard port(s), such as 503, 504, 505, or 506.



Modbus/TCP Masters to Modbus/TCP Slaves (with Non-Standard Ports)



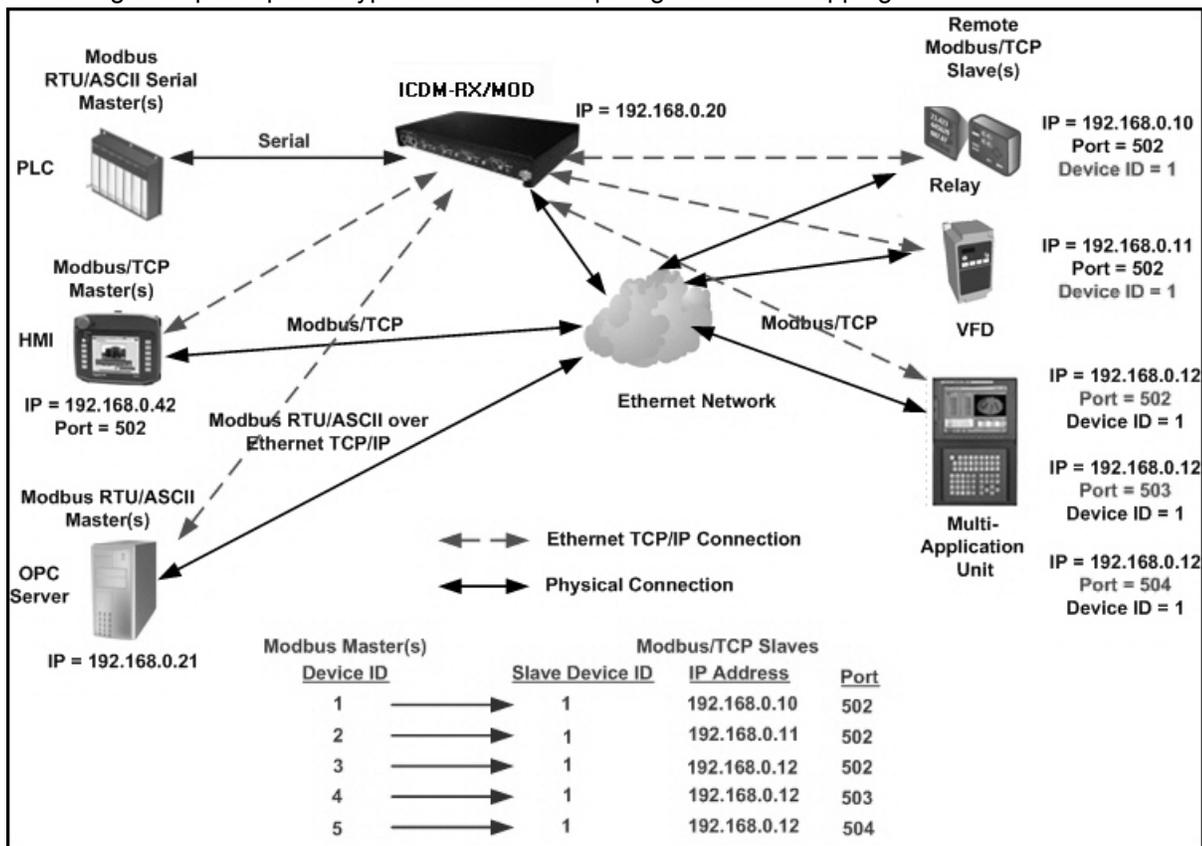
Modbus/TCP Masters to Modbus/TCP Slaves (Single Connection Devices)

1.10.4. Device ID Mapping to IP Address/Port/Slave Device IDs

Combining the Alias and Remote Modbus/TCP configurations can provide connectivity between Modbus master(s) that address slave(s) based on device ID(s) to Modbus/TCP slave(s) which require specific IP addresses, port numbers and/or alternate device ID(s). This is especially useful when:

- There are multiple Modbus/TCP slaves with the same device ID.
- A Modbus/TCP slave has multiple internal applications that are addressable through:
 - Different IP addresses, same port, same device ID
 - Different IP addresses, different ports, same device ID
 - Same IP address, different ports, same device ID

The following example depicts a typical installation requiring Device ID mapping:



Modbus Master Device ID to Slave Modbus/TCP Device Mapping Example

To implement this Device ID Mapping example, the following web page configuration entries are required on the *Modbus Alias Device ID Configuration* page, which is accessed by clicking **Modbus | Alias Configuration**.

Modbus Alias Device Id Configuration

[Add Alias Configuration](#)

Rx Device ID	Alias Device ID	Modbus/TCP Master	Modbus Serial Master	Modbus over TCP Master	Delete
2	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Delete All					<input type="checkbox"/>

[Save](#)

Where:

Parameter	Type	Description
Rx Device	Configuration (1-255)	The original, or pre-alias, device ID received from Modbus master(s). Required.
Alias Device ID	Configuration (1-255)	The corresponding slave device ID. Required.
Modbus/TCP Master	Configuration (yes/no)	Enables the Alias conversion from Modbus/TCP masters. <i>Must be enabled if Modbus/TCP master(s) are present.</i>
Modbus Serial Master	Configuration (yes/no)	Enables the Alias conversion from serial Modbus masters. <i>Must be enabled if serial Modbus master(s) are present.</i>
Modbus over TCP Master	Configuration (yes/no)	Enables the Alias conversion from Modbus over Ethernet TCP/IP masters. <i>Must be enabled if Modbus over Ethernet TCP/IP master(s) are present.</i>



Access the *Remote Modbus/TCP Device Configuration* page, by clicking **Modbus | Remote Modbus Configuration** and the following configuration entries are required.

Remote Modbus/TCP Device Configuration

[Add Remote Configuration](#)

Device ID	Remote IP Address	Remote Modbus/TCP Port	Timeout (ms)	Dedicated Connection	Send Writes First	Disable Broadcast Messages	Route on Pre-Alias Device ID	Delete
1	192.168.0.10	502	1000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	192.168.0.11	502	1000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	192.168.0.12	502	1000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	192.168.0.12	503	1000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	192.168.0.12	504	1000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Delete All

[Save](#)

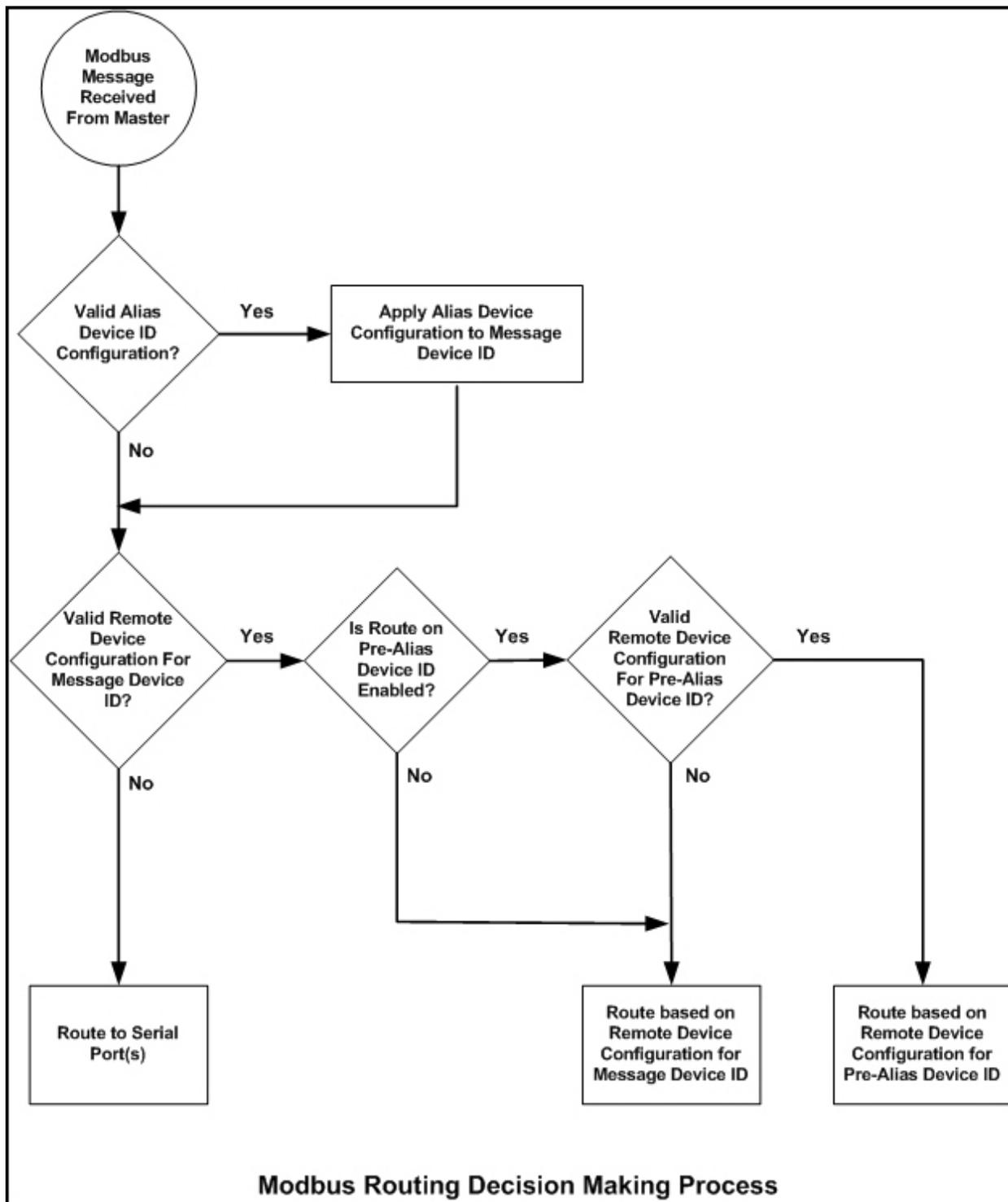
	Slave Device 1	Slave Device 2	Slave Device 3	Slave Device 4	Slave Device 5
Device ID (Can be pre-alias as received from master)	1	2	3	4	5
Message Device ID (can be aliased)	1(not aliased)	1	1	1	1
Remote IP Address	192.168.0.10	192.168.0.11	192.168.0.12	192.168.0.12	192.168.0.12
Remote IP Port	502	502	502	503	504
Timeout	1000 ms (configurable)				
Dedicated Connection	No (configurable)				
Send Writes First	No (configurable)				
Disable Broadcasts	No (configurable)				
Route on Pre-Alias Device ID	Yes (See note below)	No (N/A)	No (N/A)	No (N/A)	No (N/A)

