# **Omron FINS Ethernet Driver**

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# **Table of Contents**

Omron FINS Ethernet Driver	1
Table of Contents	
Welcome to the Omron FINS Ethernet Driver Help Center	4
Overview	4
Setup	4
Channel Properties – General	5
Tag Counts	5
Channel Properties – Ethernet Communications	5
Channel Properties – Write Optimizations	6
Channel Properties – Communications Parameters	6
Channel Properties – Advanced	8
Device Properties – General	8
Device Properties – Scan Mode	9
Device Properties – Timing	
Device Properties – Auto-Demotion	
Device Properties – FINS Network Configuration	
Device Properties – Run Mode Settings	
Device Properties – Communications Parameters	
Device Properties – Redundancy	
FINS Networks	
Multihoming	17
Data Types Description	18
Address Descriptions	19
C200H Addressing	19
C500 Addressing	23
C1000H Addressing	
C2000H Addressing	
CV500 Addressing	
CV1000 Addressing	37
CV2000 Addressing	
CVM1-CPU01 Addressing	
CVM1-CPU11 Addressing	
CVM1-CPU21 Addressing	
CS1 Addressing	
CJ1 Addressing	
CJ2 Addressing	
Event Log Messages	71
Device responded with error.   Tag address = ' <address>', Data size = <byte number="">, Main error =</byte></address>	74
<pre><code>, Sub error = <code>.</code></code></pre>	
Device responded with local node error.   Main error = <code>, Sub error = <code>.</code></code>	
Device responded with destination node error.   Main error = <code>, Sub error = <code>.</code></code>	/ 1

Device responded with a communications error.   Main error = <code>, Sub error = <code>.</code></code>	.72
Device cannot process command.   Tag address = ' <address>', Data size = <byte number="">, Main error = <code>, Sub error = <code>.</code></code></byte></address>	.72
Device responded with routing table error.   Main error = <code>, Sub error = <code>.</code></code>	
Device responded with a command format error.   Tag address = ' <address>', Data size = <byte number="">, Main error = <code>, Sub error = <code>.</code></code></byte></address>	.72
Device responded with a command parameter error.   Tag address = ' <address>', Data size = <byte number="">, Main error = <code>, Sub error = <code>.</code></code></byte></address>	.73
Device responded with read not possible.   Tag address = ' <address>', Data size = <byte number="">, Main error = <code>, Sub error = <code>.</code></code></byte></address>	. 73
Device responded with error in unit.   Main error = <code>, Sub error = <code>.</code></code>	.73
Device cannot accept command.   Tag address = ' <address>', Data size = <byte number="">, Main error = <code>, Sub error = <code>.</code></code></byte></address>	
Access right denied.   Tag address = ' <address>', Main error = <code>, Sub error = <code>.</code></code></address>	74
Device responded with write not possible.   Tag address = ' <address>', Data size = <byte number="">, Main error = <code>, Sub error = <code>.</code></code></byte></address>	.74
Device deactivated due to network settings conflict with another device.   Other device = ' <device>'</device>	.74
The current project was created with an older version of this driver. Examine device properties to validate network parameters.	.74
Unable to write to tag. The device is in run mode.   Tag address = ' <address>'.</address>	.75
Device responded with network relay error.   Net address = <address>, Node address = <address>, Main error = <code>, Sub error = <code>, End code = <code>.</code></code></code></address></address>	.75
Device responded with fatal CPU unit error.   End code = <code>.</code>	.75
Device responded with non-fatal CPU unit error.   End code = <code>.</code>	.75
Failed to set device back to Run Mode following write to tag.   Tag address = ' <address>'</address>	.76
Main and Sub Error Codes	.77
Remote Network Error	85
Index	.86

# Welcome to the Omron FINS Ethernet Driver Help Center

This help center is the user documentation for Kepware Omron FINS Ethernet Driver. This help center is updated regularly to reflect the latest functionality and information.

#### Overview

What is the Omron FINS Ethernet Driver?

#### Setup

How do I configure a device for use with this driver?

#### **Data Types Description**

What data types does this driver support?

#### **Address Descriptions**

How do I address a data location on an Omron FINS Ethernet device?

#### **Event Log Messages**

What messages does the Omron FINS Ethernet Driver produce?

Version 1.083

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## Overview

The Omron FINS Ethernet Driver provides a reliable way to connect Omron FINS Ethernet controller to client applications; including HMI, SCADA, Historian, MES, ERP, and countless custom applications.

## Setup

## **Supported Devices**

This driver supports the FINS protocol via UDP/IP. For a list of models that support the FINS Communications Service, refer to the manufacturer's website.

#### Communication Protocol

Omron FINS using UDP/IP.

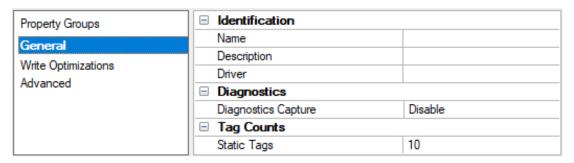
Note: This driver requires Winsock V1.1 or higher.

#### **Channel and Device Limits**

The maximum number of channels supported by this driver is 512. The maximum number of devices supported by this driver is 32 per channel.

# **Channel Properties – General**

This server supports the use of multiple simultaneous 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.



#### Identification

**Name**: Specify the 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**: Specify user-defined information about this channel.

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

**Driver**: Specify the protocol / driver for this channel. Specify 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. Changes to the properties should not be made once a large client application has been developed. Utilize proper user role and privilege management to prevent operators from changing properties or accessing 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.

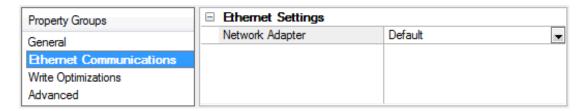
- Note: This property is not available if the driver or operating system does not support diagnostics.
- For more information, refer to Communication Diagnostics and Statistics Tags in server help.

## Tag Counts

**Static Tags**: Provides the total number of defined static tags at this level (device or channel). This information can be helpful in troubleshooting and load balancing.

# **Channel Properties – Ethernet Communications**

Ethernet Communication can be used to communicate with devices.



## **Ethernet Settings**

**Network Adapter**: Specify the network adapter to bind. When left blank or Default is selected, the operating system selects the default adapter.

# **Channel Properties – Write Optimizations**

The server must ensure that the data written from the client application gets to the device on time. Given this goal, the server provides optimization properties to meet specific needs or improve application responsiveness.

Property Groups	☐ Write Optimizations		
General	Optimization Method	Write Only Latest Value for All Tags	
,	Duty Cycle	10	
Write Optimizations			

## 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 – Communications Parameters



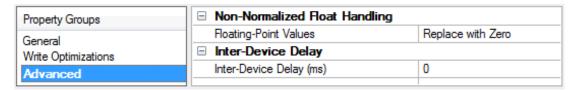
**Port**: Specify the port number to be used by the devices on the local Ethernet network. FINS requires that the source and destination port number be the same. The valid range is 1 to 65535. The default setting is 9600.

Users can create multiple channels in the server that utilize a unique port number to optimize communication performance. Examples are as follows:

- Channel1.device1 uses port 9601.
- · Channel2.device2 uses port 9602.
- · CX programmer uses port 9600.
- Note: Communication to multiple physical devices (with different port numbers configured in the devices) from the same channel in the server is not allowed because the port number and adapter are configured at the channel level.
- Important: To communicate to the same device (or multiple physical devices with the same port number configured in the devices) across multiple channels, the same port number must be used for each channel and device. Each channel, however, must be configured to use a unique network adapter and IP. For more information, refer to Multihoming.
- If using a multi-leveled FINS network, multiple device objects may need to be created in the server to be in direct communication with the same gateway PLC. Since FINS requires all nodes on an Ethernet network to use the same port number to send and receive data, this driver must impose some constraints that become relevant when distributing the communications load over multiple channels.

# 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.



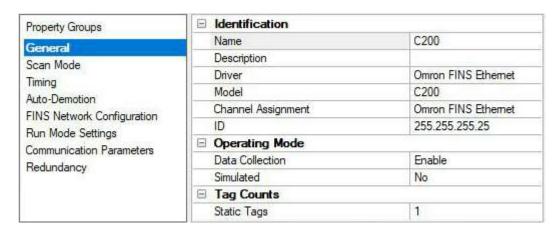
**Non-Normalized Float Handling**: A non-normalized value is defined as Infinity, Not-a-Number (NaN), or as a Denormalized Number. The default is Replace with Zero. Drivers that have native float handling may default to Unmodified. Non-normalized float handling allows users to specify how a driver handles 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 disabled 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.

## **Device Properties – General**



#### 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. For a list of models that support the FINS Communications Service, refer to the manufacturer's website.

**ID**: The ID specifies the IP address of the controller that is in direct contact with the host computer. This controller may not necessarily be the destination device, but instead be a relay device. The destination device is specified by its FINS network parameters. All parameters specified (except the ID when a relay device is used) refer to the destination device.

#### **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.

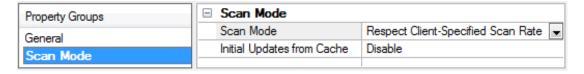
Simulated: This option places the device into Simulation Mode. In this mode, the driver does not attempt to communicate with the physical device, but the server continues to return valid OPC data. Simulated stops physical communications with the device, but allows OPC data to be returned to the OPC client 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.



**Scan Mode**: Specify 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 OPC 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	☐ Communication Timeouts		
General	Connect Timeout (s)	3	
Scan Mode	Request Timeout (ms)	1000	
Timing	Attempts Before Timeout	3	
Timing			

#### **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**: Specify 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 9999999 milliseconds (167 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: Specify 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**

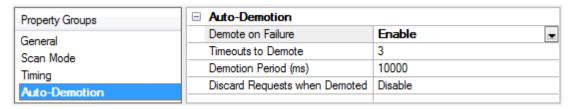
Inter-Request Delay: Specify how long the driver waits before sending the next request to the target device after receiving the response to the previous request. It overrides the normal polling frequency of tags associated with the device, as well as one-time reads and writes. This delay can be useful when dealing with devices with slow turn-around 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 reattempts 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.



**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 – FINS Network Configuration**

The FINS Network Configuration group establishes how communication is routed in a FINS network using the Omron FINS Ethernet Driver. The default value for network addresses is zero. This is interpreted by FINS as instruction to use the local network; as such, 0 must not be used when data is routed through gateway PLCs. Actual network numbers can range from 1 to 127. Using zero is convenient if there is only one network level. When using gateway devices, however, specify the actual network number (1-127) to avoid routing ambiguities.

Property Groups General	─ FINS Network Configuration		
	Source Network Address	0	
Scan Mode	Source Node	44	
Timing	Destination Network Address	0	
Auto-Demotion	Destination Node	25	
FINS Network Configuration	Destination Unit	0	
Run Mode Settings			
Communication Parameters			
Redundancy			

**Source Network Address**: Specifies the address number of the source network (the computer running the driver). The Source Network Address is sometimes referred to as SNA in Omron FINS documentation. The valid range is 0 to 127. The default setting is 0.

**Source Node**: Specifies the number of the source node (the computer running the driver). The default setting is the last octet of the network adapter specified in channel properties. This parameter specifies the node number of the source device. The Source Node is sometimes referred to as SA1 in Omron FINS documentation. The valid range is 0 to 254.

Tips:

- If the destination PLC is configured to use automatic address generation, this number must be the host number portion of the host computer IP address. For example, if the host computer has an IP of 111.222.333.123 and the subnet mask is 255.255.255.000, the source node number should be 123.
- If the target PLC is configured to use an address table, the table must have an entry for the host computer IP. The node number in table entry must agree with the source node for the driver.
- If a channel is duplicated using the Copy and Paste commands, the new channel retains the original channel's FINS network configuration parameters. Unless the Source Node is changed to a unique value, however, correct data transmission cannot be guaranteed.

**Destination Network Address**: Specifies the address number of the destination device. The Destination Network Address is sometimes referred to as DNA in Omron FINS documentation. The valid range is 0 to 127. The default setting is 0.

**Destination Node**: Specifies the node number of the destination device. The Destination Node is sometimes referred to as DA1 in Omron FINS documentation. The valid range is 0 to 254. The default setting is the last octet specified in the device ID. The correct setting value is obtained from the specific Omron Ethernet module being accessed.

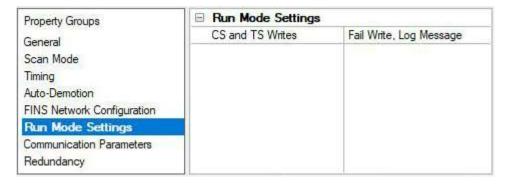
- Note: The Source Unit (SA2) is assumed to be 0.
- **Tip**: Many Omron Ethernet modules have rotary switches for setting the Destination Node. Generally there are two node number switches: x16 and x1. The switches can be difficult to read due to their small size and because the arrow can appear to fall between numbers. It may be necessary to try several Destination Node numbers to confirm the correct one. For example; on the x16 switch, the arrow may appear between 9 and A; on the x1 switch, the arrow may appear between 2 and 3. The correct Destination Node is one of the following numbers: 163 (for hex A3), 162 (for hex A2), 147 (for hex 93), or 146 (for hex 92).

