

# Modbus ASCII Driver

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|   |           |
|---|-----------|
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## Modbus ASCII Driver

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Help version 1.055

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### Overview

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The Modbus ASCII Driver provides a reliable way to connect Modbus ASCII serial devices to OPC Client applications, including HMI, SCADA, Historian, MES, ERP, and countless custom applications. It is intended for use with serial devices that support the Modbus ASCII protocol. The driver's special features provide control over the following: the amount of data requested from a device in a single request, the word ordering of 32-bit double register values, the byte ordering of 32-bit and 16-bit register values and address base adjustment. The driver can also control the RTS line operation for use with radio modems that require specific RTS timing.

### Setup

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#### Supported Devices

Modbus ASCII compatible devices

Flow Computers using the Daniels/Omni/Elliott register addressing

#### Communication Protocol

Modbus ASCII Protocol

#### Channel Setup

#### Device Setup

### Channel Setup

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The maximum number of channels supported by this driver is 100.

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## Ethernet Encapsulation

This driver supports Ethernet Encapsulation, which allows the driver to communicate with serial devices attached to an Ethernet network using a terminal server. It may be invoked through the COM ID dialog in Channel Properties. For more information, refer to the server help file.

## Supported Communication Properties

Baud Rate: 1200, 2400, 9600, 19200

Parity: Odd, Even, None

Data Bits: 8

Stop Bits: 1,2

● **Note:** Some devices may not support the listed configurations.

## Flow Control

When using an RS232/RS485 converter, the type of flow control that is required depends on the needs of the converter. Some converters do not require any flow control whereas others require RTS flow. Consult the converter's documentation to determine its flow requirements. An RS485 converter that provides automatic flow control is recommended.

### ● Notes:

1. When using the manufacturer's supplied communications cable, it is sometimes necessary to choose a flow control setting of **RTS** or **RTS Always** under the channel properties.
2. The Modbus ASCII Driver supports the RTS Manual flow control option. This selection is used to configure the driver for operation with radio modems that require special RTS timing characteristics. For more information on RTS Manual flow control, refer to the server help file.

## Communication Serialization

The Modbus ASCII Driver supports communication serialization, which specifies whether data transmissions should be limited to one channel at a time.

## Channel Properties — General

This server supports the use of simultaneous multiple communications drivers. Each protocol or driver used in a server project is called a channel. A server project may consist of many channels with the same communications driver or with unique communications drivers. A channel acts as the basic building block of an OPC link. This group is used to specify general channel properties, such as the identification attributes and operating mode.

|                     |                           |         |
|---------------------|---------------------------|---------|
| Property Groups     | [-] <b>Identification</b> |         |
| General             | Name                      |         |
| Write Optimizations | Description               |         |
| Advanced            | Driver                    |         |
|                     | [-] <b>Diagnostics</b>    |         |
|                     | Diagnostics Capture       | Disable |

## Identification

**Name:** User-defined identity of this channel. In each server project, each channel name must be unique. Although names can be up to 256 characters, some client applications have a limited display window when

browsing the OPC server's tag space. The channel name is part of the OPC browser information. The property is required for creating a channel.

• For information on reserved characters, refer to "How To... Properly Name a Channel, Device, Tag, and Tag Group" in the server help.

**Description:** User-defined information about this channel.

• Many of these properties, including Description, have an associated system tag.

**Driver:** Selected protocol / driver for this channel. This property specifies the device driver that was selected during channel creation. It is a disabled setting in the channel properties. The property is required for creating a channel.

• **Note:** With the server's online full-time operation, these properties can be changed at any time. This includes changing the channel name to prevent clients from registering data with the server. If a client has already acquired an item from the server before the channel name is changed, the items are unaffected. If, after the channel name has been changed, the client application releases the item and attempts to re-acquire using the old channel name, the item is not accepted. With this in mind, changes to the properties should not be made once a large client application has been developed. Utilize the User Manager to prevent operators from changing properties and restrict access rights to server features.

## Diagnostics

**Diagnostics Capture:** When enabled, this option makes the channel's diagnostic information available to OPC applications. Because the server's diagnostic features require a minimal amount of overhead processing, it is recommended that they be utilized when needed and disabled when not. The default is disabled.

• **Note:** This property is not available if the driver does not support diagnostics.

• For more information, refer to "Communication Diagnostics" and "Statistics Tags" in the server help.

## Channel Properties — Serial Communications

Serial communication properties are available to serial drivers and vary depending on the driver, connection type, and options selected. Below is a superset of the possible properties.

Click to jump to one of the sections: [Connection Type](#), [Serial Port Settings](#) or [Ethernet Settings](#), and [Operational Behavior](#).

• **Note:** With the server's online full-time operation, these properties can be changed at any time. Utilize the User Manager to restrict access rights to server features, as changes made to these properties can temporarily disrupt communications.

|                              |  |            |
|------------------------------|--|------------|
| Property Groups              | <input type="checkbox"/> <b>Connection Type</b>      |            |
| General                      | Physical Medium                                      | COM Port   |
| <b>Serial Communications</b> | <input type="checkbox"/> <b>Serial Port Settings</b> |            |
| Write Optimizations          | COM ID   | 39         |
| Advanced                     | Baud Rate  | 19200      |
|                              | Data Bits  | 8          |
|                              | Parity   | None       |
|                              | Stop Bits  | 1          |
|                              | Flow Control   | RTS Always |
|                              | <input type="checkbox"/> <b>Operational Behavior</b> |            |
|                              | Report Communication Errors                          | Enable     |
|                              | Close Idle Connection                                | Enable     |
|                              | Idle Time to Close (s)                               | 15         |

## Connection Type

**Physical Medium:** Choose the type of hardware device for data communications. Options include COM Port, None, Modem, and Ethernet Encapsulation. The default is COM Port.

- **None:** Select None to indicate there is no physical connection, which displays the [Operation with no Communications](#) section.
- **COM Port:** Select Com Port to display and configure the [Serial Port Settings](#) section.
- **Modem:** Select Modem if phone lines are used for communications, which are configured in the [Modem Settings](#) section.
- **Ethernet Encap.:** Select if Ethernet Encapsulation is used for communications, which displays the [Ethernet Settings](#) section.
- **Shared:** Verify the connection is correctly identified as sharing the current configuration with another channel. This is a read-only property.

## Serial Port Settings

**COM ID:** Specify the Communications ID to be used when communicating with devices assigned to the channel. The valid range is 1 to 9991 to 16. The default is 1.

**Baud Rate:** Specify the baud rate to be used to configure the selected communications port.

**Data Bits:** Specify the number of data bits per data word. Options include 5, 6, 7, or 8.


**Parity:** Specify the type of parity for the data. Options include Odd, Even, or None.

**Stop Bits:** Specify the number of stop bits per data word. Options include 1 or 2.

**Flow Control:** Select how the RTS and DTR control lines are utilized. Flow control is required to communicate with some serial devices. Options are:

- **None:** This option does not toggle or assert control lines.
- **DTR:** This option asserts the DTR line when the communications port is opened and remains on.
- **RTS:** This option specifies that the RTS line is high if bytes are available for transmission. After all buffered bytes have been sent, the RTS line is low. This is normally used with RS232/RS485 converter hardware.
- **RTS, DTR:** This option is a combination of DTR and RTS.
- **RTS Always:** This option asserts the RTS line when the communication port is opened and remains on.
- **RTS Manual:** This option asserts the RTS line based on the timing properties entered for RTS Line Control. It is only available when the driver supports manual RTS line control (or when the properties are shared and at least one of the channels belongs to a driver that provides this support).  
RTS Manual adds an **RTS Line Control** property with options as follows:
  - **Raise:** This property specifies the amount of time that the RTS line is raised prior to data transmission. The valid range is 0 to 9999 milliseconds. The default is 10 milliseconds.
  - **Drop:** This property specifies the amount of time that the RTS line remains high after data transmission. The valid range is 0 to 9999 milliseconds. The default is 10 milliseconds.