If the following conditions are all met then the routing configuration for the pre-alias device ID will be applied to the message. This includes the Remote IP Address, Remote IP Port, Dedicated Connection, Send Writes First and Disable Broadcasts options.

1. The **Route on Pre-Alias Device ID** is enabled in the remote message device ID configuration in this example: device ID 1.
2. The message device ID has been aliased, or changed from the original device ID.
3. There is a valid remote device configuration entry for the original, or pre-alias, device ID.



The routing decision making process is depicted in the following diagram:



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2. Configuration Overview

This section provides an overview of how to configure the ICDM-RX/MOD and discusses the *Home* page.

2.1. Prerequisites

Before you can configure Modbus Router on the ICDM-RX/MOD, you must have previously performed the following steps:

- Installed the hardware.
- Installed PortVision DX.
- Configured the ICDM-RX/MOD IP address using PortVision DX.

Note: *If necessary, refer to the ICDM-RX/MOD Hardware Installation and Configuration Guide for the above procedures.*

2.2. Configuration Overview

The following overview shows how to access the ICDM-RX/MOD Router Configuration embedded web pages.

If you have not configured the network information into the ICDM-RX/MOD during initial setup, you must configure the network information before configuring serial/socket port characteristics. See the PortVision DX help system for help configuring the network settings.

1. From PortVision DX, highlight the ICDM-RX/MOD that you want to configure and select **Webpage**.

Note: *Optionally, enter the IP address of the device in the Address box of your web browser.*

2. Select the appropriate procedure for your environment.

Serial Modbus Master, Slave, or Master/Slaves

- a. Click the **Serial** tab, which defaults to the **Serial Port Overview** page.
- b. Click the port that you want to configure.
- c. Change and save the serial port configuration properties as required for your installation.

Ethernet TCP/IP Modbus Master

- a. Click the **Modbus** tab, which displays the *Modbus over TCP Overview (not Modbus/TCP)* page.
- b. Click the socket that you want to configure.
- c. Change and save the Ethernet TCP/IP configuration properties as required for the interface.

Modbus/TCP Device

- a. Click the **Modbus** tab, which displays the *Modbus over TCP Overview (not Modbus/TCP)* page.
- b. Click the *Modbus/TCP Configuration* sub-menu.
- c. Change and save the Modbus/TCP configuration properties as required for the device.

Remote Modbus/TCP Device

- a. Click the **Modbus** tab, which displays the *Modbus over TCP Overview (not Modbus/TCP)* page.
- b. Click the *Remote Modbus/TCP Device Configuration* sub-menu.



- c. Update and save the remote Modbus/TCP configuration properties as required for the device.

Alias Modbus Device ID

- a. Click the **Modbus** tab, which displays the *Modbus over TCP Overview (not Modbus/TCP)* page.
- b. Click the *Alias Configuration* sub-menu.
- c. Click **Add Alias Configuration**.
- d. Configure and save the Alias Modbus Device IDs as required.

Shared Memory

- a. Click the **Modbus** tab, which displays the *Modbus over TCP Overview (not Modbus/TCP)* page.
- b. Click the *Shared Memory* sub-menu.
- c. Configure and save the Shared Memory blocks as required.

- 3. Remember to click **Save** to commit the changes and repeat for each interface that requires configuration.

Note: You may want to back up your ICDM-RX/MOD configuration using PortVision DX. Refer to the PortVision DX help system for information or the appropriate installation document.

2.3. Modbus Router Home

Access the ICDM-RX/MOD Modbus Router *Home* page from PortVision DX or enter the IP address of the ICDM-RX/MOD in the **Address** box of your web browser.

The *Home* page displays the software version and current network configuration for the ICDM-RX/MOD.

Modbus Router Home Page	
Firmware	Modbus Router firmware version currently running on the ICDM-RX/MOD.
Device Name	You can enter a Device Name in the <i>Network Configuration</i> page, which will display in this field.
Serial Number	The ICDM-RX/MOD serial number.
MAC Address	This is the MAC address of this ICDM-RX/MOD, which is located on the compliance label on the ICDM-RX/MOD.
System Uptime	Displays how long this ICDM-RX/MOD has been on-line since powered on or rebooted.
IP Config	Type of IP configuration currently in use (static or DHCP).
IP Address, IP Netmask, IP Gateway	IP address, netmask, and gateway configured in the ICDM-RX/MOD.

3. Serial Menus

This section discusses the Serial Port Overview Page and Serial Port Configuration Page on Page 35, which are located under the **Serial** menu.

3.1. Serial Port Overview Page

The *Serial Port Overview* page displays information about the configured serial settings for each port.

Valid Rcvd Msg Device ID Range (1-255) – (1-255): Displays the valid received message device ID range. Messages with other valid device IDs will not be transmitted out this port. (Informational only.)

Valid On Port Device ID Range (1-255) – (1-255): Displays the valid device ID range for slave devices connected to the serial port. Slave devices with other device IDs will not be accessible on this port. (Informational only.)

For additional diagnostic information, see the Diagnostics Menu on Page 48.

3.2. Serial Port Configuration Page

To access the *Serial Port Configuration* page, click **Serial | Port x**.

The following tables provide information about serial configuration settings.

Serial Configuration Page	
Serial Configuration	
Port Name (Default = blank)	User-definable string used to describe the serial interface. Valid characters include a-z, A-Z, 0-9, underscores, spaces and dashes. All other characters are discarded. The Port Name supports up to an 80 character ASCII string.
Port Mode (Default = RS-232)	<p>All panel or rack mount models:</p> <ul style="list-style-type: none"> • RS-232 (default) • RS-485 • RS-422 <p>All DIN rail models:</p> <ul style="list-style-type: none"> • RS-232 (default) • RS-422 • RS-485_2-wire • RS-485_4-wire_Master • RS-485_4-wire_Slave
Baud Rate (Default = 38400)	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, and 230400