**Destination Unit**: Specifies the number of the destination device unit number, sometimes referred to as DA2. The valid range is 0 to 255. The default setting is 0. The correct setting value is obtained from the specific Omron Ethernet module being accessed.

- Note: Misconfiguration of the network, in combination with some errors, can cause a Remote Network Error.
- Pay particular attention to the FINS network and node numbers configured for each device, as well as the IP address calculation method used by the target PLCs. Inconsistent values result in communications problems. For example, when using the default address of 0 (local network), the Destination Node and Source Node cannot be the same.
- 🌻 See Also: <u>FINS Networks</u>

## Device Properties – Run Mode Settings

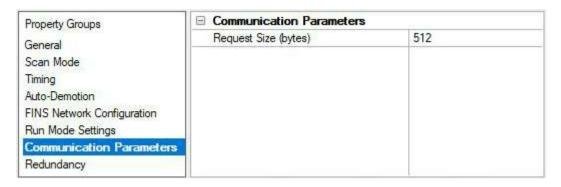
This group specifies the driver's behavior when the device makes writes to Timer Status and Counter Status while in Run Mode



**CS and TS Writes**: Select how the device performs writes in Run mode. The default setting is Fail Write, Log Message.

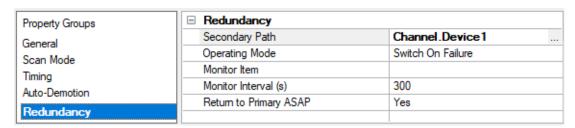
- Fail Write, Log Message: This option posts a message to the Event Log when the Write command fails
- Set PLC to Monitor Mode, Perform Write: This option changes the PLC to Monitor Mode before performing the write.
- Set PLC to Monitor Mode, Write, Reset to Run: This option changes the PLC to Monitor Mode before performing the write. Once complete, the PLC is reset to Run mode.

# Device Properties – Communications Parameters



**Request Size**: This parameter specifies the maximum number of bytes that may be requested from a device at one time. The default setting is 512 bytes. To refine the driver's performance, set the request size to one of the following settings: 32, 64, 128, 256, 512, 1024, or 1984 bytes.

## Device Properties – Redundancy



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

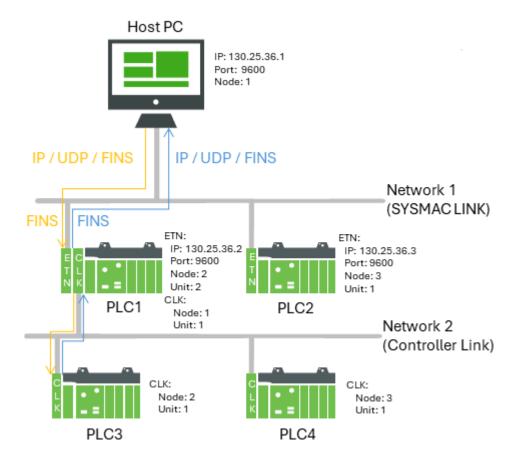
Consult the website, a sales representative, or the user manual for more information.

#### **FINS Networks**

The FINS communications service was developed by Omron to provide a consistent way for PLCs and computers on various networks to communicate. Compatible network types include Ethernet, Host Link, Controller Link, SYSMAC LINK, SYSMAC WAY, and Toolbus. FINS allows communications between nodes up to three network levels. A direct connection between a computer and a PLC via HostLink is not considered a network level.

The diagram below shows a FINS network comprised of interconnected Ethernet and Controller Link networks, and serves as an example for the following discussion. FINS allows communication between any pair of devices in the diagram. PLC 1 acts as a gateway between the two networks. The host PC sends a data request command (shown in red) to PLC 3 via PLC 1. The response is shown in blue.

Note: In principle, PLC 3 or 4 could act as a gateway to a third network layer that could also be reached by the host PC.



#### **FINS Messages**

FINS messages contain two parts: a header and a data portion. The header contains source and destination information, among other things. The data portion contains command codes and optional command parameters. The six source and destination parameters contained in the header are as follows:

- DNA: Destination Network Address.
- DA1: Destination Node Number.
- DA2: Destination Module Address.
- SNA: Source Network Address.
- SA1: Source Node Number.
- SA2: Source Module Address.

This driver always sets DA2 and SA2 to zero; meaning, communication is between the host computer and the destination node's CPU module.

#### **Ethernet Communications**

This driver is able to communicate with any FINS compatible device on an Ethernet network. The FINS device can process a given FINS command if it is the destination node or relay the message to another device if it is not. In the figure above, it is desired to send a data request from the host PC to PLC 3. The driver constructs a FINS message with appropriate source and destination parameters set in the header, encapsulates that message in a UDP/IP datagram, and then sends it off to PLC 1. The message cannot be sent directly to PLC 3 because it is not on the same network as the PC. PLC 1 examines the FINS message header and determines that node 1 on network 2 (which is PLC 3) is the intended destination. PLC 1 relays the FINS message to PLC 3. Since PLC 3 is not on an Ethernet network, the UDP/IP wrapper is removed. PLC 3 then sends its reply back to the host PC via PLC 1.

A problem arises when PLC 1 must forward the reply from PLC 3 to the host PC. The reply from PLC 3 addresses the destination using FINS network parameters only: it does not explicitly give the destination IP address. Omron has devised three methods for a PLC to determine destination IPs from FINS network parameters. The method is chosen when the PLC is configured and determines what node numbers should be assigned to each device on the Ethernet network. The three methods are Automatic Address Generation, IP Address Table, and Combined Address Conversion. Descriptions of the methods are as follows:

- Automatic Address Generation: This method uses the relay device to construct the destination IP from its
  own IP, the subnet mask, and the FINS destination node number. IP addresses are made up of two parts:
  the network number (which is the same for all nodes on the local network) and the host number (which is
  unique to each node on the local network). The Automatic Address Generation method requires that the
  host number portion of each node's IP be the same as its FINS node number.
  - Note: In this example, PLC 1 would calculate the network number by first performing a logical AND operation between its own IP address and subnet mask. In Boolean algebra terms, 130.25.36.2 AND 255.255.255.0 equals 130.25.36.0. The destination IP would then be calculated by adding the FINS destination node number to the network number. For the Destination IP, 130.25.36.0 + 1 = 130.25.36.1.
- IP Address Table: This method uses an IP address table, which is a list of FINS node numbers and their associated IP addresses. In this method, the host number portion of the IP address does not need to be the same as the FINS node number. If used, the IP address tables must be programmed into the PLCs on the Ethernet networks.
- Combined Address Conversion: This method uses a device to look up the FINS destination node number in its IP address table. If the node number is found, the corresponding IP address is taken from the table and used to construct the UDP/IP datagram. If the node number is not found, the destination IP is computed using the Automatic Address Generation method.
- Note: PLC 1 also needs to know on what port the host PC is listening. Since FINS requires that all nodes on an Ethernet network listen on the same port number, the PLC uses the port number on which it has been configured to listen.

#### **Server Configuration Example**

- To start, create a channel that uses this driver to communicate with devices on the Ethernet network. FINS
  requires that all nodes on an Ethernet network use the same port number to send and receive data. For this
  example, use the default value 9600.
- 2. Next, create a device on that channel that represents the destination node. For this example, use PLC 3.
- 3. Set the Device ID, which must be the IP address of the PLC with which the driver is in direct communication. For this example, use PLC 1 (130.25.36.2).
  - Note: The Device ID should be the IP address of the destination device if that device is on the host PC's local Ethernet network. This would be the case with PLC 2.
- 4. Next, set the FINS network parameters to identify the source (host PC) and destination (PLC 3). In this example, the settings are as follows:
  - Source Network Address (SNA): 1.\*
  - Source Node (SA1): 1.
  - Destination Network Address (DNA): 2.\*
  - Destination Node (DA1): 1.

<sup>\*</sup>The default value for network addresses is zero. This is interpreted by FINS as instruction to use the local

network. Actual network numbers can range from 1 to 127. Using zero is convenient if there is only one network level. When using gateway devices, however, specify the actual network number (1-127) to avoid routing ambiguities.

#### Notes:

- 1. SA2 and DA2 are automatically set to zero by the driver.
- 2. Similar device objects would need to be created for PLC 1, 2, and 4.

#### **Routing Tables**

With multi-level networks, additional information must be programmed into the PLCs so they can send messages to other nodes in the system. This is accomplished using FINS routing tables, which come in two types: Local and Remote. Local routing tables associate a network number with one of the communication modules or Special Input/Output Units (SIOU) installed in the PLC's rack. Remote routing tables give directions on how to reach one of the next network levels. The routing tables for the given example would appear as shown below.

## PLC 1 (Local)

Network Number	Unit
1	2
2	1

There are two local networks for PLC 1. The Ethernet and Controller Link network numbers are assigned as 1 and 2, respectively. The Ethernet and Controller Link modules are assigned unit numbers 2 and 1, respectively. The network node number of each of these modules is configured by the user and must be unique within its associated network.

Note: Both of the communications modules in PLC 1 node 10 can be called because they are on different networks. There are no remote networks for PLC 1.

#### PLC 2 (Local)

Network Number	Unit
1	1

PLC 2 has only one communications module: the Ethernet module, and only one entry in its local routing table.

#### PLC 2 (Remote)

Remote Network Number	Relay Network	Relay Node
2	1	2

Network 2 is a remote network for PLC 2. To send a message to a node on network 2, PLC 2 must send that message to a relay node (the gateway) on one of its local networks. This local network is called the relay network and must be network 1 in the given example. The Ethernet module in the gateway (PLC 1) is node number 2. Therefore, the relay node for PLC 2 is 2.

Likewise, routing tables for PLC 3 and 4 must appear like the following. They happen to be the same in the given example because the Controller Link modules in both PLCs are unit number 1. These modules must be assigned node numbers that are unique in network 2.

# PLC 3 and 4 (Local)

Network Number	Unit
2	1

## PLC 3 and 4 (Remote)

Remote Network Number	Relay Network	Relay Node
1	2	1

#### **Duplicate Devices**

It is generally recommended that the communications load be distributed over multiple channels. Significant performance gains can be achieved since the Windows operation system allows each channel to operate on an independent thread. The idea is to have as few devices on each channel as possible, so that no one device can significantly impact the update rate of the others.

Although it is not usually advantageous to create multiple server device objects that communicate with a single physical device, it is necessary to do so when using a multi-level FINS network. In the example above, device objects are needed for PLC 3 and PLC 4. The driver is actually in direct communications with PLC 1. This means that the device number configured for both device objects must be the IP address of PLC 1. With most Ethernet drivers, this sort of thing is perfectly safe. Because FINS requires that all nodes on an Ethernet network use the same port number to send and receive data, however, a problem arises.

If the device objects for PLC 3 and 4 were created on the same channel, everything works fine. Users may encounter the problem when attempting to improve performance by placing the device objects on separate channels. It is important to know that this driver gives each one of these channels an Ethernet communications socket. For example, if the host PC has only one IP associated with it, then both of these sockets must use that IP as its source address and both of these sockets needs to use the same port number according to the FINS protocol. If the driver allowed users to do this, the UDP/IP datagrams from PLC 1 would contain the same source and destination address information (where source is 130.25.36.2/9600 and destination is 130.25.36.1/9600) regardless of the intended destination device object. Users cannot be guaranteed that the operating system sends the datagrams to the correct socket if both happen to be waiting for responses from PLC 3 and 4. The only way to remove the ambiguity is to associate each channel / socket with a unique IP address.

To associate a unique IP address with each channel, users must multihome the host computer. This means that the computer must have multiple NICs installed or users must associate multiple IP addresses with a single NIC. Things work if both devices are on the same channel because all transactions are carried out serially on a given channel. It doesn't matter if the source and destination addresses (IP/port) in responses from PLC 3 and 4 look the same because the socket is waiting for a response from only one PLC at a time. This is only relevant when multilevel FINS networks are being used.

- Pay particular attention to the FINS network and node numbers configured for each device, as well as the IP address calculation method being used by the target PLCs. Inconsistent values result in communications problems.
- For more information on FINS networking, refer to Omron documentation.

## Multihoming

Some applications require users to associate a unique IP address with each channel. In these cases, the host computer must be multihomed; meaning, it must be configured to have more than one IP address. This may be accomplished by installing multiple Network Adapter Cards (NIC) in the computer or by assigning multiple IP addresses to a single NIC.

#### Adding IP Addresses to a Single NIC

- 1. Click Start and then open Network Connections.
- 2. Next, click **Control Panel | Network and Internet**. Then, select the connection to change (such as the Local Area Connection).
- 3. Click Properties, and then provide the administrator password or confirmation (if prompted).
- 4. Select the Networking tab. Beneath This connection uses the following items, click Internet Protocol Version 4 (TCP/IPv4).
- 5. Next, click **Properties**. Ensure that the connection is set to use an IP address by clicking **Use the following** IP address
- 6. Next, specify the IP address settings in the IP Address, Subnet Mask, and Default Gateway fields.
- To add a second IP address, click Advanced | IP Settings. Beneath IP Address, click Add. Then, enter a new IP address and subnet mask.