- **Poll Delay:** This property specifies the amount of time that polling for communications is delayed. The valid range is 0 to 9999. The default is 10 milliseconds.

 **Tip:** When using two-wire RS-485, "echoes" may occur on the communication lines. Since this communication does not support echo suppression, it is recommended that echoes be disabled or a RS-485 converter be used.


## Operational Behavior

- **Report Communication Errors:** Enable or disable reporting of low-level communications errors. When enabled, low-level errors are posted to the Event Log as they occur. When disabled, these same errors are not posted even though normal request failures are. The default is Enable.
- **Close Idle Connection:** Choose to close the connection when there are no longer any tags being referenced by a client on the channel. The default is Enable.
- **Idle Time to Close:** Specify the amount of time that the server waits once all tags have been removed before closing the COM port. The default is 15 seconds.

## Ethernet Settings

 **Note:** Not all serial drivers support Ethernet Encapsulation. If this group does not appear, the functionality is not supported.

Ethernet Encapsulation provides communication with serial devices connected to terminal servers on the Ethernet network. A terminal server is essentially a virtual serial port that converts TCP/IP messages on the Ethernet network to serial data. Once the message has been converted, users can connect standard devices that support serial communications to the terminal server. The terminal server's serial port must be properly configured to match the requirements of the serial device to which it is attached. *For more information, refer to "How To... Use Ethernet Encapsulation" in the server help.*

- **Network Adapter:** Indicate a network adapter to bind for Ethernet devices in this channel. Choose a network adapter to bind to or allow the OS to select the default.
  -  *Specific drivers may display additional Ethernet Encapsulation properties. For more information, refer to Channel Properties — Ethernet Encapsulation.*

## Modem Settings

- **Modem:** Specify the installed modem to be used for communications.
- **Connect Timeout:** Specify the amount of time to wait for connections to be established before failing a read or write. The default is 60 seconds.
- **Modem Properties:** Configure the modem hardware. When clicked, it opens vendor-specific modem properties.
- **Auto-Dial:** Enables the automatic dialing of entries in the Phonebook. The default is Disable. *For more information, refer to "Modem Auto-Dial" in the server help.*
- **Report Communication Errors:** Enable or disable reporting of low-level communications errors. When enabled, low-level errors are posted to the Event Log as they occur. When disabled, these same errors are not posted even though normal request failures are. The default is Enable.
- **Close Idle Connection:** Choose to close the modem connection when there are no longer any tags being referenced by a client on the channel. The default is Enable.
- **Idle Time to Close:** Specify the amount of time that the server waits once all tags have been removed before closing the modem connection. The default is 15 seconds.

## Operation with no Communications



- **Read Processing:** Select the action to be taken when an explicit device read is requested. Options include Ignore and Fail. Ignore does nothing; Fail provides the client with an update that indicates failure. The default setting is Ignore.

## Channel Properties — Write Optimizations

As with any server, writing data to the device may be the application's most important aspect. The server intends to ensure that the data written from the client application gets to the device on time. Given this goal, the server provides optimization properties that can be used to meet specific needs or improve application responsiveness.

|                            |                                |                                      |
|----------------------------|--------------------------------|--------------------------------------|
| Property Groups            | [-] <b>Write Optimizations</b> |                                      |
| General                    | Optimization Method            | Write Only Latest Value for All Tags |
| <b>Write Optimizations</b> | Duty Cycle                     | 10                                   |
|                            |                                |                                      |

### Write Optimizations

**Optimization Method:** Controls how write data is passed to the underlying communications driver. The options are:

- **Write All Values for All Tags:** This option forces the server to attempt to write every value to the controller. In this mode, the server continues to gather write requests and add them to the server's internal write queue. The server processes the write queue and attempts to empty it by writing data to the device as quickly as possible. This mode ensures that everything written from the client applications is sent to the target device. This mode should be selected if the write operation order or the write item's content must uniquely be seen at the target device.
- **Write Only Latest Value for Non-Boolean Tags:** Many consecutive writes to the same value can accumulate in the write queue due to the time required to actually send the data to the device. If the server updates a write value that has already been placed in the write queue, far fewer writes are needed to reach the same final output value. In this way, no extra writes accumulate in the server's queue. When the user stops moving the slide switch, the value in the device is at the correct value at virtually the same time. As the mode states, any value that is not a Boolean value is updated in the server's internal write queue and sent to the device at the next possible opportunity. This can greatly improve the application performance.
  - **Note:** This option does not attempt to optimize writes to Boolean values. It allows users to optimize the operation of HMI data without causing problems with Boolean operations, such as a momentary push button.
- **Write Only Latest Value for All Tags:** This option takes the theory behind the second optimization mode and applies it to all tags. It is especially useful if the application only needs to send the latest value to the device. This mode optimizes all writes by updating the tags currently in the write queue before they are sent. This is the default mode.

**Duty Cycle:** is used to control the ratio of write to read operations. The ratio is always based on one read for every one to ten writes. The duty cycle is set to ten by default, meaning that ten writes occur for each read operation. Although the application is performing a large number of continuous writes, it must be ensured that read data is still given time to process. A setting of one results in one read operation for every write operation. If there are no write operations to perform, reads are processed continuously. This allows optimization for applications with continuous writes versus a more balanced back and forth data flow.

• **Note:** It is recommended that the application be characterized for compatibility with the write optimization enhancements before being used in a production environment.

## Channel Properties — Advanced

This group is used to specify advanced channel properties. Not all drivers support all properties; so the Advanced group does not appear for those devices.

|                     |   |                   |
|---------------------|---|-------------------|
| Property Groups     | <input type="checkbox"/> <b>Non-Normalized Float Handling</b> |                   |
| General             | Floating-Point Values   | Replace with Zero |
| Write Optimizations | <input type="checkbox"/> <b>Inter-Device Delay</b>            |                   |
| <b>Advanced</b>     | Inter-Device Delay (ms)                                       | 0                 |

**Non-Normalized Float Handling:** A non-normalized value is defined as Infinity, Not-a-Number (NaN), or as a Denormalized Number. The default is Replace with Zero. Drivers that have native float handling may default to Unmodified. Non-normalized float handling allows users to specify how a driver handles non-normalized IEEE-754 floating point data. Descriptions of the options are as follows:

- **Replace with Zero:** This option allows a driver to replace non-normalized IEEE-754 floating point values with zero before being transferred to clients.
- **Unmodified:** This option allows a driver to transfer IEEE-754 denormalized, normalized, non-number, and infinity values to clients without any conversion or changes.

● **Note:** This property is not available if the driver does not support floating point values or if it only supports the option that is displayed. According to the channel's float normalization setting, only real-time driver tags (such as values and arrays) are subject to float normalization. For example, EFM data is not affected by this setting.

● *For more information on the floating point values, refer to "How To ... Work with Non-Normalized Floating Point Values" in the server help.*

**Inter-Device Delay:** Specify the amount of time the communications channel waits to send new requests to the next device after data is received from the current device on the same channel. Zero (0) disables the delay.

● **Note:** This property is not available for all drivers, models, and dependent settings.

## Channel Properties — Communication Serialization

The server's multi-threading architecture allows channels to communicate with devices in parallel. Although this is efficient, communication can be serialized in cases with physical network restrictions (such as Ethernet radios). Communication serialization limits communication to one channel at a time within a virtual network.