Serial Configuration Page (Continued)	
Parity (Default = None)	None Even Odd
Data Bits (Default = 8)	5, 6, 7, 8
Stop Bits (Default = 1)	1 or 2
Flow Control (Default = None)	RTS/CTS XON/XOFF Half Duplex
Terminating Resistor (Only displays on applicable models)	To ensure the best signal integrity on a long distance high-speed RS-422 or RS-485 network, sometimes it is required to place a 120Ω termination resistor between each of the transmit differential pair or receive differential pair. Signal reflection is reduced and a reliable communication is ensured by placing the 120Ω termination resistor. Using the software, you can place 120Ω termination resistors between the signals shown below: <ul style="list-style-type: none"> • RS-422 Mode <ul style="list-style-type: none"> - Between TxD+ and TxD- (Pin 5 and 7) - Between RxD+ and RxD- (Pin 4 and 2) • RS-485 - Between TxD/RxD+ and TxD/RxD- (Pin 5 and 7)
DTR Mode (Default = Off)	0=Off 1=On
Rx Timeout Between Packets (ms) (Default = 200)	Receive time-out (0-65535) between packets in msec. This is the maximum spacing between received bytes allowed before the received Modbus serial message is expected to be complete.
Discard Rx Packets With Errors (Default = On)	On or Off: If selected, the ICDM-RX/MOD drops all packets received with parity, framing, or overrun errors. Note: <i>Modbus/RTU messages with invalid CRCs and Modbus/ASCII messages without correct start and end of transmission characters are always discarded independent of this setting.</i>
Modbus Settings	
Serial Port Protocol (Default = Modbus/RTU-to-Slaves)	The Modbus Protocol, setting for this serial port: <ul style="list-style-type: none"> • Modbus/RTU-to-Slaves – Configures the serial port to communicate to Modbus/RTU slaves. • Modbus/ASCII-to-Slaves – Configures the serial port to communicate to Modbus/ASCII slaves. • Modbus/RTU-to-Master – Configures the serial port to communicate to a Modbus/RTU master. • Modbus/ASCII-to-Master – Configures the serial port to communicate to a Modbus/ASCII master. • Modbus/RTU-to-Master/Slaves – Configures the serial port to communicate to a serial bus with a Modbus/RTU master and Modbus/RTU slave(s). • Modbus/ASCII-to-Master/Slaves – Configures the serial port to communicate to a serial bus with a Modbus/ASCII master and Modbus/ASCII slaves.

Serial Configuration Page (Continued)	
Modbus To-Slaves Settings	
Response Timeout (Default = 1000 msec)	The maximum allowable time (0 to 65535 msec.) for a slave device to respond to a message before the message is considered timed out.
Lost Device Search Enable <i>Not supported: 1-port</i> (Default = Off)	If selected, lost devices that were on this port are searched for on other Modbus/RTU and Modbus/ASCII slave ports that also have this option set.
Inactivity Wait Time Before Tx (ms) (Default = 0 ms)	The minimum time (0 to 65535 msec.) that the ICDM-RX/MOD waits after receiving a response or transmitting a Modbus request before transmitting the next request.
Send Write Messages First (Default = Off)	If selected, it transmits any write messages before transmitting any read messages that may have already been queued for transmission.
Disable Writes (Read Only) (Default = Off)	If selected, it disables transmission of all standard Modbus write messages.
Device ID Offset Mode (Default = Off)	<ul style="list-style-type: none"> • Off disables Device ID Offset functionality. • Add-to-Msg-ID adds the Device Offset to the message device ID. • Subtract-from-Msg-ID subtracts the Device ID Offset from the message device ID.
Device ID Offset	<ul style="list-style-type: none"> • 0 = disables Device ID Offset functionality. • 1-254 = dependent on the Device ID Offset Mode, is added to or subtracted from the message device ID before the Modbus message is transmitted out the serial port.
Modbus To-Master Settings	
Discard Modbus Errors (Default = Off)	If selected, all broadcast messages from the serial master will be forwarded to the Modbus network through the ICDM-RX/MOD.
Modbus Master/Slave Settings	
Forward Broadcasts from Master (Default = Off)	If selected, all broadcast messages from the serial master will be forwarded to the Modbus network through the ICDM-RX/MOD.
Private Slave Device ID Range (Default: Min = 1, Max =1)	<p>This range (1-255) defines the expected slave device ID range on the serial bus. Modbus request messages received on this port within this device ID range will not be forwarded to the Modbus network.</p> <p>Note: <i>The ICDM-RX/MOD has a built-in auto-detect algorithm for detecting private slave device(s) with ID(s) not defined within the private device ID range.</i></p> <p>For a more complete discussion, refer to Modbus Master/Slaves Serial Port Mode (Private Serial Bus) on Page 21.</p> <p>Note: <i>The minimum value must be less than or equal to the maximum value.</i></p>

4. Modbus Menus

This section discusses the Modbus configuration pages:

- TCP/IP Configuration Pages on Page 38
- Modbus/TCP Configuration Page on Page 39
- Remote Modbus/TCP Device Configuration Page on Page 40
- Modbus Alias Device ID Configuration Page on Page 41
- Shared Memory Configuration Page on Page 41

4.1. TCP/IP Configuration Pages

This subsection discusses the Modbus over TCP Overview (not Modbus/TCP) Page and Modbus over TCP (not Modbus/TCP) Socket Configuration Page for the Ethernet TCP/IP interface.

Each Ethernet TCP/IP interface provides connectivity to either Modbus/RTU or Modbus/ASCII masters. All request messages received from the Ethernet TCP/IP interface are forwarded to the routing process which, in turn, forwards the messages to either local or remote Modbus slave devices.

Note: *The Ethernet TCP/IP interfaces are not directly tied to a serial port. All messages received over the Ethernet TCP/IP interface receive the same local and remote routing capabilities as messages received over the Modbus/TCP or serial Master interfaces.*

4.1.1. Modbus over TCP Overview (not Modbus/TCP) Page

Access the *Modbus over TCP Overview (not Modbus/TCP)* page by clicking **Modbus | TCP/IP Configuration** and the following page appears. This page provides an overview of the settings for each socket.

4.1.2. Modbus over TCP (not Modbus/TCP) Socket Configuration Page

Access the *Modbus over TCP (not Modbus/TCP Socket Configuration)* page by clicking **Modbus | TCP/IP Configuration | Socket x**. The following table provides information about each configuration setting.

Modbus over TCP (not Modbus/TCP) Socket Configuration Page	
TCP Configuration	
Connect To Mode	<ul style="list-style-type: none">• Modbus/RTU-to-Master – Configures the TCP/IP connection(s) to communicate to Modbus/RTU master(s).• Modbus/ASCII-to-Master – Configures the TCP/IP connection(s) to communicate to Modbus/ASCII master(s).
Enable (Default = Off)	If selected, this TCP/IP socket interface will be enabled.
Listen (Default = Off)	If selected, the TCP/IP socket interface will listen for a connection at the specified Listen Port .

Modbus over TCP (not Modbus/TCP) Socket Configuration Page (Continued)	
Listen Port (Defaults: Port 1=8000 Port 2=8001 Port 3=8002 Port 4=8003)	The Listen Port values are 1-65535. If Enable and Listen are both selected, allows acceptance of: <ul style="list-style-type: none"> Up to six connections from external applications if there is no active Connect-to connection. Up to five connections if there is an active Connect-to connection. Note: <i>The defined Modbus/TCP socket port of 502 will not be accepted as valid configuration data.</i>
Connect to Mode (Default = Never)	<ul style="list-style-type: none"> If Enable is selected, this setting determines how to connect to an application. If Never: Do not attempt to make a connection. If Connect-Always: Always attempt to maintain a connection to the application at Connect IP Address and Connect Port.
Connect Port (Default = 0)	Socket port to connect to (1 to 65535). Used in conjunction with Connect to Mode and Connect IP Address .
Connect IP Address (Default = 0)	IP Address of application to create a connection. Used in conjunction with Connect to Mode and Connect Port . Note: <i>The IP Address of this ICDM-RX/MOD will not be accepted as valid configuration data.</i>
Disconnect Mode (Default = Never)	Mode on which to disconnect from the application. <ul style="list-style-type: none"> Never – Will not disconnect when connection(s) are idle. Idle – Utilizes the Idle Timer to determine when to close the connection.
Idle Timer (Default = 0)	If the Disconnect Mode is set to Idle , the idle or inactivity time (1 to 65535 ms) when the connection(s) will be closed.
Rx Timeout Between Packets (Default = 100)	Receive timeout (0-65565) between packets in msec. This is the maximum spacing between received bytes allowed before the received Modbus message is expected to be complete.

4.2. Modbus/TCP Configuration Page

Access the *Modbus/TCP Interface Configuration* page by clicking **Modbus | Modbus/TCP Configuration**. The following table provides information about each configuration setting.

Modbus/TCP Configuration Page	
Modbus TCP/IP Port 1	
Enabled	Always enabled. Cannot be disabled.
TCP/IP Port	The standard Modbus TCP/IP port of 502. This port is always enabled.
Modbus TCP/IP Ports 2 to 16	
Enabled (Default: No)	If selected, the ICDM-RX/MOD will listen for Modbus/TCP requests on the configured TCP/IP port.