#### Notes:

- Some Windows systems can support up to five IP addresses for each NIC via the control panel. More IP addresses can be added to the registry manually as necessary. To browse, look under HEKY\_LOCAL\_MACHINE | SYSTEM | CurrentControlSet | Services. Then, select the service associated with the adapter card in question. Under the service, go to the Parameters | TCPIP subkey. Add the IP addresses to IPAddress and then edit SubnetMask and add an entry for each new IP address.
- 2. There is additional operating system overhead when running on a multihomed system. Unless users are using very fast devices, this overhead should not entirely cancel out the performance gain achieved from distributing the communications load over multiple channels.

# **Data Types Description**

Data Type	Description		
Boolean	Single bit		
Short	Signed 16-bit value		
	bit 0 is the low bit		
	bit 14 is the high bit		
	bit 15 is the sign bit		
Word	Unsigned 16-bit value		
	bit 0 is the low bit		
	bit 15 is the high bit		
Long	Signed 32-bit value		
	bit 0 is the low bit		
	bit 30 is the high bit		
	bit 31 is the sign bit		
DWord	Unsigned 32-bit value		
	bit 0 is the low bit		
	bit 31 is the high bit		
Float	32-bit real		
BCD	Two-byte packed BCD		
	Value range is 0-9999. Behavior is undefined for values beyond this range.		
LBCD	Four-byte packed BCD		
	Value range is 0-99999999. Behavior is undefined for values beyond this range.		
String	Null-terminated ASCII string.		
	Support includes string lengths up to 512 characters, and selection of HiLo byte order, LoHi byte order, Only High byte and Only Low byte.		

# **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.

**C200H Addressing** 

C500 Addressing

C1000H Addressing

C2000H Addressing

CV500 Addressing

CV1000 Addressing

CV2000 Addressing

CVM1-CPU01 Addressing

**CVM1-CPU11 Addressing** 

CVM1-CPU21 Addressing

**CS1 Addressing** 

**CJ1 Addressing** 

**CJ2 Addressing** 

# **C200H Addressing**

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and <u>Array Support</u>.

Device Type	Range	Data Type	Access
Auxiliary Relay	AR00-AR27	Word, Short, BCD	Read/Write
	AR00-AR26	Long, DWord, LBCD,	
	ARxx.00-ARxx.15	Float	
		Boolean	
Auxiliary Relay as String	AR00.056H-AR27.002H	String	Read/Write
with HiLo Byte Order			
	.I is string length, range 2 to 56 characters		
Auxiliary Relay as String	AR00.056L-AR27.002L	String	Read/Write
with LoHi Byte Order			
	.I is string length, range 2 to 56 char-		
	acters		
Auxiliary Relay as String	AR00.028D-AR27.001D	String	Read/Write
Using Only the High Order			
Byte of each Word	.I is string length, range 1 to 28 char-		
	acters		
Auxiliary Relay as String	AR00.028E-AR27.001E	String	Read/Write
Using Only the Low Order			
Byte of each Word	.I is string length, range 1 to 28 characters		
Data Memory	DM0000-DM6655	Word, Short, BCD	Read/Write
	DM0000-DM6654	Long, DWord, LBCD,	
	DMxxxx.00-DMxxxx.15	Float	
		Boolean	
	See also String Support		
Data Memory as String	DM0000.512H-DM6655.002H	String	Read/Write
with HiLo Byte Order			

Device Type	Range	Data Type	Access
	.l is string length, range 2 to 512 char-		
Data Mamany as String	acters DM0000.512L-DM6655.002L	Cárina	Read/Write
Data Memory as String with LoHi Byte Order	DM0000.512L-DM0055.002L	String	Read/write
with Lorii byte Order	.I is string length, range 2 to 512 char-		
	acters		
Data Memory as String	DM0000.256D-DM6655.001D	String	Read/Write
Using Only the High Order			
Byte of each Word	.I is string length, range 1 to 256 char-		
	acters		
Data Memory as String	DM0000.256E-DM6655.001E	String	Read/Write
Using Only the Low Order	1 1 1. 050		
Byte of each Word	.I is string length, range 1 to 256 characters		
Expansion Data Memory	EM0000-EM6143	Word, Short, BCD	Read/Write
(Current Bank)	EM0000-EM6142	Long, DWord, LBCD,	
,	EMxxxx.00-EMxxxx.15	Float	
		Boolean	
Expansion Data Memory	EM0000.512H-EM6143.002H	String	Read/Write
(current bank) as String			
with HiLo Byte Order	.l is string length, range 2 to 512 char-		
Evanaian Data Mamany	acters EM0000.512L-EM6143.002L	Ctring	Read/Write
Expansion Data Memory (current bank) as String	EW0000.512L-EW0145.002L	String	Read/Wille
with LoHi Byte Order	.I is string length, range 2 to 512 char-		
Will Lot ii Byto Ordor	acters		
Expansion Data Memory	EM0000.256D-EM6143.001D	String	Read/Write
(Current Bank) as String			
Using Only the High Order	.I is string length, range 1 to 256 char-		
Byte of each Word	acters		
Expansion Data Memory	EM0000.256E-EM6143.001E	String	Read/Write
(current bank) as String			
Using Only the Low Order	.l is string length, range 1 to 256 characters		
Byte of each Word		W. 101 : 505	D 1044 ::
Expansion Data Memory	EM00:0000-EM07:6143	Word, Short, BCD	Read/Write
	EM00:0000-EM07:6142 EMx:x.00-EMxx:xxxx.15	Long, DWord, LBCD, Float	
	EIVIX.X.00-EIVIXX.XXXX.13	Boolean	
Expansion Data Memory as	EM00:0000.512H-EM07:6143.002H	String	Read/Write
String with HiLo Byte Order	.I is string length, range 2 to 512 char-		
	acters		
Expansion Data Memory as	EM00:0000.512L-EM07:6143.002L	String	Read/Write
String with LoHi Byte Order			
	.I is string length, range 2 to 512 characters		
Expansion Data Memory	EM00:0000.256D-EM07:6143.001D	String	Read/Write
as String Using Only the	EM00.0000.200D-EM07.0143.001D	Juliy	T Cau/ WITE
High Order Byte of each	.I is string length, range 1 to 256 char-		
Word	acters		
Expansion Data Memory	EM00:0000.256E-EM07:6143.001E	String	Read/Write

Device Type	Range	Data Type	Access
as String Using Only the			
Low Order Byte of each	.I is string length, range 1 to 256 char-		
Word	acters		
Holding Relay	HR00-HR99	Word, Short, BCD	Read/Write
	HR00-HR98	Long, DWord, LBCD,	
	HRxx.00-HRxx.15	Float	
		Boolean	
Holding Relay as String	HR00.200H-HR99.002H	String	Read/Write
with HiLo Byte Order			
	I is string length, range 2 to 200 char-		
	acters		D 104/ ::
Holding Relay as String	HR00.200L-HR99.002L	String	Read/Write
with LoHi Byte Order			
	.l is string length, range 2 to 200 char-		
Haldina Dalassa Otsina	acters	Otalia a	D = = 1/04/sit =
Holding Relay as String	HR00.100D-HR99.001D	String	Read/Write
Using Only the High Order	1		
Byte of each Word	.l is string length, range 1 to 100 characters		
Holding Relay as String	HR00.100E-HR99.001E	String	Read/Write
Using Only the Low Order	HK00.100E-HK99.001E	Sumg	Read/Wille
Byte of each Word	.I is string length, range 1 to 100 char-		
byte of each word	acters		
Internal Relay	IR000-IR511	Word, Short, BCD	Read/Write
momaritolay	IR000-IR510	Long, DWord, LBCD,	T today VVIIto
	IRxxx.00-IRxxx.15	Float	
		Boolean	
Internal Relay as a String	IR000.512H-IR511.002H	String	Read/Write
with HiLo Byte Order			
•	.I is string length, range 2 to 512 char-		
	acters		
Internal Relay as a String	IR000.512L-IR511.002L	String	Read/Write
with LoHi Byte Order			
	.I is string length, range 2 to 512 char-		
	acters		
Internal Relay as a String	IR000.256D-IR511.001D	String	Read/Write
Using Only the High Order			
Byte of each Word	.I is string length, range 1 to 256 char-		
	acters	1	
Internal Relay as a String	IR000.256E-IR511.001E	String	Read/Write
Using Only the Low Order	l		
Byte of each Word	I is string length, range 1 to 256 char-		
Link Deleve	acters	Word Object DOD	D = = d // / / / / / -
Link Relays	LR00-LR63 LR00-LR62	Word, Short, BCD	Read/Write
		Long, DWord, LBCD, Float	
	LRxx.00-LRxx.15	Boolean	
Link Relay as String	LR00.128H-LR63.002H	String	Read/Write
•	L130.12011-L1303.00211	Juniy	r toda/ vviite
with Hill o Ryte Order			
with HiLo Byte Order	.I is string length, range 2 to 128 char-		

Device Type	Range	Data Type	Access
Link Relay as String with LoHl Byte Order	LR00.128L-LR63.002L	String	Read/Write
	.I is string length, range 2 to 128 characters		
Link Relay as String	LR00.064D-LR63.001D	String	Read/Write
Using Only the High Order			
Byte of each Word	.I is string length, range 1 to 64 characters		
Link Relay as String	LR00.064E-LR63.001E	String	Read/Write
Using Only the Low Order			
Byte of each Word	.I is string length, range 1 to 64 characters		
Temporary Relay	TR	Word, Short	Read/Write
	TR0-TR7	Boolean	
Timer/Counter	TC000-TC511	BCD, Word, Short	Read/Write
Timer/Counter as String	TC000.512H-TC511.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Timer/Counter as String	TC000.512L-TC511.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters		
Timer/Counter as String	TC000.256D-TC511.001D	String	Read/Write
Using Only the High Order			
Byte of each Word	.l is string length, range 1 to 256 characters		
Timer/Counter as String	TC000.256E-TC511.001E	String	Read/Write
Using Only the Low Order			
Byte of each Word	.l is string length, range 1 to 256 char-		
	acters		
Timer/Counter Status	TS000-TS511	Boolean	Read/Write

## **BCD Support**

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

### Example

IR0D @ Short = -50

IR0D @ Word = 8050 (MSB set)

IR0 @ BCD = 8050

IR0D @ Short = 50 IR0D @ Word = 50 IR0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

## **String Support**

The C200H model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- To address a string starting at DM1000 with a length of 100 bytes and HiLo byte order, enter: DM1000.100H
- To address a string starting at DM1100 with a length of 78 bytes and LoHi byte order, enter: DM1100.078L
- 3. To address a string starting at DM2000 with a length of 55 bytes and Only the High Order byte, enter: DM2000.055D
- To address a string starting at DM2200 with a length of 37 bytes and Only the Low Order byte, enter: DM2200.037E

### **Array Support**

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

DMxxxx [rows] [cols] DMxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

▶ Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords DM0 and DM1 overlap at word DM1. Writing to DM0 also modifies the value held in DM1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, users may want to use DM0, DM2, DM4, and so on to prevent overlapping Words.

# C500 Addressing

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and <u>Array Support</u>.