The term "virtual network" describes a collection of channels and associated devices that use the same pipeline for communications. For example, the pipeline of an Ethernet radio is the master radio. All channels using the same master radio associate with the same virtual network. Channels are allowed to communicate each in turn, in a "round-robin" manner. By default, a channel can process one transaction before handing communications off to another channel. A transaction can include one or more tags. If the controlling channel contains a device that is not responding to a request, the channel cannot release control until the transaction times out. This results in data update delays for the other channels in the virtual network.

|                                    |                                   |               |
|------------------------------------|-----------------------------------|---------------|
| Property Groups                    | [-] <b>Channel-Level Settings</b> |               |
| General                            | Virtual Network                   | None          |
| Serial Communications              | Transactions per Cycle            | 1             |
| <b>Communication Serialization</b> | [-] <b>Global Settings</b>        |               |
|                                    | Network Mode                      | Load Balanced |

## Channel-Level Settings

**Virtual Network:** This property specifies the channel's mode of communication serialization. Options include None and Network 1 - Network 500. The default is None. Descriptions of the options are as follows:

- **None:** This option disables communication serialization for the channel.
- **Network 1 - Network 500:** This option specifies the virtual network to which the channel is assigned.

**Transactions per Cycle:** This property specifies the number of single blocked/non-blocked read/write transactions that can occur on the channel. When a channel is given the opportunity to communicate, this is the number of transactions attempted. The valid range is 1 to 99. The default is 1.

## Global Settings

- **Network Mode:** This property is used to control how channel communication is delegated. In **Load Balanced** mode, each channel is given the opportunity to communicate in turn, one at a time. In **Priority** mode, channels are given the opportunity to communicate according to the following rules (highest to lowest priority):
  - Channels with pending writes have the highest priority.
  - Channels with pending explicit reads (through internal plug-ins or external client interfaces) are prioritized based on the read's priority.
  - Scanned reads and other periodic events (driver specific).

The default is Load Balanced and affects *all* virtual networks and channels.

🔥 Devices that rely on unsolicited responses should not be placed in a virtual network. In situations where communications must be serialized, it is recommended that Auto-Demotion be enabled.

Due to differences in the way that drivers read and write data (such as in single, blocked, or non-blocked transactions); the application's Transactions per cycle property may need to be adjusted. When doing so, consider the following factors:

- How many tags must be read from each channel?
- How often is data written to each channel?
- Is the channel using a serial or Ethernet driver?
- Does the driver read tags in separate requests, or are multiple tags read in a block?
- Have the device's Timing properties (such as Request timeout and Fail after x successive timeouts) been optimized for the virtual network's communication medium?

## Device Setup

The maximum number of supported devices is 247 per channel.

Device properties are organized into groups. Click on a link below for details about the properties in that group.

[Identification](#)

[Operating Mode](#)

[Scan Mode](#)

[Timing](#)

[Auto-Demotion](#)

[Tag Generation](#)

[Block Sizes](#)

[Variable Import Settings](#)

[Settings](#)

[Error Handling](#)

[Redundancy](#)

## Device Properties — General

| Property Groups          |  |                     |
|--------------------------|--|---------------------|
| <b>General</b>           | <input type="checkbox"/> <b>Identification</b> |                     |
| Scan Mode                | Name   | Modbus_ASCII        |
| Timing                   | Description                                    |                     |
| Auto-Demotion            | Channel Assignment                             | Modbus_ASCII        |
| Tag Generation           | Driver   | Modbus_ASCII_Serial |
| Block Sizes              | Model  | Modbus_Ascii        |
| Variable Import Settings | ID Format                                      | Decimal             |
| Settings                 | ID   | 1                   |
| Error Handling           | <input type="checkbox"/> <b>Operating Mode</b> |                     |
| Redundancy               | Data Collection                                | Enable              |
|                          | Simulated                                      | No                  |

### Identification

**Name:** User-defined identity of this device.

**Description:** User-defined information about this device.

**Channel Assignment:** User-defined name of the channel to which this device currently belongs.

**Driver:** Selected protocol driver for this device.

**Model:** The specific version of the device.

**ID Format:** Select how the device identity is formatted. Options include Decimal, Octal, and Hex.

**ID:** the unique device number. Modbus Serial devices are assigned device IDs in the range of 1 to 247.

### Operating Mode

**Data Collection:** This property controls the device's active state. Although device communications are enabled by default, this property can be used to disable a physical device. Communications are not attempted when a device is disabled. From a client standpoint, the data is marked as invalid and write operations are not accepted. This property can be changed at any time through this property or the device system tags.

**Simulated:** This option places the device into Simulation Mode. In this mode, the driver does not attempt to communicate with the physical device, but the server continues to return valid OPC data. Simulated stops physical communications with the device, but allows OPC data to be returned to the OPC client as valid data. While in Simulation Mode, the server treats all device data as reflective: whatever is written to the simulated device is read back and each OPC item is treated individually. The item's memory map is based on the group Update Rate. The data is not saved if the server removes the item (such as when the server is reinitialized). The default is No.

**Notes:**

1. This System tag (\_Simulated) is read only and cannot be written to for runtime protection. The System tag allows this property to be monitored from the client.
2. In Simulation mode, the item's memory map is based on client update rate(s) (Group Update Rate for OPC clients or Scan Rate for native and DDE interfaces). This means that two clients that reference the same item with different update rates return different data.

Simulation Mode is for test and simulation purposes only. It should never be used in a production environment.

## Device Properties — Scan Mode

The Scan Mode specifies the subscribed-client requested scan rate for tags that require device communications. Synchronous and asynchronous device reads and writes are processed as soon as possible; unaffected by the Scan Mode properties.

|                 |                            |                                      |
|-----------------|----------------------------|--------------------------------------|
| Property Groups | Scan Mode                  |                                      |
| General         | Scan Mode                  | Respect Client-Specified Scan Rate ▼ |
| Scan Mode       | Initial Updates from Cache | Disable                              |

**Scan Mode:** Specifies how tags in the device are scanned for updates sent to subscribing clients. Descriptions of the options are:

- **Respect Client-Specified Scan Rate:** This mode uses the scan rate requested by the client.
- **Request Data No Faster than Scan Rate:** This mode specifies the value set as the maximum scan rate. The valid range is 10 to 99999990 milliseconds. The default is 1000 milliseconds.
  - **Note:** When the server has an active client and items for the device and the scan rate value is increased, the changes take effect immediately. When the scan rate value is decreased, the changes do not take effect until all client applications have been disconnected.
- **Request All Data at Scan Rate:** This mode forces tags to be scanned at the specified rate for subscribed clients. The valid range is 10 to 99999990 milliseconds. The default is 1000 milliseconds.
- **Do Not Scan, Demand Poll Only:** This mode does not periodically poll tags that belong to the device nor perform a read to get an item's initial value once it becomes active. It is the client's responsibility to poll for updates, either by writing to the \_DemandPoll tag or by issuing explicit device reads for individual items. *For more information, refer to "Device Demand Poll" in server help.*

- **Respect Tag-Specified Scan Rate:** This mode forces static tags to be scanned at the rate specified in their static configuration tag properties. Dynamic tags are scanned at the client-specified scan rate.

**Initial Updates from Cache:** When enabled, this option allows the server to provide the first updates for newly activated tag references from stored (cached) data. Cache updates can only be provided when the new item reference shares the same address, scan rate, data type, client access, and scaling properties. A device read is used for the initial update for the first client reference only. The default is disabled; any time a client activates a tag reference the server attempts to read the initial value from the device.

## Device Properties — Timing

The device Timing properties allow the driver's response to error conditions to be tailored to fit the application's needs. In many cases, the environment requires changes to these properties for optimum performance. Factors such as electrically generated noise, modem delays, and poor physical connections can influence how many errors or timeouts a communications driver encounters. Timing properties are specific to each configured device.

|                 |  |      |
|-----------------|--|------|
| Property Groups | <input type="checkbox"/> <b>Communication Timeouts</b> |      |
| General         | Connect Timeout (s)                                    | 3    |
| Scan Mode       | Request Timeout (ms)                                   | 1000 |
| <b>Timing</b>   | Attempts Before Timeout                                | 3    |
| Redundancy      | <input type="checkbox"/> <b>Timing</b>                 |      |
|                 | Inter-Request Delay (ms)                               | 0    |

### Communications Timeouts

**Connect Timeout:** This property (which is used primarily by Ethernet based drivers) controls the amount of time required to establish a socket connection to a remote device. The device's connection time often takes longer than normal communications requests to that same device. The valid range is 1 to 30 seconds. The default is typically 3 seconds, but can vary depending on the driver's specific nature. If this setting is not supported by the driver, it is disabled.