Modbus/TCP Configuration Page (Continued)	
TCP/IP Port Default Port 2 = 503 Default Port 3 = 505 Default Port 4 = 506 Default Port 5 = 507 Default Port 6 = 508 Default Port 7 = 509 Default Port 8 = 510	The specified TCP/IP port(1-65535) that the ICDM-RX/MOD will listen for Modbus/TCP requests on. Default ports are the first seven unassigned ports, as determined by the Internet Assigned Numbers Authority after the standard Modbus/TCP port of 502. Note: <i>TCP/IP ports 0, 22, 23, 80, 443, 4606 and 4607 are not allowed. Enabling TCP/IP ports other than the defaults may cause disruptions on your network. Please verify any configuration changes with your IT department.</i>

4.3. Remote Modbus/TCP Device Configuration Page

All Modbus devices not configured remotely are assumed to be local, or connected to this gateway. The location of all local Modbus devices is determined automatically. Access the *Remote Modbus/TCP Device Configuration* page by clicking **Modbus | Remote Modbus Configuration**. Click the **Add Remote Configuration** button to add additional remote devices.

The following table provides details about configuration options.

Remote Modbus/TCP Device Configuration Page	
Device ID #	The Device ID (also often called the unit ID) of the remote device must be unique. The Device ID range is 1-255. 0 means that it is not configured.
Remote IP Address	IP address of the Modbus/TCP device. All 0s means that it is not configured. Note: <i>The IP address of the ICDM-RX/MOD will not be accepted as valid configuration data.</i>
Remote Modbus/TCP Port (Default = 502)	The TCP/IP port (1-65535) to connect to on the remote device.
Timeout (ms) (Default = 1000 msec)	The maximum allowable time (0 to 65535 msec) for a slave device to respond to a message before the message is considered timed out.
Dedicated Connection (Default = Off)	If selected, a dedicated Modbus/TCP connection will be used to connect to this remote device. Note: <i>This is most commonly used when connecting to another gateway, multiple devices are being accessed, and maximum bandwidth is desired.</i>
Send Writes First (Default = Off)	If selected, will forward write messages before forwarding any pending read messages. Note: <i>This is most commonly used when multiple messages may be outstanding for the remote device(s) and low latency for write messages is desired.</i>
Disable Broadcast Messages (Default = Off)	If selected, will disable broadcasts to this remote device. Note: <i>If multiple remote devices are accessed through another gateway, then this option must be selected for all remote devices configured to that gateway to prevent broadcast messages from being sent to those devices.</i>

Remote Modbus/TCP Device Configuration Page (Continued)	
Route on Pre-Alias Device ID (Default = Off)	<p>This setting only applies to a Modbus message if the following two statements are true:</p> <ul style="list-style-type: none"> The Modbus message device ID has been aliased, or changed, as a result of a corresponding Alias Device ID configuration via the Modbus Alias Id Configuration page. A Remote Modbus/TCP Device configuration exists for the pre-aliased, or original, device ID. <p>If selected and all requirements are true, then the Remote Device ID configuration for the pre-aliased device ID will be applied to the Modbus message. This includes the IP address/port, timeout and control flags.</p>
Delete	If enabled, that Device ID or IDs are deleted when you click the Save button.

4.4. Modbus Alias Device ID Configuration Page

You can configure up to four alias device IDs at one time.

Access the *Modbus Alias Device ID Configuration* page by clicking **Modbus | Alias Configuration**.

The following configuration options apply:

Modbus Alias Device ID Configuration Page	
Rx Device ID	The device ID (also often called the unit ID) of the received message from a master. Device IDs range from 1 to 255.
Alias Device ID	The alias device ID to convert the received device ID to. Alias Device IDs range from 1 to 255.
Modbus/TCP Master (Default = Off)	If selected, this applies the alias device ID configuration to messages received from Modbus/TCP masters.
Modbus Serial Master (Default = Off)	If selected, this applies the alias device ID configuration to messages received from serial Modbus masters.
Modbus over TCP Master (Default = Off)	If selected, this applies the alias device ID configuration to messages received from Modbus RTU/ASCII over Ethernet TCP/IP masters.

4.5. Shared Memory Configuration Page

Access the *Shared Memory Configuration* page by clicking **Modbus | Shared Memory**.

The following table displays the supported **Holding Register Block** function codes.

Holding Register Block Function Codes	
3	Read Holding Registers
6	Write Single Register
16	Write Multiple Registers
22	Write Mask Register
23	Read Write Registers

This shows the supported **Coil Block** function codes.

Coil Block Function Codes	
1	Read Coils
5	Write Single Coil
15	Write Multiple Coils

The following table provides details about the configuration options. Click the **Display** button to view detailed information about a specific block or coil.

Shared Memory Configuration Page	
Enable Shared Memory (Default = Off)	If selected, enables the Shared Memory functionality.
Shared Memory Device ID (Default = 252)	The Device ID (also often called the unit ID) of the Shared Memory must be unique within the public Modbus network. The Device ID range is 1 to 255.
Holding Register Start Address (Base 1) (Default = 400001)	Specifies the starting address of the Shared Memory Holding Register blocks. The range is 400001 to 463935.
Coil Block Start Address (Base 1) (Default = 1)	Specifies the starting address of the Shared Memory Coil blocks. The range is 1 to 64255.
Shared Holding Registers	
Block	Specifies the block number.
Address Range	Specifies the block address range.
Accept Broadcast Messages (Default = No)	If selected, the Shared Memory block(s) will accept broadcast messages addressed to their memory block(s).
Write Master(s) (Default = All)	Indicates which master(s) have write access to the Shared Memory block. <ul style="list-style-type: none"> • All – All masters have write access to the block • Port specific serial master: <ul style="list-style-type: none"> - Port-1 - Port-2 (2-port and 4-port models only) - Port-3 (4-port models only) - Port-4 (4-port models only) • Ethernet based masters: <ul style="list-style-type: none"> - Modbus/TCP - Modbus/TCP master(s) at a specified IP address - Ethernet TCP/IP – Ethernet TCP/IP master(s) at a specified IP address
Serial Port / IP Address	IP address of the Modbus/TCP or Ethernet TCP/IP master. Zeros indicate that there is no configuration. Note: Does not apply to All or port-specific serial masters.
Description	User-defined description of the Shared Memory block. ASCII string with a maximum of 80 characters in length.
Shared Coils	
Block	Specifies the block number.
Coil Range	Specifies the coil range.

Shared Memory Configuration Page (Continued)	
Accept Broadcast Messages (Default = No)	If selected, the Shared Memory block(s) will accept broadcast messages addressed to their memory block(s).
Write Master(s) (Default = All)	<p>Indicates which master(s) have write access to the Shared Memory block.</p> <ul style="list-style-type: none"> • All – All masters have write access to the block • Port specific serial master: <ul style="list-style-type: none"> - Port-1 - Port-2 (2-port and 4-port models only) - Port-3 (4-port models only) - Port-4 (4-port models only) • Ethernet based masters: <ul style="list-style-type: none"> - Modbus/TCP - Modbus/TCP master(s) at a specified IP address - Ethernet TCP/IP – Ethernet TCP/IP master(s) at a specified IP address
Serial Port / IP Address	<p>IP address of the Modbus/TCP or Ethernet TCP/IP master. Zeros indicate that there is no configuration.</p> <p>Note: <i>Does not apply to All or port-specific serial masters.</i></p>
Description	User-defined description of the Shared Memory block. ASCII string with a maximum of 80 characters in length.



5. Network Menu

This section discusses the pages under the *Network* menu, which includes:

- Network Configuration Page on Page 44
- Password Page on Page 45
- Security Page on Page 45
- Keys/Certs Page on Page 46

5.1. Network Configuration Page

You can use the *Network Configuration* page to change the ICDM-RX/MOD network configuration after using PortVision DX for initial network configuration.

Click the **Network tab** to access this page.

The following table provides information about the **Network Configuration** fields.