Device Type	Range	Data Type	Access
Data Memory	DM000-DM511	Word, Short, BCD,	Read/Write
	DM000-DM510	Long, DWord, LBCD,	
	DMxxx.00-DMxxx.15	Float,	
	See also <u>String Support</u>	Boolean	
Data Memory as String	DM000.512H-DM511.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Data Memory as String	DM000.512L-DM511.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Data Memory as String	DM000.256D-DM511.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Data Memory as String	DM000.256E-DM511.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Holding Relay	HR00-HR31	Word, Short, BCD,	Read/Write
	HR00-HR30	Long, DWord, LBCD,	
	HRxx.00-HRxx.15	Float,	
Halding Dalace as Obije a	LUDOO OCALL LUDOA OOOLI	Boolean	D 1/1/1/
Holding Relay as String with HiLo Byte Order	HR00.064H-HR31.002H	String	Read/Write
,	.I is string length, range 2 to 64 characters		
Holding Relay as String	HR00.064L-HR31.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 64 characters		
Holding Relay as String	HR00.032D-HR31.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 32 characters		
Holding Relay as String	HR00.032E-HR31.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 32 characters		
Internal Relay	IR00-IR63	Word, Short, BCD,	Read/Write
	IR00-IR62	Long, DWord, LBCD,	
	IRxx.00-IRxx.15	Float,	
Internal Dalay on a Othica	ID00 12011 ID02 00011	Boolean	Deed (\A/\sit
Internal Relay as a String with HiLo Byte Order	IR00.128H-IR63.002H	String	Read/Write
,	.I is string length, range 2 to 128 characters		
Internal Relay as a String	IR00.128L-IR63.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 128 characters		
Internal Relay as a String	IR00.064D-IR63.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 64 characters		
Internal Relay as a String	IR00.064E-IR63.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 64		

Device Type	Range	Data Type	Access
Byte of each Word	characters		
Link Relays	LR00-LR31 LR00-LR30 LRxx.00-LRxx.15	Word, Short, BCD, Long, DWord, LBCD, Float, Boolean	Read/Write
Link Relays as String with HiLo Byte Order	LR00.064H-LR31.002H  I is string length, range 2 to 64 characters	String	Read/Write
Link Relays as String with LoHi Byte Order	LR00.064L-LR31.002L  I is string length, range 2 to 64 characters	String	Read/Write
Link Relays as String Using Only the High Order Byte of each Word	LR00.032D-LR31.001D  I is string length, range 1 to 32 characters	String	Read/Write
Link Relays as String Using Only the Low Order Byte of each Word	LR00.032E-LR31.001E  I is string length, range 1 to 32 characters	String	Read/Write
Temporary Relay	TR TR0-TR7	Word, Short, Boolean	Read/Write
Timer/Counter	TC000-TC127	BCD, Word, Short	Read/Write
Timer/Counter as String with HiLo Byte Order	TC000.256H-TC127.002H  .I is string length, range 2 to 256 characters	String	Read/Write
Timer/Counter as String with LoHi Byte Order	TC000.256L-TC127.002L  .I is string length, range 2 to 256 characters	String	Read/Write
Timer/Counter as String Using Only the High Order Byte of each Word	TC000.128D-TC127.001D  I is string length, range 1 to 128 characters	String	Read/Write
Timer/Counter as String Using Only the Low Order Byte of each Word	TC000.128E-TC127.001E  .I is string length, range 1 to 128 characters	String	Read/Write
Timer/Counter Status	TS000-TS127	Boolean	Read/Write

## **BCD Support**

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example

IROD @ Short = -50 IROD @ Word = 8050 (MSB set) IRO @ BCD = 8050

IR0D @ Short = 50 IR0D @ Word = 50 IR0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

## **String Support**

The C500 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- 1. To address a string starting at DM100 with a length of 100 bytes and HiLo byte order, enter: DM100.100H
- 2. To address a string starting at DM110 with a length of 78 bytes and LoHi byte order, enter: DM110.078L
- 3. To address a string starting at DM200 with a length of 55 bytes and Only the High Order byte, enter: DM200.055D
- 4. To address a string starting at DM220 with a length of 37 bytes and Only the Low Order byte, enter: DM220.037E

#### Array Support

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

DMxxxx [rows] [cols] DMxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords DM0 and DM1 overlap at word DM1. Writing to DM0 also modifies the value held in DM1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use DM0, DM2, DM4, and so on to prevent overlapping Words.

# C1000H Addressing

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

# • For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and <u>Array Support</u>.

Device Type	Range	Data Type	Access
Auxiliary Relay	AR00-AR27	Word, Short,	Read/Write
	AR00-AR26	BCD,	
	ARxx.00-ARxx.15	Long, DWord, LBCD, Float	
		Boolean	
Auxiliary Relay as String with HiLo Byte Order	AR00.056H-AR27.002H	String	Read/Write
	.I is string length, range 2 to 56 characters		
Auxiliary Relay as String with LoHi Byte Order	AR00.056L-AR27.002L	String	Read/Write
	.I is string length, range 2 to 56 characters		
Auxiliary Relay as String Using Only the High	AR00.028D-AR27.001D	String	Read/Write
Order Byte of each Word	.I is string length, range 1 to 28 characters		
Auxiliary Relay as String Using Only the Low	AR00.028E-AR27.001E	String	Read/Write
Order Byte of each Word	.I is string length, range 1 to 28 characters		
Data Memory	DM0000-DM4095	Word, Short,	Read/Write
	DM0000-DM4094	BCD,	
	DMxxxx.00-DMxxxx.15	Long, DWord,	
	See also String Support	LBCD, Float	
		Boolean	5 101/11
Data Memory as String with HiLo Byte Order	DM0000.512H- DM4095.002H	String	Read/Write
	.l is string length, range 2 to 512 characters		
Data Memory as String with LoHi Byte Order	DM0000.512L- DM4095.002L	String	Read/Write
	.I is string length, range 2 to 512 characters		
Data Memory as String Using Only the High Order Byte of each Word	DM0000.256D- DM4095.001D	String	Read/Write
	.I is string length, range 1 to 256 characters		
Data Memory as String Using Only the Low Order Byte of each Word	DM0000.256E- DM4095.001E	String	Read/Write
	.I is string length, range 1 to 256 characters		
Holding Relay	HR00-HR99	Word, Short,	Read/Write
	HR00-HR98	BCD,	
	HRxx.00-HRxx.15	Long, DWord,	
		LBCD, Float  Boolean	
Holding Dolov on String with Hill a Puta Order	HD00 200H HD00 002H		Dood/M/rits
Holding Relay as String with HiLo Byte Order	HR00.200H-HR99.002H	String	Read/Write
	.l is string length, range 2 to 200 characters		
Holding Relay as String with LoHi Byte Order	HR00.200L-HR99.002L	String	Read/Write
	I is string length, range 2 to 200 characters		

Device Type	Range	Data Type	Access
Holding Relay as String Using Only the High	HR00.100D-HR99.001D	String	Read/Write
Order Byte of each Word	I is string length, range 1 to 100 characters		
Holding Relay as String Using Only the Low	HR00.100E-HR99.001E	String	Read/Write
Order Byte of each Word	.I is string length, range 1 to 100 characters		
Internal Relay	IR000-IR255	Word, Short,	Read/Write
	IR000-IR254	BCD,	
	IRxxx.00-IRxxx.15	Long, DWord, LBCD, Float	
		Boolean	
Internal Relay as a String with HiLo Byte Order	IR000.512H-IR255.002H	String	Read/Write
	.l is string length, range 2 to 512 characters		
Internal Relay as a String with LoHi Byte Order	IR000.512L-IR255.002L	String	Read/Write
	.l is string length, range 2 to 512 characters		
Internal Relay as a String Using Only the High	IR000.256D-IR255.001D	String	Read/Write
Order Byte of each Word	I is string length, range 1 to 256 characters		
Internal Relay as a String Using Only the Low	IR000.256E-IR255.001E	String	Read/Write
Order Byte of each Word	.l is string length, range 1 to 256 characters		
Link Relays	LR00-LR63	Word, Short,	Read/Write
	LR00-LR62	BCD,	
	LRxx.00-LRxx.15	Long, DWord, LBCD, Float,	
		Boolean	
Link Relays as String with HiLo Byte Order	LR00.128H-LR63.002H	String	Read/Write
	.I is string length, range 2 to 128 characters	-	
Link Relays as String with LoHi Byte Order	LR00.128L-LR63.002L	String	Read/Write
	.I is string length, range 2 to 128 characters		
Link Relays as String Using Only the High	LR00.064D-LR63.001D	String	Read/Write
Order Byte of each Word	I is string length, range 1 to 64 characters		
Link Relays as String Using Only the Low Order	LR00.064E-LR63.001E	String	Read/Write
Byte of each Word	I is string length, range 1 to 64 characters		
Temporary Relay	TR	Word, Short,	Read/Write
	TR0-TR7	Boolean	
Timer/Counter	TC000-TC511	BCD, Word, Short	Read/Write
Timer/Counter as String with HiLo Byte Order	TC000.512H-TC511.002H	String	Read/Write
	.l is string length, range 2 to 512 characters		
Timer/Counter as String with LoHi Byte Order	TC000.512L-TC511.002L	String	Read/Write
	.I is string length, range 2 to 512 characters		
Timer/Counter as String Using Only the High	TC000.256D-TC511.001D	String	Read/Write

Device Type	Range	Data Type	Access
Order Byte of each Word	.l is string length, range 1 to 256 characters		
Timer/Counter as String Using Only the Low Order Byte of each Word	TC000.256E-TC511.001E  .I is string length, range 1 to 256 characters	String	Read/Write
Timer/Counter Status	TS000-TS511	Boolean	Read/Write

### **BCD Support**

16-bit and 32-bit data can be referenced as signed and unsigned BCD values. Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example:

IR0D @ Short = -50 IR0D @ Word = 8050 (MSB set) IR0 @ BCD = 8050

IR0D @ Short = 50 IR0D @ Word = 50 IR0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

## String Support

The C1000H model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

 To address a string starting at DM1000 with a length of 100 bytes and HiLo byte order, enter: DM1000.100H

- To address a string starting at DM1100 with a length of 78 bytes and LoHi byte order, enter: DM1100.078L
- To address a string starting at DM2000 with a length of 55 bytes and Only the High Order byte, enter: DM2000.055D
- 4. To address a string starting at DM2200 with a length of 37 bytes and Only the Low Order byte, enter: DM2200.037E

## **Array Support**

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

DMxxxx [rows] [cols] DMxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

• Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords DM0 and DM1 overlap at word DM1. Writing to DM0 also modifies the value held in DM1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use DM0, DM2, DM4, and so on, to prevent overlapping Words.

## C2000H Addressing

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

For more information, refer below the table for notes and restrictions on BCD Support, String Support, and Array Support.

Device Type	Range	Data Type	Access
Auxiliary Relay	AR00-AR27	Word, Short, BCD,	Read/Write
	AR00-AR26	Long, DWord, LBCD,	
	ARxx.00-ARxx.15	Float,	
		Boolean	
Auxiliary Relay as String	AR00.056H-AR27.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 56		
	characters		
Auxiliary Relay as String	AR00.056L-AR27.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 56		
	characters		
Auxiliary Relay as String	AR00.028D-AR27.001D	String	Read/Write
Using Only the High Order Byte of	.I is string length, range 1 to 28		
each Word	characters		
Auxiliary Relay as String	AR00.028E-AR27.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 28		
Byte of each Word	characters		
Data Memory	DM0000-DM6655	Word, Short, BCD,	Read/Write
	DM0000-DM6654	Long, DWord, LBCD,	
	DMxxxx.00-DMxxxx.15	Float,	
	See also String Support	Boolean	
Data Memory as String	DM0000.512H-DM6655.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512		
	characters		

Device Type	Range	Data Type	Access
Data Memory as String	DM0000.512L-DM6655.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Data Memory as String	DM0000.256D-DM6655.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Data Memory as String	DM0000.256E-DM6655.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Holding Relay	HR00-HR99 HR00-HR98 HRxx.00-HRxx.15	Word, Short, BCD, Long, DWord, LBCD, Float, Boolean	Read/Write
Holding Relay as String	HR00.200H-HR99.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 200 characters		
Holding Relay as String with LoHi Byte Order	HR00.200L-HR99.002L  I is string length, range 2 to 200 characters	String	Read/Write
Holding Relay as String	HR00.100D-HR99.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 100 characters		
Holding Relay as String	HR00.100E-HR99.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 100 characters		
Byte of each Word		Mand Object DOD	Read/Write
Internal Relay	IR000-IR255 IR000-IR254 IRxxx.00-IRxxx.15	Word, Short, BCD, Long, DWord, LBCD, Float Boolean	Read/Wille
Internal Relay as a String	IR000.512H-IR255.002H	String	Read/Write
with HiLo Byte Order	I is string length, range 2 to 512 characters		rtead/vviite
Internal Relay as a String with LoHi Byte Order	IR000.512L-IR255.002L I is string length, range 2 to 512 characters	String	Read/Write
Internal Relay as a String	IR000.256D-IR255.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Internal Relay as a String	IR000.256E-IR255.001E	String	Read/Write
Using Only the Low Order	.l is string length, range 1 to 256		
Byte of each Word	characters		
Link Relays	LR00-LR63 LR00-LR62 LRxx.00-LRxx.15	Word, Short, BCD, Long, DWord, LBCD, Float, Boolean	Read/Write
Link Relays as String	LR00.128H-LR63.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 128 characters		
Link Relays as String	LR00.128L-LR63.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 128		

Device Type	Range	Data Type	Access
	characters		
Link Relays as String	LR00.064D-LR63.001D	String	Read/Write
>Using Only the High Order Byte of each Word	.I is string length, range 1 to 64 characters		
Link Relays as String	LR00.064E-LR63.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 64		
>Byte of each Word	characters		
Temporary Relay	TR	Word, Short,	Read/Write
	TR0-TR7	Boolean	
Timer/Counter	TC000-TC511	BCD, Word, Short	Read/Write
Timer/Counter as String	TC000.512H-TC511.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Timer/Counter as String	TC000.512L-TC511.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Timer/Counter as String	TC000.256D-TC511.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer/Counter as String	TC000.256E-TC511.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 256		
Byte of each Word	characters		
Timer/Counter Status	TS000-TS511	Boolean	Read/Write

# **BCD Support**

16-bit and 32-bit data can be referenced as signed and unsigned BCD values. Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short / Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

### Example

IR0D @ Short = -50

IR0D @ Word = 8050 (MSB set)

IR0 @ BCD = 8050

IR0D @ Short = 50

IR0D @ Word = 50

IR0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

#### **String Support**

The C2000H model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- To address a string starting at DM1000 with a length of 100 bytes and HiLo byte order, enter: DM1000.100H
- 2. To address a string starting at DM1100 with a length of 78 bytes and LoHi byte order, enter: DM1100.078L
- To address a string starting at DM2000 with a length of 55 bytes and Only the High Order byte, enter: DM2000.055D
- 4. To address a string starting at DM2200 with a length of 37 bytes and Only the Low Order byte, enter: DM2200.037E

#### Array Support

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

DMxxxx [rows] [cols] DMxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

• Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords DM0 and DM1 overlap at word DM1. Writing to DM0 also modifies the value held in DM1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use DM0, DM2, DM4, and so on to prevent overlapping Words.