● **Note:** Due to the nature of UDP connections, the connection timeout setting is not applicable when communicating via UDP.

**Request Timeout:** This property specifies an interval used by all drivers to determine how long the driver waits for a response from the target device to complete. The valid range is 50 to 9,999,999 milliseconds (167.6667 minutes). The default is usually 1000 milliseconds, but can vary depending on the driver. The default timeout for most serial drivers is based on a baud rate of 9600 baud or better. When using a driver at lower baud rates, increase the timeout to compensate for the increased time required to acquire data.

**Attempts Before Timeout:** This property specifies how many times the driver issues a communications request before considering the request to have failed and the device to be in error. The valid range is 1 to 10. The default is typically 3, but can vary depending on the driver's specific nature. The number of attempts configured for an application depends largely on the communications environment. This property applies to both connection attempts and request attempts.

### Timing

**Inter-Request Delay:** This property specifies how long the driver waits before sending the next request to the target device. It overrides the normal polling frequency of tags associated with the device, as well as one-time reads and writes. This delay can be useful when dealing with devices with slow turnaround times and in cases where network load is a concern. Configuring a delay for a device affects communications with

all other devices on the channel. It is recommended that users separate any device that requires an inter-request delay to a separate channel if possible. Other communications properties (such as communication serialization) can extend this delay. The valid range is 0 to 300,000 milliseconds; however, some drivers may limit the maximum value due to a function of their particular design. The default is 0, which indicates no delay between requests with the target device.

● **Note:** Not all drivers support Inter-Request Delay. This setting does not appear if it is not available.

## Device Properties — Auto-Demotion

The Auto-Demotion properties can temporarily place a device off-scan in the event that a device is not responding. By placing a non-responsive device offline for a specific time period, the driver can continue to optimize its communications with other devices on the same channel. After the time period has been reached, the driver re-attempts to communicate with the non-responsive device. If the device is responsive, the device is placed on-scan; otherwise, it restarts its off-scan time period.

|                      |                               |          |
|----------------------|-------------------------------|----------|
| Property Groups      | ☐ <b>Auto-Demotion</b>        |          |
| General              | Demote on Failure             | Enable ▾ |
| Scan Mode            | Timeouts to Demote            | 3        |
| Timing               | Demotion Period (ms)          | 10000    |
| <b>Auto-Demotion</b> | Discard Requests when Demoted | Disable  |

**Demote on Failure:** When enabled, the device is automatically taken off-scan until it is responding again.

● **Tip:** Determine when a device is off-scan by monitoring its demoted state using the `_AutoDemoted` system tag.

**Timeouts to Demote:** Specify how many successive cycles of request timeouts and retries occur before the device is placed off-scan. The valid range is 1 to 30 successive failures. The default is 3.

**Demotion Period:** Indicate how long the device should be placed off-scan when the timeouts value is reached. During this period, no read requests are sent to the device and all data associated with the read requests are set to bad quality. When this period expires, the driver places the device on-scan and allows for another attempt at communications. The valid range is 100 to 3600000 milliseconds. The default is 10000 milliseconds.

**Discard Requests when Demoted:** Select whether or not write requests should be attempted during the off-scan period. Disable to always send write requests regardless of the demotion period. Enable to discard writes; the server automatically fails any write request received from a client and does not post a message to the Event Log.

## Device Properties — Tag Generation

The automatic tag database generation features make setting up an application a plug-and-play operation. Select communications drivers can be configured to automatically build a list of tags that correspond to device-specific data. These automatically generated tags (which depend on the nature of the supporting driver) can be browsed from the clients.

● *Not all devices and drivers support full automatic tag database generation and not all support the same data types. Consult the data types descriptions or the supported data type lists for each driver for specifics.*

If the target device supports its own local tag database, the driver reads the device's tag information and uses the data to generate tags within the server. If the device does not natively support named tags, the

driver creates a list of tags based on driver-specific information. An example of these two conditions is as follows:

1. If a data acquisition system supports its own local tag database, the communications driver uses the tag names found in the device to build the server's tags.
2. If an Ethernet I/O system supports detection of its own available I/O module types, the communications driver automatically generates tags in the server that are based on the types of I/O modules plugged into the Ethernet I/O rack.

● **Note:** Automatic tag database generation's mode of operation is completely configurable. *For more information, refer to the property descriptions below.*

| Property Groups       | Tag Generation                          |                            |
|-----------------------|---|----------------------------|
| General               | On Property Change                      | Yes                        |
| Scan Mode             | On Device Startup                       | Do Not Generate on Startup |
| Timing                | On Duplicate Tag                        | Delete on Create           |
| Auto-Demotion         | Parent Group                            |                            |
| <b>Tag Generation</b> | Allow Automatically Generated Subgroups | Enable                     |
| Redundancy            | Create                                  | Create tags                |

**On Property Change:** If the device supports automatic tag generation when certain properties change, the **On Property Change** option is shown. It is set to **Yes** by default, but it can be set to **No** to control over when tag generation is performed. In this case, the **Create tags** action must be manually invoked to perform tag generation.

**On Device Startup:** This property specifies when OPC tags are automatically generated. Descriptions of the options are as follows:

- **Do Not Generate on Startup:** This option prevents the driver from adding any OPC tags to the tag space of the server. This is the default setting.
- **Always Generate on Startup:** This option causes the driver to evaluate the device for tag information. It also adds tags to the tag space of the server every time the server is launched.
- **Generate on First Startup:** This option causes the driver to evaluate the target device for tag information the first time the project is run. It also adds any OPC tags to the server tag space as needed.

● **Note:** When the option to automatically generate OPC tags is selected, any tags that are added to the server's tag space must be saved with the project. Users can configure the project to automatically save from the **Tools | Options** menu.

**On Duplicate Tag:** When automatic tag database generation is enabled, the server needs to know what to do with the tags that it may have previously added or with tags that have been added or modified after the communications driver since their original creation. This setting controls how the server handles OPC tags that were automatically generated and currently exist in the project. It also prevents automatically generated tags from accumulating in the server.

For example, if a user changes the I/O modules in the rack with the server configured to **Always Generate on Startup**, new tags would be added to the server every time the communications driver detected a new I/O module. If the old tags were not removed, many unused tags could accumulate in the server's tag space. The options are:



- **Delete on Create:** This option deletes any tags that were previously added to the tag space before any new tags are added. This is the default setting.
- **Overwrite as Necessary:** This option instructs the server to only remove the tags that the communications driver is replacing with new tags. Any tags that are not being overwritten remain in the server's tag space.
- **Do not Overwrite:** This option prevents the server from removing any tags that were previously generated or already existed in the server. The communications driver can only add tags that are completely new.
- **Do not Overwrite, Log Error:** This option has the same effect as the prior option, and also posts an error message to the server's Event Log when a tag overwrite would have occurred.

● **Note:** Removing OPC tags affects tags that have been automatically generated by the communications driver as well as any tags that have been added using names that match generated tags. Users should avoid adding tags to the server using names that may match tags that are automatically generated by the driver.

**Parent Group:** This property keeps automatically generated tags from mixing with tags that have been entered manually by specifying a group to be used for automatically generated tags. The name of the group can be up to 256 characters. This parent group provides a root branch to which all automatically generated tags are added.