Network Configuration Page	
General	
Host Name	You can enter a 16-character Host Name to identify this ICDM-RX/MOD on the <i>Home</i> page.
TCP Keepalive Default = 60	<p>The TCP protocol has a keepalive feature where the two network stacks periodically ping each other to make sure the connection is still up.</p> <p>Upon loss of a TCP/IP connection, the network stack starts a timer. If the TCP/IP connection is still lost after the number of seconds set by the TCP Keepalive value, then the ICDM-RX/MOD closes the connection and frees all the ports associated with the connection.</p> <p>If the ICDM-RX/MOD was the originator of the first connection, it will then try to re-connect the TCP/IP connection. This allows the ICDM-RX/MOD to be connected and ready to send/receive data even after a network disturbance.</p> <p>For most networks the default value should not need to be changed.</p>
Boot Timeout Default = 15	<p>Allows you to change the bootloader time-out value before the default application, Modbus Router loads.</p> <p>You may need to increase this time-out value to 45 for compatibility with spanning tree devices (normally switches). If you change the time-out value to 0, this prevents Modbus Router from loading.</p>
IP Configuration (IPv4)	
Use DHCP	<p>Configures the ICDM-RX/MOD to use DHCPv4 mode.</p> <p>If you select Use DHCP, the IPv4 Address field below is disabled and set to 0.0.0.0.</p> <p>See your System Administrator to acquire a unique reserved IPv4 address if you are using DHCP. They will need the MAC address of the unit to provide you with an IPv4 address.</p>



Network Configuration Page	
Use static configuration below	<p>Configures the ICDM-RX/MOD with the static IPv4 address information that you provide in the IPv4 Address, IPv4 Netmask, and IPv4 Gateway fields below.</p> <p>The ICDM-RX/MOD is shipped from the factory with the following default IPv4 network settings:</p> <ul style="list-style-type: none"> • IPv4 address = 192.168.250.250 • IPv4 Netmask = 255.255.0.0 • IPv4 Gateway address = 192.168.250.1

5.2. Password Page

You can easily set up a password to secure the ICDM-RX/MOD.

There is no password set from the factory.

Use the following information to configure a password for this ICDM-RX/MOD.

1. If necessary, click **Network | Password**.
2. If changing an existing password, enter that password in the **Old Password** field.
3. Enter a new password.
4. Enter the password in the **Confirm New Password** field.
5. Click the **Save** button.

To log into the ICDM-RX/MOD, you must enter the following:

- **admin** for the username
- The configured password for the password

5.3. Security Page

The following table discusses **Security Settings** options.

Security Settings Page	
Enable Secure Config Mode	<p>If Secure Config mode is enabled, unencrypted access to administrative and diagnostic functions is disabled. Secure Config mode changes ICDM-RX/MOD behavior as follows:</p> <ul style="list-style-type: none"> • Telnet access to administrative and diagnostic functions is disabled. SSH access is still allowed. • Unencrypted access to the web server via port 80 (http:// URLs) is disabled. Encrypted access to the web server via port 443 (https:// URLs) is still allowed. • Administrative commands that change configuration or operating state which are received using the Pepperl+Fuchs Comtrol proprietary TCP driver protocol on TCP port 4606 are ignored. • Administrative commands that change configuration or operating state that are received using the Pepperl+Fuchs Comtrol MAC mode proprietary Ethernet protocol number 0x11FE are ignored.

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Security Settings Page (Continued)	
Enable Telnet/ssh	This option enables or disables the telnet security feature after you click Save and the ICDM-RX/MOD has been rebooted. This option is enabled by default.
Enable SNMP	This option enables or disables the SNMP security feature after you click Save and the ICDM-RX/MOD has been rebooted. This option is enabled by default.
Minimum Allowed SSL/TLS Version	<p>You can select the appropriate version for your environment.</p> <ul style="list-style-type: none"> • SSLv3.0 • TLSv1.0 (default) • TLSv1.1 • TLSv1.2

Use the following steps to change security settings in the ICDM-RX/MOD.

1. Click the **Network | Security**.
2. Click the appropriate check boxes in the *Security Settings* page to enable or disable security accordingly.
3. After making changes, you must click **Save**.
4. You may need to configure security keys or certificates depending on your choices using the next subsection.

5.4. Keys/Certs Page

For secure operation, the ICDM-RX/MOD uses a set of three keys and certificates. These keys and certificates are user configurable.

Note: All ICDM-RX/MOD units are shipped from the factory with identical configurations. They all have the identical self-signed, Pepperl+Fuchs Control Server RSA Certificates, Server RSA Keys, and Server DH Keys.

For maximum data and access security, you should configure all ICDM-RX/MOD units with custom certificates and keys.

Key and Certificate Management Page	
RSA Key pair used by SSL and SSH servers	<p>This is a private/public key pair that is used for two purposes:</p> <ul style="list-style-type: none"> • It is used by some cipher suites to encrypt the SSL/TLS handshaking messages. Possession of the private portion of this key pair allows an eavesdropper to both decrypt traffic on SSL/TLS connections that use RSA encryption during handshaking. • It is used to sign the Server RSA Certificate in order to verify that the ICDM-RX/MOD is authorized to use the server RSA identity certificate. <p>Note: Possession of the private portion of this key pair allows somebody to pose as the ICDM-RX/MOD.</p> <p>If the Server RSA Key is to be replaced, a corresponding RSA identity certificate must also be generated and uploaded or clients are not able to verify the identity certificate.</p>

Key and Certificate Management Page (Continued)	
RSA Server Certificate used by SSL servers	<p>This is the RSA identity certificate that the ICDM-RX/MOD uses during SSL/TLS handshaking to identify itself. It is used most frequently by SSL server code in the ICDM-RX/MOD when clients open connections to the ICDM-RX/MOD's secure web server or other secure TCP ports.</p> <p>If a ICDM-RX/MOD serial port configuration is set up to open (as a client) a TCP connection to another server device, the ICDM-RX/MOD also uses this certificate to identify itself as an SSL client if requested by the server.</p> <p>In order to function properly, this certificate must be signed using the Server RSA Key. This means that the server RSA certificate and server RSA key must be replaced as a pair.</p>
DH Key pair used by SSL servers	<p>This is a private/public key pair that is used by some cipher suites to encrypt the SSL/TLS handshaking messages.</p> <p>Note: <i>Possession of the private portion of the key pair allows an eavesdropper to decrypt traffic on SSL/TLS connections that use DH encryption during handshaking.</i></p>

Use the following steps to update security keys and certificates in the ICDM-RX/MOD.

1. Click the **Network | Keys/Cert.**
2. Click **Browse** to locate the key or certificate file, highlight the file, and click **Open**.
3. Click **Upload** when you return to the Key and Certificate Management page.

The key or certificate notation changes from **factory** or **none** to **User** when the ICDM-RX/MOD is secure.

Note: *You do not need to click Save, but changes will not take effect until the ICDM-RX/MOD is rebooted.*



6. Diagnostics Menu

The following pages are located under the *Diagnostics* menu:

- Serial Communication Statistics Page on Page 48
- Modbus RTU/ASCII over Ethernet TCP Statistics Page on Page 49
- Serial Interface Logs Page on Page 50
- Known Modbus Slave Device List Page on Page 50
- Modbus/TCP and Serial Modbus Master Statistics Page on Page 52
- Modbus/TCP Connections Page on Page 54
- Modbus Alias Device ID Statistics Page on Page 55
- Shared Memory Contents Page on Page 55
- System Log Page on Page 57

6.1. Serial Communication Statistics Page

Click **Diagnostics | Communication | Serial Statistics** to access the *Serial Communication Statistics* page.

The following table provides detailed information about the *Serial Communications Statistics* page.

Serial Communication Statistics Page	
TX Byte Count (To Device)	Displays the number of bytes transmitted out the serial port.
TX Message/Response Count	Displays the number of messages or responses transmitted out of the serial port.
RX Byte Count (From Device)	Displays the number of bytes received on the serial port.
RX Message/Response Count	Displays the number of messages or responses received on the serial port.
TX or RX Broadcast Msg Count	Displays the number of broadcast messages transmitted out the serial port.
Master/Slaves Private Messages	Displays the number of private messages detected, those between a master and private slave(s), on a serial port configured in Master/Slaves mode.
Parity Error Count	Displays the number of parity errors received on the serial port. Typically occurs due to an incorrect parity setting.
Framing Error Count	Displays the number of framing errors received on the serial port. Typically occurs due to an incorrect baud rate or stop bit setting.
Overrun Error Count	Displays the number of overrun errors received on the serial port. This typically occurs to one of the following events: incorrect flow control, incorrect baud rate, incorrect data size, or incorrect stop bit setting.

Serial Communication Statistics Page (Continued)	
Dropped Message/Response Count	<p>Displays the number of messages or responses dropped to any of the following:</p> <ul style="list-style-type: none"> Incomplete message or response. Did not receive valid start and/or end characters (Modbus/ASCII only).
Invalid Message/Response Count	<p>Displays the number of invalid messages or responses received to any of the following events:</p> <ul style="list-style-type: none"> Message received after the timeout period. This may require increasing the Device Response Timeout. Incorrect device ID in response message. Incorrect function code in response message.
Device Timeouts	Displays the number of device timeouts that occurred when there was no response for a Modbus message.
Blocked Write Messages	Displays the number of Modbus write messages that were not transmitted as a result of the Disable Writes (Read Only) option being set.