## CV500 Addressing

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and <u>Array Support</u>.

Device Type	Range	Data Type	Access
Action Flag	AC0000-AC1023	Boolean	Read Only
Auxiliary Relay	A000-A255	Word, Short, BCD	Read/Write
	A000-A254	Long, DWord, LBCD, Float	
	A256-A511 A256-A510	Word, Short, BCD Long, DWord, LBCD,	Read Only

Device Type	Range	Data Type	Access
	A000.00-A000.15-A255.00- A255.15	Float	Read/Write
		Boolean	Read Only
	A256.00-A256.15-A511.00- A511.15		
		Boolean	
Auxiliary Relay as String	A000.512H-A255.002H	String	Read/Write
with HiLo Byte Order	A256.512H-A511.002H	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.512L-A255.002L	String	Read/Write
with LoHi Byte Order	A256.512L-A511.002L	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.256D-A255.001D	String	Read/Write
Using Only the High Order Byte of	A256.256D-A511.001D	String	Read Only
each Word	.l is string length, range 1 to 256 characters		
Auxiliary Relay as String	A000.256E-A255.001E	String	Read/Write
Using Only the Low Order	A256.256E-A511.001E	String	Read Only
Byte of each Word	.I is string length, range 1 to 256 characters		
CIO	CIO0000-CIO2555	Word, Short, BCD	Read/Write
	CIO0000-CIO2554	Long, DWord, LBCD, Float	
	CIOxxxx.00-CIOxxxx.15	Boolean	
CIO Memory as String	CIO0000.512H-CIO2555.002H	String	Read/Write
with HiLo Byte Order			
	.l is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.512L-CIO2555.002L	String	Read/Write
with LoHi Byte Order			
	.I is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.256D-CIO2555.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
CIO Memory as String	CIO0000.256E-CIO2555.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 256		
Byte of each Word	characters		
Counter	C000-C511	BCD, Word, Short	Read/Write
Counter as String	C000.512H-C511.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Counter as String	C000.512L-C511.002L	String	Read/Write
with LoHi Byte Order			

Device Type	Range	Data Type	Access
	.I is string length, range 2 to 512 characters		
Counter as String	C000.256D-C511.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Counter as String	C000.256E-C511.001E	String	Read/Write
Using Only the Low Order			
Byte of each Word	.I is string length, range 1 to 256 characters		
Counter Status	CS000-CS511	Boolean	Read/Write
CPU Bus Link	G000-G255	Word, Short, BCD	Read/Write
	G000-G254	Long, DWord, LBCD,	
	Gxxx.00-Gxxx.15	Float	
ODU D. I. I. O	0000 54011 0055 00011	Boolean	D 100/ 3
CPU Bus Link as String	G000.512H-G255.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
CPU Bus Link as String	G000.512L-G255.002L	String	Read/Write
with LoHi Byte Order			
	.I is string length, range 2 to 512 characters		
CPU Bus Link as String	G000.256D-G255.001D	String	Read/Write
Using Only the High Order Byte of each Word	I is string length, range 1 to 256 characters		
CPU Bus Link as String	G000.256E-G255.001E	String	Read/Write
Using Only the Low Order			
Byte of each Word	.I is string length, range 1 to 256 characters		
Data Memory	D0000-D8191	Word, Short, BCD	Read/Write
	D0000-D8190	Long, DWord, LBCD,	
	Dxxxx.00-Dxxxx.15	Float Boolean	
	Con also Cárrin a Commant	Boolean	
Doto Momon, or String	<ul> <li>See also <u>String Support</u></li> <li>D0000.512H-D8191.002H</li> </ul>	String	Dood/M/:its
Data Memory as String with HiLo Byte Order	.l is string length, range 2 to 512	String	Read/Write
with thico byte Order	characters		
Data Memory as String	D0000.512L-D8191.002L	String	Read/Write
with LoHi Byte Order			
·	.I is string length, range 2 to 512 characters		
Data Memory as String	D0000.256D-D8191.001D	String	Read/Write
Using Only the High Order Byte of			
each Word	.l is string length, range 1 to 256 characters		
Data Memory as String	D0000.256E-D8191.001E	String	Read/Write
Using Only the Low Order			
Byte of each Word	.I is string length, range 1 to 256 characters		

Device Type	Range	Data Type	Access
Data Register	DR0-DR2	Word, Short, BCD*	Read/Write
Index Register	IR0-IR2	Word, Short, BCD*	Read/Write
Step Timer	ST000-ST511	Word, Short, BCD*	Read/Write
Step Timer Status	STS000-STS511	Boolean	Read/Write
Temporary Relay	TR	Word, Short	Read/Write
	TR0-TR7	Boolean	
Timer	T000-T511	BCD, Word, Short	Read/Write
Timer as String	T000.512H-T511.002H	String	Read/Write
with HiLo Byte Order			
	.I is string length, range 2 to 512 characters		
Timer as String	T000.512L-T511.002L	String	Read/Write
with LoHi Byte Order			
	.I is string length, range 2 to 512 characters		
Timer as String	T000.256D-T511.001D	String	Read/Write
Using Only the High Order	.I is string length, range 1 to 256		
Byte of each Word	characters		
Timer as String	T000.256E-T511.001E	String	Read/Write
Using Only the Low Order			
Byte of each Word	.I is string length, range 1 to 256 characters		
Timer Status	TS000-TS511	Boolean	Read/Write
Transition Flag	TN000-TN511	Boolean	Read/Write

<sup>\*</sup>Arrays are not supported.

## **BCD Support**

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

## Example

IROD @ Short = -50 IROD @ Word = 8050 (MSB set) IRO @ BCD = 8050

IR0D @ Short = 50 IR0D @ Word = 50 IR0 @ BCD = 50 Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

#### **String Support**

The CV500 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- 1. To address a string starting at D1000 with a length of 100 bytes and HiLo byte order, enter: D1000.100H
- 2. To address a string starting at D1100 with a length of 78 bytes and LoHi byte order, enter: D1100.078L
- To address a string starting at D2000 with a length of 55 bytes and Only the High Order byte, enter: D2000.055D
- To address a string starting at D2200 with a length of 37 bytes and Only the Low Order byte, enter: D2200.037E

# **Array Support**

Arrays are supported for all data types except Boolean, Data Register, Index Register, Step Timer, and String. There are two methods of addressing an array. Examples are given using data memory locations.

Dxxxx [rows] [cols]
Dxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

• Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords DM0 and DM1 overlap at word DM1. Writing to DM0 also modifies the value held in DM1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use DM0, DM2, DM4, and so on to prevent overlapping Words.

# CV1000 Addressing

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and <u>Array Support</u>.

Device Type	Range	Data Type	Access
Action Flag	AC0000-AC2047	Boolean	Read Only
Auxiliary Relay	A000-A255	Word, Short, BCD	Read/Write
	A000-A254	Long, DWord,	Read Only
	A256-A511	LBCD, Float	Read/Write

Device Type	Range	Data Type	Access
	A256-A510	Word, Short, BCD	Read Only
	A000.00-A000.15-A255.00- A255.15	Long, DWord, LBCD, Float	
	A256.00-A256.15-A511.00-	Boolean	
	A511.15	Boolean	
Auxiliary Relay as String	A000.512H-A255.002H	String	Read/Write
with HiLo Byte Order	A256.512H-A511.002H	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.512L-A255.002L	String	Read/Write
with LoHi Byte Order	A256.512L-A511.002L	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.256D-A255.001D	String	Read/Write
Using Only the High Order Byte of each	A256.256D-A511.001D	String	Read Only
Word	.I is string length, range 1 to 256 characters		
Auxiliary Relay as String	A000.256E-A255.001E	String	Read/Write
Using Only the Low Order	A256.256E-A511.001E	String	Read Only
Byte of each Word	.I is string length, range 1 to 256 characters		
CIO	CIO0000-CIO2555	Word, Short, BCD	Read/Write
	CIO0000-CIO2554	Long, DWord,	
	CIOxxxx.00-CIOxxxx.15	LBCD, Float	
0.014	0100000 54011 0100555 00011	Boolean	D 104/ :
CIO Memory as String	CIO0000.512H-CIO2555.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.512L-CIO2555.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.256D-CIO2555.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
CIO Memory as String	CIO0000.256E-CIO2555.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Counter	C0000-C1023	BCD, Word, Short	Read/Write
Counter as String	C0000.512H-C1023.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Counter as String	C0000.512L-C1023.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Counter as String	C0000.256D-C1023.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Counter as String	C0000.256E-C1023.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to		
Byte of each Word	256 characters		

Device Type	Range	Data Type	Access
Counter Status	CS0000-CS1023	Boolean	Read/Write
CPU Bus Link	G000-G255	Word, Short, BCD	Read/Write
	G000-G254	Long, DWord,	
	Gxxx.00-Gxxx.15	LBCD, Float	
		Boolean	
CPU Bus Link as String	G000.512H-G255.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
CPU Bus Link as String	G000.512L-G255.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
CPU Bus Link as String	G000.256D-G255.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
CPU Bus Link as String	G000.256E-G255.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to		
Byte of each Word	256 characters		
Data Memory	D00000-D24575	Word, Short, BCD	Read/Write
	D00000-D24574	Long, DWord,	
	Dxxxxx.00-Dxxxxx.15	LBCD, Float	
	See also String Support	Boolean	
Data Memory as String	D00000.512H-D24575.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Data Memory as String	D00000.512L-D24575.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Data Memory as String	D00000.256E-D24575.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Data Memory as String	D00000.256D-D24575.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to		
Byte of each Word	256 characters		
Data Register	DR0-DR2	Word, Short, BCD*	Read/Write
Expansion Data Memory	E00000-E32765	Word, Short, BCD	Read/Write
(current bank)	E00000-E32764	Long, DWord,	
	Exxxxx.00-Exxxxx.15	LBCD, Float	
		Boolean	
Expansion Data Memory	E00000.512H-E32765.002H	String	Read/Write
(current bank) as String	.I is string length, range 2 to		
with HiLo Byte Order	512 characters		
Expansion Data Memory	E00000.512L-E32765.002L	String	Read/Write
(current bank) as String	.I is string length, range 2 to		
with LoHi Byte Order	512 characters		
Expansion Data Memory	E00000.256D-E32765.001D	String	Read/Write
(current bank) Using Only the High Order Byte of each Word	I is string length, range 1 to 256 characters		
Expansion Data Memory	E00000.256E-E32765.001E	String	Read/Write
(current bank) Using Only the Low Order	.I is string length, range 1 to		

Device Type	Range	Data Type	Access
Byte of each Word	256 characters		
Expansion Data Memory	E00:00000-E07:32765 E00:00000-E07:32764 Ex:x.00-Exx:xxxxx.15	Word, Short, BCD Long, DWord, LBCD, Float Boolean	Read/Write
Expansion Data Memory as String with HiLo Byte Order	E00:00000.512H- E07:32765.002H .1 is string length, range 2 to 512 characters	String	Read/Write
Expansion Data Memory as String with LoHi Byte Order	E00:00000.512L- E07:32765.002L .1 is string length, range 2 to 512 characters	String	Read/Write
Expansion Data Memory as String Using Only the High Order Byte of each Word	E00:00000.256D- E07:32765.001D .I is string length, range 1 to 256 characters	String	Read/Write
Expansion Data Memory as String Using Only the Low Order Byte of each Word	E00:00000.256E- E07:32765.001E .I is string length, range 1 to 256 characters	String	Read/Write
Index Register	IR0-IR2	Word, Short, BCD*	Read/Write
Step Timer	ST0000-ST1023	Word, Short, BCD*	Read/Write
Step Timer Status	STS0000-STS1023	Boolean	Read/Write
Temporary Relay	TR TR0-TR7	Word, Short Boolean	Read/Write
Timer	T0000-T1023	BCD, Word, Short	Read/Write
Timer as String with HiLo Byte Order	T0000.512H-T1023.002H I is string length, range 2 to 512 characters	String	Read/Write
Timer as String with LoHi Byte Order	T0000.512L-T1023.002L I is string length, range 2 to 512 characters	String	Read/Write
Timer as String Using Only the High Order Byte of each Word	T0000.256D-T1023.001D I is string length, range 1 to 256 characters	String	Read/Write
Timer as String Using Only the Low Order Byte of each Word	T0000.256E-T1023.001E  .I is string length, range 1 to 256 characters	String	Read/Write
Timer Status	TS0000-TS1023	Boolean	Read/Write
Transition Flag	TN0000-TN1023	Boolean	Read/Write

<sup>\*</sup>Arrays are not supported.