**Allow Automatically Generated Subgroups:** This property controls whether the server automatically creates subgroups for the automatically generated tags. This is the default setting. If disabled, the server generates the device's tags in a flat list without any grouping. In the server project, the resulting tags are named with the address value. For example, the tag names are not retained during the generation process.

● **Note:** If, as the server is generating tags, a tag is assigned the same name as an existing tag, the system automatically increments to the next highest number so that the tag name is not duplicated. For example, if the generation process creates a tag named "AI22" that already exists, it creates the tag as "AI23" instead.

**Create:** Initiates the creation of automatically generated OPC tags. If the device's configuration has been modified, **Create tags** forces the driver to reevaluate the device for possible tag changes. Its ability to be accessed from the System tags allows a client application to initiate tag database creation.

● **Note:** **Create tags** is disabled if the Configuration edits a project offline.

## Device Properties — Block Sizes

|                          |   |         |
|--------------------------|---|---------|
| Property Groups          | [-] <b>Coils (8-2000 in multiples of 8)</b> |         |
| General                  | Output Coils                                | 32      |
| Scan Mode                | Input Coils                                 | 32      |
| Timing                   | [-] <b>Registers (1-120)</b>                |         |
| Auto-Demotion            | Internal Registers                          | 32      |
| Tag Generation           | Holding Registers                           | 32      |
| <b>Block Sizes</b>       | [-] <b>Block Sizes</b>                      |         |
| Variable Import Settings | Block Read Strings                          | Disable |
| Settings                 |   |         |
| Error Handling           |   |         |
| Redundancy               |   |         |

### Coils

**Output Coils:** Coils can be read from 8 to 2000 points (bits) at a time. A higher block size means more points are read from the device in a single request. Block size can be reduced if data needs to be read from non-contiguous locations within the device.

**Input Coils:** Coils can be read from 8 to 2000 points (bits) at a time. A higher block size means more points are read from the device in a single request. Block size can be reduced if data needs to be read from non-contiguous locations within the device.

## Registers

**Internal Registers:** Registers can be read from 1 to 100 locations (words) at a time. A higher block size means more register values are read from the device in a single request. Block size can be reduced if data needs to be read from non-contiguous locations within the device.

**Holding Registers:** Registers can be read from 1 to 100 locations (words) at a time. A higher block size means more register values are read from the device in a single request. Block size can be reduced if data needs to be read from non-contiguous locations within the device.

⚠ **Caution:** If the register block sizes value is set above 120 and a 32- or 64-bit data type is used for any tag, an error can occur. To prevent errors from occurring, decrease the block size value to 120.

## Block Sizes

**Block Read Strings:** Enable this option to block read string tags, which are normally read individually. When this option is enabled, string tags are grouped together depending on the selected block size. Block reads can only be performed for Modbus model string tags.

## Device Properties — Variable Import Settings

📘 For more information on CSV files for Modbus Drivers, refer to [Creating CSV Files for Modbus Drivers](#).

|                                 |                                 |           |
|---------------------------------|---------------------------------|-----------|
| Property Groups                 | <b>Variable Import Settings</b> |           |
| Tag Generation                  | Variable Import File            | *.txt ... |
| Block Sizes                     | Include Descriptions            | Enable    |
| <b>Variable Import Settings</b> |                                 |           |
| Settings                        |                                 |           |
| Error Handling                  |                                 |           |

**Variable Import File:** Specifies the exact location and name of the semicolon-delimited text file the driver should use for automatic tag generation. Variable import files can be created from many applications.

**Include Descriptions:** When enabled, tag descriptions are imported if present in the file. The default setting is enabled.

📘 For more information on configuring the Automatic Tag Database Generation feature and creating a variable import file, refer to [Automatic Tag Database Generation](#).

📘 For specific information on creating the variable import file from Concept and ProWORX, consult Technical Note "Creating CSV Files for Modbus Drivers."

## Device Properties — Settings

|                          |   |         |
|--------------------------|---|---------|
| Property Groups          | <input type="checkbox"/> <b>Data Access</b>   |         |
| General                  | Zero-Based Addressing                         | Enable  |
| Scan Mode                | Zero-Based Bit Addressing                     | Enable  |
| Timing                   | Holding Register Bit Writes                   | Disable |
| Auto-Demotion            | Modbus Function 06                            | Enable  |
| Tag Generation           | Modbus Function 05                            | Enable  |
| Block Sizes              | <input type="checkbox"/> <b>Data Encoding</b> |         |
| Variable Import Settings | Modbus Byte Order                             | Enable  |
| <b>Settings</b>          | First Word Low                                | Enable  |
| Error Handling           | First DWord Low                               | Enable  |
| Redundancy               | Modicon Bit Order                             | Disable |

## Data Access

**Zero-Based Addressing** : If the address numbering convention for the device starts at one as opposed to zero, users can specify it when defining the device's properties. By default, user-entered addresses have one subtracted when frames are constructed to communicate with a Modbus device. If the device doesn't follow this convention, users can disable the zero-based addressing. The default behavior (zero-based) follows the convention of the Modicon PLCs.

**Zero-Based Bit Addressing**: For memory types that allow bits within Words can be referenced as a Boolean, the addressing notation is `<address>.<bit>` where `<bit>` represents the bit number within the Word. Addressing within registers provides two ways of addressing a bit within a given Word. Zero-based bit addressing within registers means the first bit begins at 0. One-based addressing within registers means that the first bit begins at 1. For data type Word, the bit range with zero-bit addressing is 0-15; whereas the range for one-based bit addressing is 1-16.

**Holding Register Bit Writes**: When writing to a bit location within a holding register, the driver should only modify the bit of interest. Some devices support a command to manipulate a single bit within a register (Function code hex 0x16 or decimal 22). If the device does not support this feature, the driver must perform a Read/Modify/Write operation to ensure that only the single bit is changed. Enable if the device supports holding register bit access. The default setting is disabled. If this setting is enabled, the driver uses function code 0x16 regardless of the setting for Modbus Function 06 for register writes. If this setting is not selected, the driver uses either function code 0x06 or 0x10, depending on the setting for Modbus Function 06.

● **Note**: When Modbus byte order is not selected, the byte order of the masks sent in the command is Intel byte order.

**Modbus Function 06**: The Modbus driver has the option of using two Modbus protocol functions to write holding register data to the target device. In most cases, the driver switches between these two functions based on the number of registers being written. When writing a single 16-bit register, the driver generally uses Modbus function 06. When writing a 32-bit value into two registers, the driver uses Modbus function 16. For the standard Modicon PLC, the use of either of these functions is not a problem. There are, however, a number of third-party devices using the Modbus protocol and many of these devices support only the use of Modbus function 16 to write to holding registers regardless of the number of registers to be written. Use function 06 can be used to force the driver to use only Modbus function 16 if needed. This selection is enabled by default. It allows the driver to switch between 06 and 16 as needed. If the device requires all writes to be done using only Modbus function 16, disable this selection.

● **Note**: For bit within word writes, the Holding Register Bit Writes property takes precedence over this property (Modbus Function 06). If Holding Register Bit Writes is selected, then function code 0x16 is used regard-

less of the selection for this property. However, if Holding Register Bit Writes is not selected, depending on the selection of this property, either function code 0x06 or 0x10 is used for bit within word writes.

**Use Function 05:** The Modbus driver has the option of using two Modbus protocol functions to write output coil data to the target device. In most cases, the driver switches between these two functions based on the number of coils being written. When writing a single coil, the driver uses Modbus function 05. When writing an array of coils, the driver uses Modbus function 15. For the standard Modicon PLC, the use of either of these functions is not a problem. There are, however, a number of third-party devices using the Modbus protocol and many of these devices support only the use of Modbus function 15 to write to output coils regardless of the number of coils to be written. Modbus Function 05 can be used to force the driver to use only Modbus function 15 if needed. This selection is enabled by default. It allows the driver to switch between 05 and 15 as needed. If a device requires all writes to be done using only Modbus function 15, disable this selection.