6.2. Modbus RTU/ASCII over Ethernet TCP Statistics Page

Click **Diagnostics | Communication | TCP Statistics** to access the *Modbus RTU/ASCII over Ethernet TCP Statistics* page.

The following table provides information about Ethernet TCP/IP interface statistics on the *Modbus RTU/ASCII over Ethernet TCP Statistics* page.

Modbus RTU/ASCII over Ethernet TCP Statistics Page	
TX Byte Count (To Application)	The number of bytes transmitted out of the TCP/IP connection(s).
TX Response Count	The number of responses transmitted out of the TCP/IP connection(s).
Dropped TX Responses	The number of responses that were intended to be transmitted out the TCP/IP connection(s) but could not be and were dropped. This typically occurs when one or more connections close unexpectedly.
RX Byte Count (From Application)	The number of bytes received on the TCP/IP connection(s).
RX Message Count	The number of messages received on the TCP/IP connection(s).
Dropped RX Messages Due to Congestion	The number of messages that were dropped to the gateway being overly congested. This typically occurs when the application(s) send messages faster than the slave device(s) can respond.
Dropped Invalid or Incomplete RX Messages	<p>The number of messages from the application(s) that were dropped to:</p> <ul style="list-style-type: none"> Containing an invalid Modbus message format. Containing an incomplete Modbus message.
Dropped RX Messages Due to Invalid CRCs	The number of messages from the application(s) that were dropped due to an invalid Modbus/RTU CRC or Modbus/ASCII LRC.
Remote Connection Status	Displays remote TCP/IP connections.



6.3. Serial Interface Logs Page

This page displays the serial messages transmitted and received during normal operation. Click **Diagnostics | Communication | Serial Logs** to access this page.

The format is as follows:

Pkt(N): ddd:hh:mm:ss.mss Rx/Tx>(data packet)

Where:

- ddd** – days since last system restart
- hh** – hours since last system restart
- mm** – minutes since last system restart
- ss** – seconds since last system restart
- mss** – milliseconds since last system restart
- (data)** – Modbus/RTU or Modbus/ASCII message data.

- Private messages between the master and slaves on the Master/Slaves ports are indicated with “(Private)”.
- All other messages are those routed through the Modbus gateway to the Modbus network or Shared Memory.

6.4. Known Modbus Slave Device List Page

The *Known Modbus Slave Device List* page provides device specific status and statistics for each device connected locally to one or more of the serial ports or remotely through a remote Modbus/TCP device configuration.

Access the *Known Modbus Slave Device List* page by clicking **Diagnostics | Modbus Diagnostics | Modbus Devices**.

The following table provides detailed information about this page.

Known Modbus Slave Device List Page - Public Devices	
Device ID	Displays the device ID associated with this device. Note: <i>If Device ID Offset Mode is enabled, the actual device ID transmitted out the serial port displays as (SP=xxx).</i>
Active?	Displays the status of device: <ul style="list-style-type: none"> • Yes means that the last request received a valid response and did not time out. • No means that the last request timed out or the device has not yet received a message.
IP Address	Displays the IP address associated with the local device under Configured Remote Modbus Devices .
IP Port	Displays the TCP/IP port associated with the remote device under Configured Remote Modbus Devices .
Tx Req	Displays the number of Modbus messages transmitted to this device.
Rx Rsp	Displays the number of Modbus responses received from this device.
Timeouts	Displays the number of response timeouts associated with this device.
Last Rsp Time	Displays the last response time from the Modbus device.
Avg Rsp Time	Displays the average response time from the Modbus device.

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Known Modbus Slave Device List Page - Public Devices (Continued)	
Min Rsp Time	Displays the minimum response time from the Modbus device.
Max Rsp Time	Displays the maximum response time from the Modbus device.
Error Rsp	Displays the number of responses with Modbus error indications.
No Path	This displays under Configured Remote Modbus Devices the number of times the network path could not be connected. This could be a result of: <ul style="list-style-type: none"> • Out of Modbus/TCP connections. • Modbus/TCP device not responding. • Incorrect IP address.
Invalid Responses	Displays the number of invalid messages or responses received to any of the following: <ul style="list-style-type: none"> • Message received after the timeout period. This may require increasing the Device Response Timeout. • Incorrect device ID in response message. • Incorrect function code in response message.
Blocked Writes	Displays the number of Modbus write messages that were not transmitted for this device. This only occurs when the Disable Writes (Read Only) serial port option is selected.
Tx Broadcasts	Displays the number of Modbus broadcast messages transmitted to this device.

Known Modbus Slave Device List Page - Private Devices	
Device ID	Displays the device ID associated with this device. Note: <i>If Device ID Offset Mode is enabled, the actual device ID transmitted out the serial port displays as (SP=xxx).</i>
Requests	Displays the number of private requests addressed to this Modbus device.
Responses	Displays the number of private responses from this Modbus device.
Req Or Resp?	Displays the number of private requests/responses addressed to/from this Modbus device that could not be identified specifically as either a request or a response.
No Responses	Displays the number of requests that this Modbus device did not respond to.
Last Rsp Time	Displays the last response time from the Modbus device.
Avg Rsp Time	Displays the average response time from the Modbus device.
Min Rsp Time	Displays the minimum response time from the Modbus device.
Max Rsp Time	Displays the maximum response time from the Modbus device.
Error Rsp	Displays the number of responses with Modbus error indications.

6.5. Modbus/TCP and Serial Modbus Master Statistics Page

Click [Diagnostics](#) | [Modbus Diagnostics](#) | [Modbus/TCP Interface](#) to access the *Modbus/TCP and Serial Modbus Master Statistics* page, which is explained in the following table.

Note: The Modbus/TCP interface uses the standard socket port of 502.

Modbus/TCP and Serial Modbus Master Statistics Page	
Modbus/TCP Slave Mode Specific Statistics	
Active Modbus/TCP Slave Connections	Displays the current number of active Modbus/TCP slave connections. These connections were initiated by a controller to the ICDM-RX/MOD.
Modbus/TCP Slave Connections Opened	Displays the total number of Modbus/TCP slave connections that have been opened.
Modbus/TCP Slave Connections Closed	Displays the total number of Modbus/TCP slave connections that have been closed.
Messages Received From Modbus/TCP Master(s)	Displays the total number of Modbus/TCP messages received from Modbus/TCP master(s).
Responses Sent to Modbus/TCP Master(s)	Displays the total number of Modbus/TCP responses sent to Modbus/TCP master(s).
Modbus Broadcasts Received From Modbus/TCP Masters	Displays the number of Modbus broadcast messages received from Modbus/TCP Masters.
Invalid Command Lengths	Displays the number of messages received with invalid command lengths.
Invalid Message Data Errors	Displays the number of messages received with invalid message data errors. These errors occur when the ICDM-RX/MOD receives a message that cannot be processed due to improper message data.
Invalid request Protocol Types	Displays the number of messages received with invalid protocol errors. This occurs when a message is received with a protocol other than the Modbus/TCP protocol value of zero.
Modbus/TCP Master Mode Specific Statistics	
Active Modbus/TCP Master Connections	Displays the current number of active Modbus/TCP master connections. These connections were initiated by the ICDM-RX/MOD to a Modbus/TCP slave.
Modbus/TCP Master Connections Opened	Displays the total number of Modbus/TCP master connections that have been opened.
Modbus/TCP Master Connections Closed	Displays the total number of Modbus/TCP master connections that have been closed.
Messages Sent To Modbus/TCP Slave(s)	Displays the total number Modbus messages sent to remote Modbus/TCP slaves.
Responses Received From Modbus/TCP Slave(s)	Displays the total number of Modbus responses received from the Modbus/TCP Slave(s).
Invalid Response Data Errors From Modbus/TCP Slave(s)	Displays the number of response data errors to polling requests returned from the Modbus/TCP Slave(s). Possible causes include: <ul style="list-style-type: none"> • Incorrect transaction ID incorrect. • Message command length to large. • Incorrect device Id in response.