16-bit and 32-bit data can be referenced as signed and unsigned BCD values. Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD

0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example

IR0D @ Short = -50 IR0D @ Word = 8050 (MSB set) IR0 @ BCD = 8050

IR0D @ Short = 50 IR0D @ Word = 50 IR0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

#### **String Support**

The CV1000 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- To address a string starting at D01000 with a length of 100 bytes and HiLo byte order, enter: D01000.100H
- 2. To address a string starting at D01100 with a length of 78 bytes and LoHi byte order, enter: D01100.078L
- 3. To address a string starting at D02000 with a length of 55 bytes and Only the High Order byte, enter: D02000.055D
- To address a string starting at D02200 with a length of 37 bytes and Only the Low Order byte, enter: D02200.037E

# **Array Support**

Arrays are supported for all data types except Boolean, Data Register, Index Register, Step Timer, and String. There are two methods of addressing an array. Examples are given using data memory locations.

Dxxxx [rows] [cols]
Dxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

• Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords D0 and D1 overlap at word D1. Writing to D0 also modifies the value held in D1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use D0, D2, D4, and so on to prevent overlapping Words.

# CV2000 Addressing

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

For more information, refer below the table for notes and restrictions on BCD Support, String Support, and Array Support.

Device Type	Range	Data Type	Access
Action Flag	AC0000-AC2047	Boolean	Read Only
Auxiliary Relay	A000-A255	Word, Short, BCD	Read/Write
	A000-A254	Long, DWord,	Read Only
	A256-A511	LBCD, Float	Read/Write
	A256-A510	Word, Short, BCD	Read Only
	A000.00-A000.15-A255.00- A255.15	Long, DWord, LBCD, Float	
	A256.00-A256.15-A511.00-	Boolean	
	A511.15	Boolean	
Auxiliary Relay as String	A000.512H-A255.002H	String	Read/Write
with HiLo Byte Order	A256.512H-A511.002H	String	Read Only
	.l is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.512L-A255.002L	String	Read/Write
with LoHi Byte Order	A256.512L-A511.002L	String	Read Only
	.l is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.256D-A255.001D	String	Read/Write
Using Only the High Order Byte of each	A256.256D-A511.001D	String	Read Only
Word	.l is string length, range 1 to 256 characters		
Auxiliary Relay as String	A000.256E-A255.001E	String	Read/Write
Using Only the Low Order Byte of each	A256.256E-A511.001E	String	Read Only
Word	.l is string length, range 1 to 256 characters		
CIO	CIO0000-CIO2555	Word, Short, BCD	Read/Write
	CIO0000-CIO2554	Long, DWord,	
	CIOxxxx.00-CIOxxxx.15	LBCD, Float	
		Boolean	
CIO Memory as String	CIO0000.512H-CIO2555.002H	String	Read/Write
with HiLo Byte Order	I is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.512L-CIO2555.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.256D-CIO2555.001D	String	Read/Write
Using Only the High Order Byte of each Word	.l is string length, range 1 to 256 characters		

Device Type	Range	Data Type	Access
CIO Memory as String	CIO0000.256E-CIO2555.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.l is string length, range 1 to 256 characters		
Counter	C0000-C1023	BCD, Word, Short	Read/Write
Counter as String	C0000.512H-C1023.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
Counter as String with LoHi Byte Order	C0000.512L-C1023.002L  I is string length, range 2 to 512 characters	String	Read/Write
Counter as String Using Only the High Order Byte of each Word	C0000.256D-C1023.001D  I is string length, range 1 to 256 characters	String	Read/Write
Counter as String	C0000.256E-C1023.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.l is string length, range 1 to 256 characters		
Counter Status	CS0000-CS1023	Boolean	Read/Write
CPU Bus Link	G000-G255	Word, Short, BCD	Read/Write
	G000-G254 Gxxx.00-Gxxx.15	Long, DWord, LBCD, Float Boolean	
CPU Bus Link as String	G000.512H-G255.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters	- u <b>g</b>	
CPU Bus Link as String	G000.512L-G255.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters		
CPU Bus Link as String	G000.256D-G255.001D	String	Read/Write
Using Only the High Order Byte of each Word	.l is string length, range 1 to 256 characters		
CPU Bus Link as String	G000.256E-G255.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Data Memory	D00000-D24575 D00000-D24574 Dxxxxx.00-Dxxxxxx.15 See also String Support	Word, Short, BCD Long, DWord, LBCD, Float Boolean	Read/Write
Data Memory as String with HiLo Byte Order	D00000.512H-D24575.002H  I is string length, range 2 to 512 characters	String	Read/Write
Data Memory as String	D00000.512L-D24575.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters		
Data Memory as String	D00000.256D-D24575.001D	String	Read/Write
Using Only the High Order Byte of each Word	.l is string length, range 1 to 256 characters		
Data Memory as String	D00000.256E-D24575.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.l is string length, range 1 to 256 characters		
Data Register	DR0-DR2	Word, Short, BCD*	Read/Write

Device Type	Range	Data Type	Access
Expansion Data Memory	E00000-E32765	Word, Short, BCD	Read/Write
(current bank)	E00000-E32764	Long, DWord,	
	Exxxxx.00-Exxxxx.15	LBCD, Float	
		Boolean	
Expansion Data Memory	E00000.512H-E32765.002H	String	Read/Write
(current bank) as String	.l is string length, range 2 to 512		
with HiLo Byte Order	characters		
Expansion Data Memory	E00000.512L-E32765.002L	String	Read/Write
(current bank) as String	.I is string length, range 2 to 512 characters		
with LoHi Byte Order			
Expansion Data Memory	E00000.256D-E32765.001D	String	Read/Write
(current bank) as String	I is string length, range 1 to 256		
Using Only the High Order Byte of each Word	characters		
Expansion Data Memory	E00000.256E-E32765.001E	String	Read/Write
(current bank) as String	.I is string length, range 1 to 256		
Using Only the Low Order Byte of each Word	characters		
Expansion Data Memory	E00:00000-E07:32765	Word, Short, BCD	Read/Write
	E00:00000-E07:32764	Long, DWord,	
	Ex:x.00-Exx:xxxxx.15	LBCD, Float	
		Boolean	
Expansion Data Memory as	E00:00000.512H -	String	Read/Write
String with HiLo Byte Order	E07:32765.002H		
	.l is string length, range 2 to 512 characters		
Expansion Data Memory as	E00:00000.512L -	String	Read/Write
String with LoHi Byte Order	E07:32765.002L		
,	.I is string length, range 2 to 512		
	characters		
Expansion Data Memory as	E00:00000.256D-	String	Read/Write
String Using Only the High Order Byte	E07:32765.001D		
of each Word	.I is string length, range 1 to 256 characters		
Expansion Data Memory as	E00:00000.256E-	String	Read/Write
String Using Only the Low Order Byte of	E07:32765.001E		
each Word	.l is string length, range 1 to 256 characters		
Index Register	IR0-IR2	Word, Short, BCD*	Read/Write
Step Timer	ST0000-ST1023	Word, Short, BCD*	Read/Write
Step Timer Status	STS0000-STS1023	Boolean	Read/Write
Temporary Relay	TR	Word, Short	Read/Write
	TR0-TR7	Boolean	
Timer	T0000-T1023	BCD, Word, Short	Read/Write
Timer as String	T0000.512H-T1023.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
Timer as String	T0000.512L-T1023.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512		
	characters		

Device Type	Range	Data Type	Access
Timer as String	T0000.256D-T1023.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer as String	T0000.256E-T1023.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer Status	TS0000-TS1023	Boolean	Read/Write
Transition Flag	TN0000-TN1023	Boolean	Read/Write

<sup>\*</sup>Arrays are not supported.

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example

IR0D @ Short = -50 IR0D @ Word = 8050 (MSB set) IR0 @ BCD = 8050

IR0D @ Short = 50

IR0D @ Word = 50 IR0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

# **String Support**

The CV2000 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

# **Examples**

- To address a string starting at D01000 with a length of 100 bytes and HiLo byte order, enter: D01000.100H
- 2. To address a string starting at D01100 with a length of 78 bytes and LoHi byte order, enter: D01100.078L
- 3. To address a string starting at D02000 with a length of 55 bytes and Only the High Order byte, enter: D02000.055D
- To address a string starting at D02200 with a length of 37 bytes and Only the Low Order byte, enter: D02200.037E

#### **Array Support**

Arrays are supported for all data types except Boolean, Data Register, Index Register, Step Timer, and String. There are two methods of addressing an array. Examples are given using data memory locations.

Dxxxx [rows] [cols]
Dxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords D0 and D1 overlap at word D1. Writing to D0 also modifies the value held in D1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use D0, D2, D4, and so on to prevent overlapping Words.

# CVM1-CPU01 Addressing

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and <u>Array Support</u>.

Device Type	Range	Data Type	Access
Auxiliary Relay	A000-A255	Word, Short, BCD	Read/Write
	A000-A254	Long, DWord, LBCD,	Read Only
	A256-A511	Float	Read/Write
	A256-A510	Word, Short, BCD	Read Only
	A000.00-A000.15-A255.00-	Long, DWord, LBCD,	
	A255.15	Float	
	A256.00-A256.15-A511.00-	Boolean	
	A511.15	Boolean	
Auxiliary Relay as String	A000.512H-A255.002H	String	Read/Write
with HiLo Byte Order	A256.512H-A511.002H	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.512L-A255.002L	String	Read/Write
with LoHi Byte Order	A256.512L-A511.002L	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.256D-A255.001D	String	Read/Write
Using Only the High Order Byte of	A256.256D-A511.001D	String	Read Only
each Word	.I is string length, range 1 to 256 characters		

Device Type	Range	Data Type	Access
Auxiliary Relay as String	A000.256E-A255.001E	String	Read/Write
Using Only the Low Order	A256.256E-A511.001E	String	Read Only
Byte of each Word	.I is string length, range 1 to 256 characters		
CIO	CIO0000-CIO2555	Word, Short, BCD	Read/Write
	CIO0000-CIO2554	Long, DWord, LBCD,	
	CIOxxxx.00-CIOxxxx.15	Float Boolean	
CIO Memory as String	CIO0000.512H-CIO2555.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.512L-CIO2555.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.256D-CIO2555.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
CIO Memory as String	CIO0000.256E-CIO2555.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 256		
Byte of each Word	characters		
Counter	C000-C511	BCD, Word, Short	Read/Write
Counter as String	C000.512H-C511.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
Counter as String	C000.512L-C511.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters		
Counter as String	C000.256D-C511.001D	String	Read/Write
Using Only the High Order Byte of each Word	I is string length, range 1 to 256 characters		
Counter as String	C000.256E-C511.001E	String	Read/Write
Using Only the Low Order	.l is string length, range 1 to 256		
Byte of each Word	characters		
Counter Status	CS000-CS511	Boolean	Read/Write
CPU Bus Link	G000-G255	Word, Short, BCD	Read/Write
	G000-G254	Long, DWord, LBCD, Float	
	Gxxx.00-Gxxx.15	Boolean	
CPU Bus Link as String	G000.512H-G255.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512		
	characters		
CPU Bus Link as String	G000.512L-G255.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters		
CPU Bus Link as String	G000.256D-G255.001D	String	Read/Write
Using Only the High Order Byte of each Word	.l is string length, range 1 to 256 characters		
CPU Bus Link as String	G000.256E-G255.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 256		
Byte of each Word	characters		

Device Type	Range	Data Type	Access
Data Memory	D0000-D8191	Word, Short, BCD	Read/Write
	D0000-D8190	Long, DWord, LBCD,	
	Dxxxx.00-Dxxxx.15	Float	
	See also String Support	Boolean	
Data Memory as String	D0000.512H-D8191.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Data Memory as String	D0000.512L- D8191.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Data Memory as String	D0000.256D-D8191.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Data Memory as String	D0000.256E-D8191.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 256		
Byte of each Word	characters		
Data Register	DR0-DR2	Word, Short, BCD*	Read/Write
Index Register	IR0-IR2	Word, Short, BCD*	Read/Write
Temporary Relay	TR	Word, Short	Read/Write
	TR0-TR7	Boolean	
Timer	T000-T511	BCD, Word, Short	Read/Write
Timer as String	T000.512H-T511.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Timer as String	T000.512L-T511.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Timer as String	T000.256D-T511.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer as String	T000.256E-T511.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to 256		
Byte of each Word	characters		
Timer Status	TS000-TS511	Boolean	Read/Write

<sup>\*</sup>Arrays are not supported.