**Data Encoding**

**Modbus Byte Order:** The driver's byte order can be changed from the default Modbus byte ordering to Intel byte ordering by using this selection. Modbus Byte Order sets the data encoding of each register / 16-bit value. This election is enabled by default, which is the normal setting for Modbus compatible devices. If the device uses Intel byte ordering, disabling this selection allows the Modbus driver to properly read Intel formatted data.

**First Word Low:** Two consecutive registers' addresses in a Modbus device are used for 32-bit data types. Users can specify whether the driver should assume the first word is the low or the high word of the 32-bit value and each double word of a 64-bit value. The default, first word low, follows the convention of the Modicon Modsoft programming software.

**First DWord Low:** Four consecutive registers' addresses in a Modbus device are used for 64-bit data types. Users can specify whether the driver should assume the first DWord is the low or the high DWord of the 64-bit value. The default, first DWord low, follows the default convention of 64-bit data types.

**Modicon Bit Order:** When enabled, the driver reverses the bit order on reads and writes to registers to follow the convention of the Modicon Modsoft programming software. For example, a write to address 40001.0/1 affects bit 15/16 in the device when this option is enabled. This option is disabled by default.

**Note:** For the following example, the 1st through 16th bit signifies either 0-15 bits or 1-16 bits depending on if the driver is set at zero-based or one-based bit addressing within registers.

MSB = Most Significant Bit  
 LSB = Least Significant Bit

**Modicon Bit Order Enabled**

|            |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |
|------------|---|---|---|---|---|---|---|------------|----|----|----|----|----|----|----|
| <b>MSB</b> |   |   |   |   |   |   |   | <b>LSB</b> |    |    |    |    |    |    |    |
| 1          | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9          | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

**Modicon Bit Order Disabled**

|            |    |    |    |    |    |    |   |            |   |   |   |   |   |   |   |
|------------|----|----|----|----|----|----|---|------------|---|---|---|---|---|---|---|
| <b>MSB</b> |    |    |    |    |    |    |   | <b>LSB</b> |   |   |   |   |   |   |   |
| 16         | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8          | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

| Data Types               | Modbus Byte Order | First Word Low | First DWord Low |
|--------------------------|-------------------|----------------|-----------------|
| Word, Short, BCD         | Applicable        | N/A            | N/A             |
| Float, DWord, Long, LBCD | Applicable        | Applicable     | N/A             |
| Double                   | Applicable        | Applicable     | Applicable      |

| Data Encoding Group Option  | Data Encoding   |  |
|-----------------------------|---|--|
| Modbus Byte Order - Enable  | High Byte (15..8)   | Low Byte (7..0)  |
| Modbus Byte Order - Disable | Low Byte (7..0)   | High Byte (15..8)  |
| First Word Low - Disabled   | High Word (31..16)<br>High Word(63..48) of Double Word in 64-bit data types | Low Word (15..0)<br>Low Word (47..32) of Double Word in 64-bit data types    |
| First Word Low - Enabled    | Low Word (15..0)<br>Low Word (47..32) of Double Word in 64-bit data types   | High Word (31..16)<br>High Word (63..48) of Double Word in 64-bit data types |
| First DWord Low - Disabled  | High Double Word (63..32)   | Low Double Word (31..0)  |
| First DWord Low - Enabled   | Low Double Word (31..0)   | High Double Word (63..32)  |

🟢 The default settings are correct for the majority of Modbus devices, but the particular device's documentation can determine the correct settings of the data encoding options.

## Device Properties — Error Handling

|                          |   |        |
|--------------------------|---|--------|
| Property Groups          | <input checked="" type="checkbox"/> <b>Error Handling</b> |        |
| Block Sizes              | Deactivate Tags on Illegal Address                        | Enable |
| Variable Import Settings |   |        |
| Settings                 |   |        |
| <b>Error Handling</b>    |   |        |
| Redundancy               |   |        |

**Deactivate Tags on Illegal Address:** If a device returns Modbus exception code 2 (illegal address) or 3 (illegal data, such as number of points) in response to a read of a block, the driver can stop polling the block with the errors or continue trying to poll the block. Select Enable to stop polling on an illegal address error. Select disable to continue to poll that data block. Restarting the server is not required to activate a deactivated block. The default setting is enabled.

## Device Properties — Redundancy

|                   |  |                   |
|-------------------|--|-------------------|
| Property Groups   | <input type="checkbox"/> <b>Redundancy</b> |                   |
| General           | Secondary Path                             | ...               |
| Scan Mode         | Operating Mode                             | Switch On Failure |
| Timing            | Monitor Item                               |                   |
| <b>Redundancy</b> | Monitor Interval (s)                       | 300               |
|                   | Return to Primary ASAP                     | Yes               |

Redundancy is available with the Media-Level Redundancy Plug-In.

• Consult the website, a sales representative, or the user manual for more information.

## Automatic Tag Database Generation

The Modbus ASCII Driver makes use of the Automatic Tag Database Generation feature. This enables drivers to automatically create tags that access data points used by the device's ladder program. While it is sometimes possible to query a device for the information needed to build a tag database, this driver must use a Variable Import File instead. Variable import files can be generated using device programming applications, such as Concept and ProWORX.

### Creating the Variable Import File

The import file must be in semicolon-delimited .TXT format, which is the default export file format of the Concept device programming application. The ProWORX programming application can export variable data in this format.

• For specific information on creating the variable import file from Concept and ProWORX, consult Technical Note "Creating CSV Files for Modbus Drivers."

### Server Configuration

The automatic tag database generation feature can be customized to fit the application's needs. The primary control options can be set during the Database Creation step of the Device Wizard or later by selecting the device then **Properties | Tag Generation**.

• For more information, refer to the server help documentation.

This driver requires specialized properties in addition to the basic settings that are common to all drivers that support automatic tag database generation. These specialized properties include the name and location of the variable import file. This information can be specified during the Variable Import Settings step of the Device Wizard or later by selecting the device then **Properties | Variable Import Settings**.

• For more information, refer to [Variable Import Settings](#).

### Operation

Depending on the configuration, tag generation may start automatically when the server project starts or be initiated manually at some other time. The Event Log shows when the tag generation process started, any errors that occurred while processing the variable import file and when the process completed.

## Data Types Description

| Data Type | Description                                   |
|-----------|---|
| Boolean   | Single bit                                    |
| Word      | Unsigned 16-bit value<br>bit 0 is the low bit |

|                |  |
|----------------|--|
|                | bit 15 is the high bit   |
| Short          | Signed 16-bit value<br><br>bit 0 is the low bit<br>bit 14 is the high bit<br>bit 15 is the sign bit  |
| DWord          | Unsigned 32-bit value<br><br>bit 0 is the low bit<br>bit 31 is the high bit  |
| Long           | Signed 32-bit value<br><br>bit 0 is the low bit<br>bit 30 is the high bit<br>bit 31 is the sign bit  |
| BCD            | Two byte packed BCD<br><br>Value range is 0-9999. Behavior is undefined for values beyond this range.  |
| LBCD           | Four byte packed BCD<br><br>Value range is 0-99999999. Behavior is undefined for values beyond this range.   |
| String         | Null terminated ASCII string<br><br>Supported on Modbus Model, includes Hi-Lo Lo-Hi byte order selection.  |
| Double*        | 64-bit floating point value<br><br>The driver interprets four consecutive registers as a double precision value by making the last two registers the high DWord and the first two registers the low DWord. |
| Double Example | If register 40001 is specified as a double, bit 0 of register 40001 would be bit 0 of the 64-bit data type and bit 15 of register 40004 would be bit 63 of the 64-bit data type.                           |
| Float*         | 32-bit floating point value<br><br>The driver interprets two consecutive registers as a single precision value by making the last register the high word and the first register the low word.              |
| Float Example  | If register 40001 is specified as a float, bit 0 of register 40001 would be bit 0 of the 32-bit data type and bit 15 of register 40002 would be bit 31 of the 32-bit data type.                            |

\*The descriptions above assume the default settings; that is, first DWord low data handling of 64-bit data types and first word low data handling of 32-bit data types.