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Modbus/TCP and Serial Modbus Master Statistics Page (Continued)	
Remote Modbus/TCP Device Timeouts	Displays the number of messages to remote devices that were determined to have timed out by this gateway.
Unexpected Responses From Modbus/TCP Slaves	Displays the number of responses received when no response was expected.
Error Responses from Modbus/TCP Slave(s)	Displays the number of responses received from Modbus/TCP slaves with errors indicated. This may be caused by such things as: <ul style="list-style-type: none"> • Device timeouts detected by slave Modbus/TCP device, such a gateway. • Invalid device address. • Invalid device ID. • Invalid message data.
Unexpected Response Function Codes From Modbus/TCP Slave(s)	Displays the number of unexpected response function codes from Modbus/TCP slaves. This occurs when a response was received with a different function code than what was sent.
Invalid Response Protocol Types From Modbus/TCP Slave(s)	Displays the number of responses with invalid protocol errors. This occurs when a response is returned with a protocol other than the Modbus/TCP protocol value of zero.
Failed Modbus/TCP Connection Attempts to Modbus/TCP Slave(s)	Displays the number of failed Modbus/TCP connection attempts to the specified PLC IP address.
Modbus/TCP Connection Problems	Displays the number of Modbus/TCP connection attempt problems. This occurs when the device responds and the connection is made, but there are problems setting up the connection options. The possible option problems include: <ul style="list-style-type: none"> • Setting the TCP connection to TCP_NODELAY. • Setting the socket connection to SO_OOBINLINE. • Setting the socket connection to SO_KEEPALIVE.
Unexpected Dropped Connections	Displays the number of Modbus/TCP connections that were unexpectedly dropped.

Modbus/TCP and Serial Modbus Master Statistics Page (Continued)	
Non-Mode Specific Statistics/Diagnostics	
No Available Modbus/TCP Connection Errors	Displays the number of connections aborted when there are no available Modbus/TCP connections. This error occurs when the maximum number of Modbus/TCP connections has been reached and the ICDM-RX/MOD is attempting to form another Modbus/TCP connection.
Improper Configuration Errors	Displays the number of errors that were caused by improper configuration errors.
System Resource Errors	Displays the numbers of system resource errors. These errors are typically caused by congestion and/or non-responding devices.
First Error Description	Displays the first error detected.
Last Error Description	Displays the last or most recent error detected.

6.6. Modbus/TCP Connections Page

Access the *Modbus/TCP Connections* page by clicking **Diagnostics | Modbus Diagnostics | Modbus/TCP Connections**.

Modbus/TCP Connections Page	
Slave Mode (From Master) Modbus/TCP Connections	
<i>Note: Only displayed if active connections.</i>	
Remote Connection	The Modbus/TCP master connection in <i>IP Address:Port Number</i> format (xxx.xxx.xxx.xxx:pppp).
Local IP Port	The local TCP/IP port on the ICDM-RX/MOD. The standard Modbus/TCP port of 502 is always enabled. Optionally, up to seven additional Modbus/TCP ports may also be enabled.
Rx Requests	Displays the number of Modbus requests that have been received since the connection was opened.
Tx Responses	Displays the number of Modbus responses that have been transmitted since the connection was opened.
Time Since Open	The time that has elapsed since the connection was opened.
Master Mode (To Slave) Modbus/TCP Connections	
<i>Note: Only displayed if active connections.</i>	
Remote Connection	The Modbus/TCP master connection in <i>IP Address:Port Number</i> format (xxx.xxx.xxx.xxx:pppp).
Tx Requests	Displays the number of Modbus requests that have been transmitted since the connection was opened.
Rx Responses	Displays the number of Modbus responses that have been received since the connection was opened.
Dedicated	Indicates if the connection is dedicated for a specified Modbus device ID.
Device ID	If the connection is dedicated, the corresponding device ID.

Modbus/TCP Connections Page (Continued)	
Time Since Open	The time that has elapsed since the connection was opened.

6.7. Modbus Alias Device ID Statistics Page

Access the *Modbus Alias Device ID Statistics* page by clicking **Diagnostics | Modbus Diagnostics | Alias Diagnostics**.

Modbus Alias Device ID Statistics Page	
Rx Device ID	Displays the device ID (also often called the unit ID) of the received message from a master.
Alias Device ID	The alias device ID to convert the received device ID to.
Modbus/TCP Master	If selected, this applies the alias device ID configuration to messages received from Modbus/TCP masters.
Modbus Serial Master	If selected, this applies the alias device ID configuration to messages received from serial Modbus masters.
Modbus over TCP Master	If selected, this applies the alias device ID configuration to messages received from Modbus RTU/ASCII over Ethernet TCP/IP masters.
Modbus/TCP Count	Number of Aliased Modbus messages received from Modbus/TCP masters.
Modbus Serial Count	Number of Aliased Modbus messages received from Modbus Serial masters.
Modbus over TCP Count	Number of Aliased Modbus messages received from Modbus over TCP masters.

6.8. Shared Memory Contents Page

This page displays the contents of a Shared Holding Register block. Access this page by clicking **Diagnostics | Modbus Diagnostics | Shared Memory** and select the Holding Register block that you want to display in the drop list.

Shared Memory Contents Page	
Shared Memory Config button	Click this button to jump to the <i>Shared Memory Configuration</i> page.
Reset Statistics button	Click this button to reset the following: <ul style="list-style-type: none"> • Write messages • Read messages • Blocked writes
Refresh button	Click this button to refresh this page.
Clear This Block button	Click this button to clear the diagnostics and data contents of this Holding Register block.
Clear Entire Shared Memory button	Click this button to clear the diagnostics and data contents of all Holding Register and Coil blocks.

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Shared Memory Contents Page (Continued)	
Shared Holding Register Block drop list	Use this drop list to select the Shared Holding Register Block or Shared Coil Block that you want to display.
Rx Rsp	Displays the number of Modbus responses received from this device.
Display Format	Selectable data format to display the contents of the Holding Register block data. <ul style="list-style-type: none"> Hex - 16 bit word (default) word-16 - unsigned 16 bit decimal word-32 - unsigned 32 bit decimal string - ASCII character string
Data line per row	Selectable data entries per row to display the contents of the Holding Register block data. <ul style="list-style-type: none"> 10-per-row – ten entries display per row 20-per-row – twenty entries displayed per row (default)
Write Messages	Displays the number of successful write messages to this Shared Memory block.
Read Messages	Displays the number of read messages addressed to this Shared Memory block.
Blocked Writes	Displays the number of write messages that were blocked, or prevented, from writing to this Shared Memory block. Note: <i>Blocked writes are treated as write violations and are added to the Write Violation Log.</i>
Description	This is the description from the <i>Shared Memory Configuration</i> page.
Write Enabled Master(s)	Displays how this is configured in the <i>Shared Memory Configuration</i> page.
Accept Broadcasts	Displays if the Accept Broadcast Messages option is enabled in the <i>Shared Memory Configuration</i> page.

6.9. Shared Memory Contents Page - Shared Coil Blocks

This page displays the contents of the selected Shared Coil block. Access this page from the *Shared Memory Configuration* page and click **Display** next to the Coil block that you want to display.

Shared Memory Contents Page - Shared Coil Blocks	
Buttons	
Shared Memory Config	Selecting this button returns you to the <i>Shared Memory Configuration</i> page.
Reset Statistics	Click this button to clear the diagnostics for this Holding Register block.
Refresh	Click this button to refresh the data on the page.
Clear This Block	Selecting this button clears the diagnostics and data contents of the Holding Register block in the drop list.
Clear Entire Shared Memory	Click button to clear the diagnostics and data contents of all Holding Register and Coil blocks.

Shared Memory Contents Page - Shared Coil Blocks (Continued)	
Drop Lists and Fields	
Shared Coil Block Drop List	Use this drop list to display data for a specific Shared Holding Register Block or Shared Coil Block.
Write Messages	Displays the number of successful write messages to this Shared Memory block.
Read Messages	Displays the number of read messages addressed to this Shared Memory block.
Blocked Writes	Displays the number of write messages that were blocked, or prevented, from writing to this Shared Memory block. Note: <i>Blocked writes are treated as write violations and are added to the Write Violation Log.</i>
Description	This is the description from the <i>Shared Memory Configuration</i> page.
Write Enabled Master(s)	Displays how this is configured in the <i>Shared Memory Configuration</i> page.
Accept Broadcasts	Displays if the Accept Broadcast Messages option is enabled in the <i>Shared Memory Configuration</i> page.

6.10. System Log Page

If you call Technical Support, they may have you send a log file.
Access the *System Log* page by clicking **Diagnostics | System Log**.



7. System Menu

This section discusses the web pages under the **System** menu:

- Update Firmware Page on Page 58
- Configuration File Page on Page 58
- Device Snapshot Page on Page 59
- Restore Defaults Page on Page 59
- Reboot Page on Page 59

7.1. Update Firmware Page

You can upload firmware (Modbus Router or Bootloader) using the **System | Update Firmware** page. You must first unpackage the firmware from the **.msi** file.

Note: *Optionally, you can use PortVision DX to upload firmware after unpackaging the .msi file.*

Use the following procedure to upload the latest firmware onto the ICDM-RX/MOD.