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD

0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD

±7999

Long as signed BCD ±79999999

#### Example

IR0D @ Short = -50 IR0D @ Word = 8050 (MSB set) IR0 @ BCD = 8050

IR0D @ Short = 50 IR0D @ Word = 50 IR0 @ BCD = 50

**Note:** Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

#### **String Support**

The CVM1-CPU01 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

# **Examples**

- 1. To address a string starting at D1000 with a length of 100 bytes and HiLo byte order, enter: D1000.100H
- 2. To address a string starting at D1100 with a length of 78 bytes and LoHi byte order, enter: D1100.078L
- To address a string starting at D2000 with a length of 55 bytes and Only the High Order byte, enter: D2000.055D
- To address a string starting at D2200 with a length of 37 bytes and Only the Low Order byte, enter: D2200.037E

#### **Array Support**

Arrays are supported for all data types except Boolean, Data Register, Index Register, and String. There are two methods of addressing an array. Examples are given using data memory locations.

Dxxxx [rows] [cols]
Dxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

• Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords DM0 and DM1 overlap at word DM1. Writing to DM0 also modifies the value held in DM1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use DM0, DM2, DM4, and so on to prevent overlapping Words.

# CVM1-CPU11 Addressing

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

• For more information, refer below the table for notes and restrictions on BCD Support, String Support, and Array Support.

Device Type	Range	Data Type	Access
Auxiliary Relay	A000-A255	Word, Short, BCD	Read/Write
	A000-A254	Long, DWord, LBCD,	Read Only
	A256-A511	Float	Read/Write
	A256-A510	Word, Short, BCD	Read Only
	A000.00-A000.15-A255.00- A255.15	Long, DWord, LBCD, Float	
	A256.00-A256.15-A511.00-	Boolean	
	A511.15	Boolean	
Auxiliary Relay as String	A000.512H-A255.002H	String	Read/Write
with HiLo Byte Order	A256.512H-A511.002H	String	Read Only
	.l is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.512L-A255.002L	String	Read/Write
with LoHi Byte Order	A256.512L-A511.002L	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.256D-A255.001D	String	Read/Write
Using Only the High Order Byte of	A256.256D-A511.001D	String	Read Only
each Word	.I is string length, range 1 to 256 characters		
Auxiliary Relay as String	A000.256E-A255.001E	String	Read/Write
Using Only the Low Order Byte of	A256.256E-A511.001E	String	Read Only
each Word	.l is string length, range 1 to 256 characters		
CIO	CIO0000-CIO2555	Word, Short, BCD	Read/Write
	CIO0000-CIO2554	Long, DWord, LBCD,	
	CIOxxxx.00-CIOxxxx.15	Float	
		Boolean	
CIO Memory as String	CIO0000.512H-CIO2555.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.512L-CIO2555.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.256D-CIO2555.001D	String	Read/Write
Using Only the High Order Byte of each Word	.l is string length, range 1 to 256 characters		
CIO Memory as String	CIO0000.256E-CIO2555.001E	String	Read/Write
Using Only the Low Order Byte of	.I is string length, range 1 to 256		
each Word	characters		
Counter	C0000-C1023	BCD, Word, Short	Read/Write
Counter as String	C0000.512H-C1023.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Counter as String	C0000.512L-C1023.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512		

Device Type	Range	Data Type	Access
	characters		
Counter as String	C0000.256D-C1023.001D	String	Read/Write
Using Only the High Order Byte of each Word	.l is string length, range 1 to 256 characters		
Counter as String	C0000.256E-C1023.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Counter Status	CS0000-CS1023	Boolean	Read/Write
CPU Bus Link	G000-G255 G000-G254 Gxxx.00-Gxxx.15	Word, Short, BCD Long, DWord, LBCD, Float Boolean	Read/Write
CPU Bus Link as String	G000.512H-G255.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters	String	Read/Wille
CPU Bus Link as String	G000.512L-G255.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
CPU Bus Link as String	G000.256D-G255.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
CPU Bus Link as String	G000.256E-G255.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.l is string length, range 1 to 256 characters		
Data Memory	D00000-D24575 D00000-D24574 Dxxxxx.00-Dxxxxxx.15	Word, Short, BCD Long, DWord, LBCD, Float	Read/Write
	See also <u>String Support</u>	Boolean	
Data Memory as String with HiLo Byte Order	D00000.512H-D24575.002H  I is string length, range 2 to 512 characters	String	Read/Write
Data Memory as String with LoHi Byte Order	D00000.512L-D24575.002L .I is string length, range 2 to 512 characters	String	Read/Write
Data Memory as String	D00000.256D-D24575.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Data Memory as String	D00000.256E-D24575.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Data Register	DR0-DR2	Word, Short, BCD*	Read/Write
Index Register	IR0-IR2	Word, Short, BCD*	Read/Write
Temporary Relay	TR TR0-TR7	Word, Short Boolean	Read/Write
Timer	T0000-T1023	BCD, Word, Short	Read/Write
Timer as String with HiLo Byte Order	T0000.512H-T1023.002H .I is string length, range 2 to 512 characters	String	Read/Write
Timer as String with LoHi Byte Order	T0000.512L-T1023.002L  .I is string length, range 2 to 512	String	Read/Write

Device Type	Range	Data Type	Access
	characters		
Timer as String	T0000.256D-T1023.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer as String	T0000.256E-T1023.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer Status	TS0000-TS1023	Boolean	Read/Write

<sup>\*</sup>Arrays are not supported.

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example

IR0D @ Short = -50 IR0D @ Word = 8050 (MSB set) IR0 @ BCD = 8050

IR0D @ Short = 50

IR0D @ Word = 50 IR0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

# String Support

The CVM1-CPU11 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

# **Examples**

- To address a string starting at D01000 with a length of 100 bytes and HiLo byte order, enter: D01000.100H
- 2. To address a string starting at D01100 with a length of 78 bytes and LoHi byte order, enter: D01100.078L
- 3. To address a string starting at D02000 with a length of 55 bytes and Only the High Order byte, enter: D02000.055D
- To address a string starting at D02200 with a length of 37 bytes and Only the Low Order byte, enter: D02200.037E

#### **Array Support**

Arrays are supported for all data types except Boolean, Data Register, Index Register, and String. There are two methods of addressing an array. Examples are given using data memory locations.

Dxxxx [rows] [cols]
Dxxxx [cols]\*

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

• Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords DM0 and DM1 overlap at word DM1. Writing to DM0 also modifies the value held in DM1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use DM0, DM2, DM4, and so on to prevent overlapping Words.

# CVM1-CPU21 Addressing

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and <u>Array Support</u>.

Device Type	Range	Data Type	Access
Auxiliary Relay	A000-A255	Word, Short, BCD,	Read/Write
	A000-A254	Long, DWord,	Read Only
	A256-A511	LBCD, Float	Read/Write
	A256-A510	Word, Short, BCD,	Read Only
	A000.00-A000.15-A255.00- A255.15	Long, DWord, LBCD, Float	
	A256.00-A256.15-A511.00-	Boolean	
	A511.15	Boolean	
Auxiliary Relay as String	A000.512H-A255.002H	String	Read/Write
with HiLo Byte Order	A256.512H-A511.002H	String	
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.512L-A255.002L	String	Read/Write
with LoHi Byte Order	A256.512L-A511.002L	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.256D-A255.001D	String	Read/Write
Using Only the High Order Byte	A256.256D-A511.001D	String	Read Only
of each Word	.I is string length, range 1 to 256 characters		

<sup>\*</sup>This method assumes that "rows" is equal to one.

Device Type	Range	Data Type	Access
Auxiliary Relay as String	A000.256E-A255.001E	String	Read/Write
Using Only the Low Order Byte	A256.256E-A511.001E	String	Read Only
of each Word	I is string length, range 1 to 256 characters		
CIO	CIO0000-CIO2555	Word, Short, BCD,	Read/Write
	CIO0000-CIO2554	Long, DWord,	
	CIOxxxx.00-CIOxxxx.15	LBCD, Float Boolean	
CIO Memory as String	CIO0000.512H-CIO2555.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.512L-CIO2555.002L	String	Read/Write
with LoHi Byte Order	.1 is string length, range 2 to 512 characters		
CIO Memory as String	CIO0000.256D-CIO2555.001D	String	Read/Write
Using Only the High Order Byte of each Word	I is string length, range 1 to 256 characters		
CIO Memory as String	CIO0000.256E-CIO2555.001E	String	Read/Write
Using Only the Low Order Byte of each Word	I is string length, range 1 to 256 characters		
Counter	C0000-C1023	BCD, Word, Short	Read/Write
Counter as String	C0000.512H-C1023.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
Counter as String	C0000.512L-C1023.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters		
Counter as String	C0000.256D-C1023.001D	String	Read/Write
Using Only the High Order Byte of each Word	I is string length, range 1 to 256 characters		
Counter as String	C0000.256E-C1023.001E	String	Read/Write
Using Only the Low Order Byte of each Word	I is string length, range 1 to 256 characters		
Counter Status	CS0000-CS1023	Boolean	Read/Write
CPU Bus Link	G000-G255	Word, Short, BCD,	Read/Write
	G000-G254	Long, DWord,	
	Gxxx.00-Gxxx.15	LBCD, Float, Boolean	
CPU Bus Link as String	G000.512H-G255.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters	Curing	rtead/write
CPU Bus Link as String	G000.512L-G255.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters	9	
CPU Bus Link as String	G000.256D-G255.001D	String	Read/Write
Using Only the High Order Byte of each Word	.l is string length, range 1 to 256 characters		
CPU Bus Link as String	G000.256E-G255.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.l is string length, range 1 to 256 characters		
Data Memory	D00000-D24575	Word, Short, BCD	Read/Write

Device Type	Range	Data Type	Access
	D00000-D24574	Long, DWord,	
	Dxxxxx.00-Dxxxxx.15	LBCD, Float	
	See also String Support	Boolean	
Data Memory as String	D00000.512H-D24575.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
Data Memory as String	D00000.512L-D24575.002L	String	Read/Write
with LoHi Byte Order	I is string length, range 2 to 512 characters		
Data Memory as String	D00000.256D-D24575.001D	String	Read/Write
Using Only the High Order Byte of each Word	I is string length, range 1 to 256 characters		
Data Memory as String	D00000.256E-D24575.001E	String	Read/Write
Using Only the Low Order Byte of each Word	I is string length, range 1 to 256 characters		
Data Register	DR0-DR2	Word, Short, BCD*	Read/Write
Expansion Data Memory	E00000-E32765	Word, Short, BCD,	Read/Write
(current bank)	E00000-E32764	Long, DWord,	
	Exxxxx.00-Exxxxx.15	LBCD, Float	
		Boolean	
Expansion Data Memory	E00000.512H-E32765.002H	String	Read/Write
(current bank) as String with HiLo Byte Order	I is string length, range 2 to 512 characters		
Expansion Data Memory	E00000.512L-E32765.002L	String	Read/Write
(current bank) as String	.I is string length, range 2 to 512		
with LoHi Byte Order	characters		
Expansion Data Memory	E00000.256D-E32765.001D	String	Read/Write
(current bank) as String	.I is string length, range 1 to 256		
Using Only the High Order Byte of each Word	characters		
Expansion Data Memory (cur-	E00000.256E-E32765.001E	String	Read/Write
rent bank) as String Using Only the Low Order Byte of each	I is string length, range 1 to 256		
Word	characters		
Expansion Data Memory	E00:00000-E07:32765	Word, Short, BCD,	Read/Write
,	E00:00000-E07:32764	Long, DWord,	
	Ex:x.00-Exx:xxxxx.15	LBCD, Float	
		Boolean	
Expansion Data Memory as String	E00:00000.512H- E07:32765.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Expansion Data Memory as	E00:00000.512L-	String	Read/Write
String	E07:32765.002L		
with LoHi Byte Order	.1 is string length, range 2 to 512 characters		
Expansion Data Memory as String	E00:00000.256D- E07:32765.001D	String	Read/Write
Using Only the High Order Byte of each Word	.l is string length, range 1 to 256 characters		
Expansion Data Memory as	E00:00000.256E-	String	Read/Write

Device Type	Range	Data Type	Access
String	E07:32765.001E		
Using Only the Low Order Byte	.I is string length, range 1 to 256		
of each Word	characters		
Index Register	IR0-IR2	Word, Short, BCD*	Read/Write
Temporary Relay	TR	Word, Short,	Read/Write
	TR0-TR7	Boolean	
Timer	T0000-T1023	BCD, Word, Short	Read/Write
Timer as String	T0000.512H-T1023.002H	String	Read/Write
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
T: 0::	0.10.0010.0	0.1	D 100/ :
Timer as String	T0000.512L-T1023.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Timer as String	T0000.256D-T1023.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer as String	T0000.256E-T1023.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer Status	TS0000-TS1023	Boolean	Read/Write

<sup>\*</sup>Arrays are not supported.