## Address Descriptions

Address specifications vary depending on the model in use. Select a link from the following list to obtain specific address information for the model of interest.

[Modbus ASCII Addressing](#)

[Flow Computer Addressing](#)

[Flow Automation Addressing](#)

## Modbus ASCII Addressing

### 5-Digit Addressing vs. 6-Digit Addressing

In Modbus addressing, the first digit of the address specifies the primary table. The remaining digits represent the device's data item. The maximum value is a two byte unsigned integer (65,535). Six digits are required to represent the entire address table and item. As such, addresses that are specified in the device's manual as 0xxxx, 1xxxx, 3xxxx, or 4xxxx are padded with an extra zero once applied to the Address field of a Modbus tag.

| Primary Table | Description        |
|---------------|--------------------|
| 0             | Output Coils       |
| 1             | Input Coils        |
| 3             | Internal Registers |
| 4             | Holding Registers  |

### Modbus ASCII Addressing

The default data types for dynamically defined tags are shown in **bold**.

• For notes and restrictions, refer to [Packed Coil Tags](#), [String Support](#), and [Array Support](#).

| Address   | Range   | Data Type   | Access     | Function Codes* |
|---|---|---|------------|-----------------|
| Output Coils                                      | 000001-065536<br>000001#1-065521#16   | <b>Boolean</b><br>Word (Packed Coil Tag)                                  | Read/Write | 01, 05, 15**    |
| Input Coils                                       | 100001-165536<br>100001#1-165521#16   | <b>Boolean</b><br>Word (Packed Coil Tag)                                  | Read Only  | 02**            |
| Internal Registers                                | 300001-365536<br>300001-365535<br>300001-365533<br>3xxxxx.0/1-<br>3xxxxx.15/16*** | <b>Word</b> , Short, BCD<br>Float, DWord, Long, LBCD<br>Double<br>Boolean | Read Only  | 04              |
| Internal Registers As String with HiLo Byte Order | 300001.2H-365536.240H<br><br>.Bit is string length, range 2 to 240 bytes.         | <b>String</b>   | Read Only  | 04              |
| Internal Registers As String with LoHi Byte Order | 300001.2L-365536.240L<br><br>.Bit is string length, range 2 to 240 bytes.         | <b>String</b>   | Read Only  | 04              |
| Holding Registers                                 | 400001-465536<br>400001-465535<br>400001-465533                                   | <b>Word</b> , Short, BCD<br>Float, DWord,                                 | Read/Write | 03, 06, 16      |



| Address   | Range  | Data Type                       | Access     | Function Codes*   |
|---|--|---------------------------------|------------|-------------------|
|   | 4xxxxx.0/1-<br>4xxxxx.15/16***   | Long, LBCD<br>Double<br>Boolean |            | 03, 06, 16,<br>22 |
| Holding Registers As String with<br>HiLo Byte Order | 400001.240H-465536.2H<br><br>.Bit is string length,<br>range 2 to 240 bytes. | <b>String</b>                   | Read/Write | 03, 16            |
| Holding Registers As String with<br>LoHi Byte Order | 400001.2L-465536.240L<br><br>.Bit is string length,<br>range 2 to 240 bytes. | <b>String</b>                   | Read/Write | 03, 16            |

\*The supported Function Codes are displayed in decimal. For more information, refer to [Function Codes Description](#).

\*\*For more information, refer to [Packed Coil Tags](#).

\*\*\*For more information, refer to the Use Zero-Based Bit Addressing subtopic in [Settings](#).

### Write-Only Access

All Read/Write addresses may be set as Write Only by prefixing a "W" to the address such as "W40001", which prevents the driver from reading the register at the specified address. Any attempts by the client to read a Write Only tag result in obtaining the last successful write value to the specified address. If no successful writes have occurred, then the client receives 0/NULL for numeric / string values for an initial value.

**Caution:** Setting the Client Access privileges of Write Only tags to Read Only causes writes to these tags to fail and the client to always receive 0 / NULL for numeric / string values.

### Packed Coil Tags

The Packed Coil address type allows access to multiple consecutive coils as an analog value. This feature is available for the Modbus ASCII model only. The only valid data type is Word. The syntax is as follows.

Output coils: 0xxxxx#nn Word Read/Write

Input coils: 1xxxxx#nn Word Read Only

where xxxxx is the address of the first coil, and nn is the number of coils to be packed into an analog value (1-16).

The bit order is such that the start address is the LSB (least significant bit) of the analog value.

### String Support

The Modbus model supports reading and writing holding register memory as an ASCII string. When using holding registers for string data, each register contains two bytes of ASCII data. The order of the ASCII data within a given register can be selected when the string is defined. The length of the string can be from 2 to 240 bytes and is entered in place of a bit number. The length must be entered as an even number. The byte order is specified by appending either a "H" or "L" to the address.

**For information on how to perform block read on string tags for the Modbus model, refer to [Block Sizes](#).**

### String Examples

1. To address a string starting at 40200 with a length of 100 bytes and HiLo byte order, enter:  
40200.100H
2. To address a string starting at 40500 with a length of 78 bytes and LoHi byte order, enter: 40500.78L

● **Note:** The string length may be limited by the maximum size of the write request that the device allows. If the error message "Unable to write to address <address> on device <device>: Device responded with exception code 3" is received while utilizing a string tag, the device did not like the string's length. If possible, try shortening the string.

### Normal Address Examples

1. The 255th output coil would be addressed as '0255' using decimal addressing.
2. Some documentation refers to Modbus addresses by function code and location. For instance, function code 3; location 2000 would be addressed as '42000' (the leading '4' represents holding registers or function code 3).
3. Some documentation refers to Modbus addresses by function code and location. For instance, setting function code 5 location 100 would be addressed as '0100' (the leading '0' represents output coils or function code 5). Writing 1 or 0 to this address would set or reset the coil.

### Array Support

Arrays are supported for internal and holding register locations for all data types except for Boolean and strings. Arrays are also supported for input and output coils (Boolean data types). There are two methods of addressing an array. Examples are given using holding register locations.

4xxxx [rows] [cols]

4xxxx [cols] this method assumes rows is equal to one

For arrays, rows multiplied by cols cannot exceed the block size that has been assigned to the device for the register / coil type. For register arrays of 32-bit data types, rows multiplied by cols multiplied by 2 cannot exceed the block size.

### Function Codes Description

| Decimal | Hexadecimal | Description               |
|---------|-------------|---------------------------|
| 01      | 0x01        | Read Coil Status          |
| 02      | 0x02        | Read Input Status         |
| 03      | 0x03        | Read Holding Registers    |
| 04      | 0x04        | Read Internal Registers   |
| 05      | 0x05        | Force Single Coil         |
| 06      | 0x06        | Preset Single Register    |
| 15      | 0x0F        | Force Multiple Coils      |
| 16      | 0x10        | Preset Multiple Registers |
| 22      | 0x16        | Masked Write Register     |

## Flow Computer Addressing

The default data types for dynamically defined tags are shown in **bold**.

| Address                 | Range                              | Data Type   | Access     |
|-------------------------|------------------------------------|---|------------|
| Output Coils            | 000001-065536                      | Boolean   | Read/Write |
| Input Coils             | 100001-165536                      | Boolean   | Read Only  |
| Internal Registers      | 300001-365536<br>300001-<br>365535 | <b>Word</b> , Short, BCD<br>Float, DWord, Long, LBCD    | Read Only  |
| Holding Registers       | 400001-465536<br>400001-<br>465535 | <b>Word</b> , Short, BCD*, Float, DWord, Long, LBCD     | Read/Write |
| Flow Computer Registers | 405000-406800<br>407000-<br>407800 | <b>Long</b> , DWord, LBCD<br><b>Float</b> , Long, DWord | Read/Write |

\*Address ranges 405000 to 406800 and 407000 to 407800 are 32-bit registers. Addresses in the range of 405000 to 406800 use a default data type of Long. Addresses in the range of 407000 to 407800 use a default data type of Float. Since these address registers are 32 bit, only Float, DWord, Long or LBCD data types are allowed. Arrays are not allowed for these special address ranges.