1. If necessary, download the firmware from <https://www.pepperl-fuchs.com>.
2. Execute the **x.x.msi** file.
3. Click the **Next** button.
4. After reviewing the license, click **I accept the terms in the License Agreement** and the **Next** button.
5. Click the **Next** button or browse to the location you want the files stored.
6. Click the **Install** button.
7. Click **Yes** to the **Do you want to allow this app to make changes to your device** pop up message.
8. Click the **Finish** button.
9. Open your web browser and enter the IP address of the ICDM-RX/MOD.
10. Click the **System** menu.
11. Click the **Browse** button, navigate to the file, select it and click the **Open** button.
12. Click the **Update** button.

An *Update In Progress* pop up notifies you with the upload duration, not to reset or disconnect the device or to close the page.

7.2. Configuration File Page

You can use the **Save Configuration** option to save a ICDM-RX/MOD configuration file for recovery purposes or to quickly configure other ICDM-RX/MODs that require the same configuration using the **Load Configuration** option.

Note: *Optionally, you can use PortVision DX to save and load configuration files.*

7.2.1. Saving a Configuration File

You can use this procedure to save a ICDM-RX/MOD configuration file.

1. Click **System | Configuration File**.
2. Click the **Save Configuration** button.
3. Save the configuration file following your browser prompts.

7.2.2. Loading a Configuration File

You can use this procedure to load a previously saved ICDM-RX/MOD configuration file.

1. Click **System | Configuration File**.
2. Click the **Browse** button, highlight the configuration file you want to load, and click the **Open** button.
3. Click the **Load Configuration** button.

7.3. Device Snapshot Page

You can use the Device Snapshot page to download a snapshot of the device status, log, and configuration. You may find the information can help you diagnose a problem with the ICDM-RX/MOD. In addition, this information may be requested by technical support if you have called for assistance.

1. Open your browser and enter the IP address of the ICDM-RX/MOD.
2. Click **System | System Snapshot**.
3. Click the **Device Snapshot** button.
4. Save the file using the method for your browser.

7.4. Restore Defaults Page

You can easily some or all of your settings to factory defaults by using the procedure below.

1. Open your browser and enter the IP address of the ICDM-RX/MOD.
2. Click **System | Restore Defaults**.
3. Select **Everything** or the specific setting or settings that you want to restore.
4. Click the **Restore** button.
5. The ICDM-RX/MOD reboots and re-opens the web interface.

7.5. Reboot Page

You can reboot the ICDM-RX/MOD remotely using the Reboot web page.

1. Click **System | Reboot**.
2. Click the **Reboot Now** button or wait the 10 seconds for it automatically reboot.



8. Troubleshooting and Technical Support

This section contains troubleshooting information for your ICDM-RX/MOD. You should review the following subsections before calling Technical Support because they will request that you perform many of the procedures or verifications before they will be able to help you diagnose a problem.

- Troubleshooting Checklist on Page 60
- General Troubleshooting on Page 61
- Daisy-Chaining ICDM-RX/MOD Units With Dual Ethernet Ports on Page 61

If you cannot diagnose the problem, you can contact Technical Support on Page 62.

8.1. Troubleshooting Checklist

The following checklist may help you diagnose your problem:

- Verify that you are using the correct types of cables on the correct connectors and that all cables are connected securely.
Note: *Most customer problems reported to Technical Support are eventually traced to cabling or network problems.*
- Isolate the ICDM-RX/MOD from the network by connecting the device directly to a NIC in a host system.

Model	Connected to	Ethernet Cable	Connector Name
1-Port	Ethernet hub or NIC	Standard	10/100 ETHERNET
4-Port	NIC	Standard	DOWN
	Ethernet hub	Standard	UP

- Verify that the Ethernet hub and any other network devices between the system and the ICDM-RX/MOD are powered up and operating.
- Reset the power on the ICDM-RX/MOD and watch the **PWR** or **Status** light activity.

ICDM-RX/MOD Models	
PWR or Status LED	Description
5 sec. off, 3 flashes, 5 sec. off, 3 flashes ...	Redboot™ checksum failure.
5 sec. off, 4 flashes, 5 sec. off, 4 flashes ...	SREC load failure.
5 quick flashes	The default application is starting up.
10 sec. on, .1 sec. off, 10 sec. on .1 sec. off ...	The default application is running.

- If the device has a power switch, turn the device's power switch off and on, while watching the LED diagnostics.
- If the ICDM-RX/MOD does not have a power switch, disconnect and reconnect the power cord.
- Verify that the network IP address, subnet mask, and gateway is correct and appropriate for the network. If IP addressing is being used, the system should be able to ping the ICDM-RX/MOD.

- Verify that the IP address programmed into the ICDM-RX/MOD matches the unique reserved IP configured address assigned by the system administrator.
- If using DHCP, the host system needs to provide the subnet mask and gateway.
- Reboot the system and the ICDM-RX/MOD.
- If you have a spare ICDM-RX/MOD, try replacing the device.

8.2. General Troubleshooting

This table illustrates some general troubleshooting tips.

Note: Make sure that you have reviewed the *Troubleshooting Checklist (Page 60)*.

General Condition	Explanation/Action
PWR or Status LED flashing	Indicates that boot program has not downloaded to the unit. 1. Reboot the system. 2. Make sure that you have downloaded the most current firmware for Modbus Router. Note: If the PWR or Status LED is still flashing, contact Technical Support.
PWR or Status LED not lit	Indicates that power has not been applied or there is a hardware failure. Contact Technical Support.
Cannot ping the device through Ethernet hub	Isolate the ICDM-RX/MOD from the network. Connect the device directly to the NIC in the host system (see Page 60).
Cannot ping or connect to the ICDM-RX/MOD	The default IP address is often not accessible due to the subnet masking from another network unless 192.168 is used in the network. In most cases, it will be necessary to program in an address that conforms to your network.
ICDM-RX/MOD continuously reboots when connected to some Ethernet switches or routers	Invalid IP information may also cause the switch or router to check for a gateway address. Lack of a gateway address is a common cause.

8.3. Daisy-Chaining ICDM-RX/MOD Units With Dual Ethernet Ports

The ICDM-RX/MOD models with dual Ethernet ports follow the IEEE specifications for standard Ethernet topologies.

When using the E1 and E2 ports, the ICDM-RX/MOD is classified as a switch.

The maximum number of daisy-chained ICDM-RX/MOD units, and the maximum distance between units is based on the Ethernet standards and will be determined by your own environment and the conformity of your network to these standards.

Pepperl+Fuchs Control has tested with seven ICDM-RX/MOD units daisy-chained together using 10 foot CAT5 cables, but this is not the theoretical limit. You may experience a performance hit on the devices at the end of the chain, so it is recommended that you overload and test for performance in your environment. The OS and the application may also limit the total number of ports that may be installed.

Following are some quick guidelines and URLs of additional information. Please note that standards and URLs do change.

- Ethernet 10BASE-T Rules

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- The maximum number of repeater hops is four.
- You can use Category 3 or 5 twisted-pair 10BASE-T cables.
- The maximum length of each cable is 100m (328ft).
Note: *Category 3 or 5 twisted pair cables look the same as telephone cables but they are not the same. The network will not work if telephone cables are used to connect the equipment.*
- Fast Ethernet 100BASE-TX rules
 - The maximum number of repeater hops is two (for a Class II hub). A Class II hub can be connected directly to one other Class II Fast Ethernet hub. A Class I hub cannot be connected directly to another Fast Ethernet hub.
 - You must use Category 5 twisted-pair 100BASE-TX cables.
 - The maximum length of each twisted-pair cable is 100m (328ft).
 - The total length of twisted-pair cabling (across directly connected hubs) must not exceed 205m (672ft).
Note: *Category 5 twisted pair cables look the same as telephone cables but they are not the same. The network will not work if telephone cables are used to connect the equipment.*
- IEEE 802.3 specification: A network using repeaters between communicating stations (PCs) is subject to the “5-4-3” rule of repeater placement on the network:
 - Five segments connected on the network.
 - Four repeaters.
 - Three segments of the 5 segments can have stations connected. The other two segments must be inter-repeater link segments with no stations connected.See <http://www.optronics.gr/Tutorials/ethernet.htm> for more specific information.
Additional information may be found at <http://compnetworking.about.com/cs/ethernet1/> or by searching the web.

8.4. Technical Support

It contains troubleshooting procedures that you should perform before contacting Technical Support since they will request that you perform, some or all of the procedures before they will be able to help you diagnose your problem. If you need technical support, use one of the following methods.

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