### Arrays

Arrays are supported for internal and holding register locations for all data types except for Boolean. There are two methods of addressing an array. Examples are given using holding register locations.

4xxxx [rows] [cols]

4xxxx [cols] this method assumes rows is equal to one

Rows multiplied by cols cannot exceed the block size that has been assigned to the device for the register type. For arrays of 32-bit data types, rows multiplied by cols multiplied by 2 cannot exceed the block size.

## Flow Automation Addressing

The default data types for dynamically defined tags are shown in **bold**.

| Address                 | Range        | Data Type    | Access     |
|-------------------------|--------------|--------------|------------|
| Flow Computer Registers | 40001-465535 | <b>Float</b> | Read/Write |

The Flow Automation Flow Computer treats all data as a 32-bit floating point value. All addresses in the holding register space of the device are read as 32-bit floating point numbers. A complete memory map of the flow automation control is provided in the custom report section of the flow automation manual.

## Event Log Messages

The following information concerns messages posted to the Event Log pane in the main user interface. Consult the server help on filtering and sorting the Event Log detail view. Server help contains many common

messages, so should also be searched. Generally, the type of message (informational, warning) and troubleshooting information is provided whenever possible.

---

**Bad address in block. | Block range = <address> to <address>.**

---

**Error Type:**

Error

**Possible Cause:**

An attempt has been made to reference a nonexistent location in the specified device.

**Possible Solution:**

Verify the tags assigned to addresses in the specified range on the device and eliminate ones that reference invalid locations.

---

**Bad array. | Array range = <start> to <end>.**

---

**Error Type:**

Error

**Possible Cause:**

An array of addresses was defined that spans past the end of the address space.

**Possible Solution:**

Verify the size of the device memory space and redefine the array length accordingly.

---

**Error opening file for tag database import. | OS error = '<error>'.**

---

**Error Type:**

Error

---

**Received block length does not match expected length. | Received length = <number> (bytes), Expected length = <number> (bytes).**

---

**Error Type:**

Warning

---

**Block request on device responded with exception. | Block Range = <address> to <address>, Exception = <code>.**

---

**Error Type:**

Warning

**Possible Cause:**

Communication with the device succeeded, but the device reported a problem.

**Possible Solution:**

Consult the device documentation for information about the error code provided.

**See Also:**

Modbus Exception Codes

---

**Unable to write to address on device. Device responded with exception. | Address = '<address>', Exception = <code>.**

---

**Error Type:**

Warning

**Possible Cause:**

Communication with the device succeeded, but the device reported a problem.

**Possible Solution:**

Consult the device documentation for information about the error code provided.

**See Also:**

Modbus Exception Codes

---

**Unable to read from address on device. Device responded with exception. | Address = '<address>', Exception = <code>.**

---

**Error Type:**

Warning

**Possible Cause:**

Communication with the device succeeded, but the device reported a problem.

**Possible Solution:**

Consult the device documentation for information about the error code provided.

**See Also:**

Modbus Exception Codes

---

**Tag import failed due to low memory resources.**

---

**Error Type:**

Warning

**Possible Cause:**

The driver could not allocate the memory required to process the variable import file.

**Possible Solution:**

Shut down unnecessary applications and try again.

---

**File exception encountered during tag import.**

---

**Error Type:**

Warning

**Possible Cause:**

The variable import file could not be read.

**Possible Solution:**

Correct or regenerate the variable import file.

**Error parsing record in import file. | Record number = <number>, Field = <number>.**

---

**Error Type:**

Warning

**Possible Cause:**

The specified field in the variable import file could not be parsed because it is longer than expected or invalid.

**Possible Solution:**

Edit the variable import file to correct the field.

**Description truncated for record in import file. | Record number = <number>.**

---

**Error Type:**

Warning

**Possible Cause:**

The tag description in the specified record is too long.

**Possible Solution:**

The description is shortened as needed. To prevent this error in the future, edit the variable import file to shorten the description.

**Imported tag name is invalid and has been changed. | Tag name = '<tag>', Changed tag name = '<tag>'.**

---

**Error Type:**

Warning

**Possible Cause:**

The tag name encountered in the variable import file contained invalid characters.

**Possible Solution:**

A valid name was constructed based on the variable import file. To prevent this error in the future and to maintain name consistency, change the name of the exported variable.

**A tag could not be imported because the data type is not supported. | Tag name = '<tag>', Unsupported data type = '<type>'.**

---

**Error Type:**

Warning

**Possible Cause:**

The data type specified in the variable import file is not one of the types supported by this driver.

**Possible Solution:**

Change the data type specified in import file to a supported types. If the variable is for a structure, edit file to define each tag required for the structure or configure the required tags in the server.

**See Also:**

[Exporting Variables from Concept](#)

**Importing tag database. | Source file = '<path>'.**

---

**Error Type:**

Informational


## Modbus Exception Codes

From Modbus Application Protocol Specifications documentation:

| Code Dec/Hex | Name                     | Meaning   |
|--------------|--------------------------|---|
| 01/0x01      | ILLEGAL FUNCTION         | The function code received in the query is not an allowable action for the server (or slave). This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the server (or slave) is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.  |
| 02/0x02      | ILLEGAL DATA ADDRESS     | The data address received in the query is not an allowable address for the server (or slave). More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, a request with offset 96 and length 4 would succeed, a request with offset 96 and length 5 generates exception 02.  |
| 03/0x03      | ILLEGAL DATA VALUE       | A value contained in the query data field is not an allowable value for server (or slave). This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the MODBUS protocol is unaware of the significance of any particular value of any particular register. |
| 04/0x04      | SLAVE DEVICE FAILURE     | An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.   |
| 05/0x05      | ACKNOWLEDGE              | The slave has accepted the request and is processing it, but a long duration of time is required. This response is returned to prevent a timeout error from occurring in the master. The master can next issue a Poll Program Complete message to determine if processing is completed.   |
| 06/0x06      | SLAVE DEVICE BUSY        | The slave is engaged in processing a long-duration program command. The master should retransmit the message later when the slave is free.  |
| 07/0x07      | NEGATIVE ACKNOWLEDGE     | The slave cannot perform the program function received in the query. This code is returned for an unsuccessful programming request using function code 13 or 14 decimal. The master should request diagnostic or error information from the slave.  |
| 08/0x08      | MEMORY PARITY ERROR      | The slave attempted to read extended memory, but detected a parity error in the memory. The master can retry the request, but service may be required on the slave device.  |
| 10/0x0A      | GATEWAY PATH UNAVAILABLE | Specialized use in conjunction with gateways, indicates that the gateway was unable to allocate an internal communication path from the input port to the output port for processing the request. This usually means that the gateway is misconfigured or overloaded.   |



| Code Dec/Hex | Name   | Meaning  |
|--------------|--|--|
| 11/0x0B      | GATEWAY<br>TARGET DEVICE<br>FAILED TO<br>RESPOND | Specialized use in conjunction with gateways, indicates that no response was obtained from the target device. Usually means that the device is not present on the network. |

 **Tip:** For this driver, the terms Slave and Unsolicited are used interchangeably.

## Error Mask Definitions

---

**B** = Hardware break detected

**F** = Framing error

**E** = I/O error

**O** = Character buffer overrun

**R** = RX buffer overrun

**P** = Received byte parity error

**T** = TX buffer full

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