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example

IR0D @ Short = -50 IR0D @ Word = 8050 (MSB set) IR0 @ BCD = 8050

IR0D @ Short = 50 IR0D @ Word = 50 IR0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

# **String Support**

The CVM1-CPU21 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- To address a string starting at D01000 with a length of 100 bytes and HiLo byte order, enter: D01000.100H
- 2. To address a string starting at D01100 with a length of 78 bytes and LoHi byte order, enter: D01100.078L
- 3. To address a string starting at D02000 with a length of 55 bytes and Only the High Order byte, enter: D02000.055D
- To address a string starting at D02200 with a length of 37 bytes and Only the Low Order byte, enter: D02200.037E

#### **Array Support**

Arrays are supported for all data types except Boolean, Data Register, Index Register, and String. There are two methods of addressing an array. Examples are given using data memory locations.

Dxxxx [rows] [cols]
Dxxxx [cols]\*

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

▶ Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. DWords DM0 and DM1 overlap at word DM1. Writing to DM0 also modifies the value held in DM1. It is recommended that users utilize these data types so that overlapping does not occur. For example, when using DWords, use DM0, DM2, DM4, and so on to prevent overlapping Words.

# **CS1 Addressing**

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and Array Support.

Device Type	Range	Data Type	Access
Auxiliary Relay	A000-A447	Word, Short, BCD,	Read Only
	A000-A446	Long, DWord, LBCD, Float	Read/Write
	A448-A959	Word, Short, BCD,	Read Only
	A448-A958	Long, DWord, LBCD, Float	Read/Write
	A000.00-A000.15-A447.00-	Boolean	
	A447.15	Boolean	
	A448.00-A448.15-A959.00- A959.15		

<sup>\*</sup>This method assumes that "rows" is equal to one.

Device Type	Range	Data Type	Access
Auxiliary Relay as String	A000.512H-A447.002H	String	Read Only
with HiLo Byte Order	A448.512H-A959.002H	String	Read/Write
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.512L-A447.002L	String	Read Only
with LoHi Byte Order	A448.512L-A959.002L	String	Read/Write
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.256D-A447.001D	String	Read Only
using only the High Order	A448.256D-A959.001D	String	Read/Write
Byte of each Word	I is string length, range 1 to 256 characters		
Auxiliary Relay as String	A000.256E-A447.001E	String	Read Only
using only the Low Order	A448.256E-A959.001E	String	Read/Write
Byte of each Word	I is string length, range 1 to 256 characters		
CIO	CIO0000-CIO6143	Word, Short, BCD,	Read/Write
	CIO0000-CIO6142	Long, DWord, LBCD, Float,	
	CIOxxxx.00-CIOxxxx.15	Boolean	
CIO memory as String with HiLo Byte Order	CIO0000.512H- CIO6143.002H	String	Read/Write
	I is string length, range 2 to 512 characters		
CIO memory as String with LoHi Byte Order	CIO0000.512L- CIO6143.002L	String	Read/Write
ŕ	.I is string length, range 2 to 512 characters		
CIO memory as String	CIO0000.256D-	String	Read/Write
Using Only the High Order Byte of			
each Word	.l is string length, range 1 to 256 characters		
CIO Memory as String	CIO0000.256E-	String	Read/Write
Using Only the Low Order	CIO6143.001E		
Byte of each Word	I is string length, range 1 to 256 characters		
Counter	C0000-C4095	BCD, Word, Short	Read/Write
Counter as String	C0000.512H-C4095.002H	String	Read/Write
with HiLo Byte Order	I is string length, range 2 to 512 characters		
Counter as String	C0000.512L-C4095.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Counter as String	C0000.256D-C4095.001D	String	Read/Write
using only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Counter as String	C0000.256E-C4095.001E	String	Read/Write
using only the Low Order Byte of each Word	.I is string length, range 1 to 256 characters		
Counter Status	CS0000-CS4095	Boolean	Read/Write*
	D00000-D32767	Word, Short, BCD,	Read/Write
Data Memory			

Device Type	Range	Data Type	Access
	Dxxxxx.00-Dxxxxx.15	Boolean	
	See also String Support		
Data Memory as String with HiLo Byte Order	D00000.512H- D32767.002H	String	Read/Write
	.l is string length, range 2 to 512 characters		
Data Memory as String	D00000.512L-D32767.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Data Memory as String using only the High Order Byte of	D00000.256D- D32767.001D	String	Read/Write
each Word	I is string length, range 1 to 256 characters		
Data Memory as String Using Only the Low Order	D00000.256E- D32767.001E	String	Read/Write
Byte of each Word	I is string length, range 1 to 256 characters		
Data Register	DR00-DR15	Word, Short, BCD,	Read/Write*
	DR00-DR14	Long, DWord, LBCD, Float	
Expansion Data Memory	E00000-E32767	Word, Short, BCD,	Read/Write
(current bank)	E00000-E32766	Long, DWord, LBCD, Float,	
	Exxxxx.00-Exxxxx.15	Boolean	
Expansion Data Memory	E00000.512H-	String	Read/Write
(current bank) as String	E32767.002H		
with HiLo Byte Order	I is string length, range 2 to 512 characters		
Expansion Data Memory	E00000.512L-E32767.002L	String	Read/Write
(current bank) as String with LoHi Byte Order	I is string length, range 2 to 512 characters		
Expansion Data Memory (current bank) as String	E00000.256D- E32767.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Expansion Data Memory	E00000.256E-E32767.001E	String	Read/Write
(current bank) as String	.I is string length, range 1 to		
Using Only the Low Order	256 characters		
Byte of each Word			
Expansion Data Memory	E00:00000-E12:32767	Word, Short, BCD,	Read/Write
	E00:00000-E12:32766	Long, DWord, LBCD, Float	
	Ex:x.00-Exx:xxxxx.15	Boolean	
Expansion Data Memory as String with HiLo Byte Order	E00:00000.512H- E12:32767.002H	String	Read/Write
	.I is string length, range 2 to 512 characters		
Expansion Data Memory as	E00:00000.512L-	String	Read/Write
String with LoHi Byte Order	E12:32767.002L		
	.l is string length, range 2 to 512 characters		
Expansion Data Memory as	E00:00000.256D-	String	Read/Write
String Using Only the High Order	E12:32767.001D		
Byte of each Word	.I is string length, range 1 to		

Device Type	Range	Data Type	Access
	256 characters		
Expansion Data Memory as	E00:00000.256E-	String	Read/Write
String Using Only the Low	E12:32767.001E		
Order Byte of each Word	.I is string length, range 1 to 256 characters		
Holding Relay	H0000-H1535	Word, Short, BCD, Long,	Read/Write
	H0000-H1534	DWord, LBCD, Float,	
	Hxxxx.00-Hxxxx.15	Boolean	
Holding Relay as String	H0000.512H-H1535.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Holding Relay as String	H0000.512L-H1535.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Holding Relay as String	H0000.256D-H1535.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Holding Relay as String	H0000.256E-H1535.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to		
Byte of each Word	256 characters		
Index Register	IR00-IR15	DWord, Long, LBCD, Float	Read/Write*
Task Flag	TK00-TK31	Boolean	Read Only
Timer	T0000-T4095	BCD, Word, Short	Read/Write
Timer as String	T0000.512H-T4095.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Timer as String	T0000.512L-T4095.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Timer as String	T0000.256D-T4095.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Timer as String	T0000.256E-T4095.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to		
Byte of each Word	256 characters		
Timer Status	TS0000-TS4095	Boolean	Read/Write*
Working Relay	W000-W511	Word, Short, BCD, Long,	Read/Write
	W000-W510	DWord, LBCD, Float,	
	Wxxx.00-Wxxx.15	Boolean	
Working Relay as String	W000.512H-W511.002H	String	Read/Write
with HiLo Byte Order	.I is string length, range 2 to 512 characters		
Working Relay as String	W000.512L-W511.002L	String	Read/Write
with LoHi Byte Order	.I is string length, range 2 to 512 characters		
Working Relay as String	W000.256D-W511.001D	String	Read/Write
Using Only the High Order Byte of each Word	.I is string length, range 1 to 256 characters		
Working Relay as String	W000.256E-W511.001E	String	Read/Write
Using Only the Low Order	.I is string length, range 1 to		

Device Type	Range	Data Type	Access
Byte of each Word	256 characters		

▶ Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. Therefore, DWords D0 and D1 overlap at word D1 and writing to D0 also modifies the value held in D1. It is recommended that users utilize these data types so that overlapping does not occur. When using DWords, users may want to use D0, D2, D4, and so on to prevent overlapping Words. The exception to this is IR tags, which are native 32-bit values with MSB to LSB byte ordering for the CS1-series PLCs.

# **BCD Support**

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example

D0D @ Short = -50 D0D @ Word = 8050 (MSB set) D0 @ BCD = 8050 D0D @ Short = 50

D0D @ Snort = 50 D0D @ Word = 50 D0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

#### **String Support**

The CS1 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- To address a string starting at D01000 with a length of 100 bytes and HiLo byte order, enter: D01000.100H
- 2. To address a string starting at D01100 with a length of 78 bytes and LoHi byte order, enter: D01100.078L
- 3. To address a string starting at D02000 with a length of 55 bytes and Only the High Order byte, enter: D02000.055D
- To address a string starting at D02200 with a length of 37 bytes and Only the Low Order byte, enter: D02200.037E

# **Array Support**

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

Dxxxx [rows] [cols]
Dxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

#### Writing to CS, TS, DR, and IR Registers

CS and TS registers can be written to only when the device is in Monitor Mode or Programming Mode. DR and IR registers can be written to only when the device is in Programming Mode. CS, TS, DR, and IR registers cannot be written to in Run Mode. If the device is in Run Mode and a write is attempted to one of these registers, the value in the device does not change. The following occurs:

- If the device is in Run Mode and a write is attempted to a CS or TS register, an "unable to write" error message is returned.
- If the device is in Run Mode and a write is attempted to a DR or IR register, the write succeeds. Although
  no error message is returned, the value in the device does not change because the device is in Run
  Mode.

# **CJ1 Addressing**

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and Array Support.

Device Type	Range	Data Type	Access
Auxiliary Relay	A000-A447	Word, Short, BCD	Read Only
	A000-A446	Long,DWord, LBCD, Float	Read/Write
	A448-A959	Word, Short, BCD	Read Only
	A448-A958	Long, DWord, LBCD, Float	Read/Write
	A000.00-A000.15-A447.00-	Boolean	
	A447.15	Boolean	
	A448.00-A448.15-A959.00-		
	A959.15		
Auxiliary Relay as String	A000.512H-A447.002H	String	Read Only
with HiLo Byte Order	A448.512H-A959.002H	String	Read/Write
	.I is string length, range 2 to		
	512 characters		
Auxiliary Relay as String	A000.512L-A447.002L	String	Read Only
with LoHi Byte Order	A448.512L-A959.002L	String	Read/Write
	.I is string length, range 2 to		

Device Type	Range	Data Type	Access
	512 characters		
Auxiliary Relay as String	A000.256D-A447.001D	String	Read Only
Using Only the High Order	A448.256D-A959.001D	String	Read/Write
Byte of each Word	I is string length, range 1 to 256 characters		
Auxiliary Relay as String	A000.256E-A447.001E	String	Read Only
Using Only the Low Order	A448.256E-A959.001E	String	Read/Write
Byte of each Word	I is string length, range 1 to 256 characters		
CIO	CIO0000-CIO6143	Word, Short, BCD	Read/Write
	CIO0000-CIO6142	Long, DWord, LBCD, Float	
	CIOxxxx.00-CIOxxxx.15	Boolean	
CIO Memory as String with HiLo Byte Order	CIO0000.512H- CIO6143.002H	String	Read/Write
	I is string length, range 2 to 512 characters		
CIO Memory as String with LoHi Byte Order	CIO0000.512L- CIO6143.002L	String	Read/Write
	I is string length, range 2 to 512 characters		
CIO Memory as String Using Only the High Order Byte of	CIO0000.256D- CIO6143.001D	String	Read/Write
each Word	.I is string length, range 1 to 256 characters		
CIO Memory as String	CIO0000.256E-	String	Read/Write
Using Only the Low Order	CIO6143.001E		
Byte of each Word	.l is string length, range 1 to 256 characters		
Counter	C0000-C4095	BCD, Word, Short	Read/Write
Counter Status	CS0000-CS4095	Boolean	Read/Write*
Data Memory	D00000-D32767	Word, Short, BCD	Read/Write
	D00000-D32766	Long, DWord, LBCD, Float	
	Dxxxxx.00-Dxxxxx.15	Boolean	
	See also <u>String Support</u>		
Data Memory as String with HiLo Byte Order	D00000.512H- D32767.002H	String	Read/Write
	.l is string length, range 2 to 512 characters		
Data Memory as String	D00000.512L-D32767.002L	String	Read/Write
with LoHi Byte Order	I is string length, range 2 to 512 characters		
Data Memory as String	D00000.256D-	String	Read/Write
Using Only the High Order Byte of	D32767.001D		
each Word	.l is string length, range 1 to 256 characters		
Data Memory as String Using Only the Low Order	D00000.256E- D32767.001E	String	Read/Write
Byte of each Word	.l is string length, range 1 to 256 characters		
Data Register	DR00-DR15	Word, Short, BCD	Read/Write*
	DR00-DR14	Long, DWord, LBCD, Float	

Device Type	Range	Data Type	Access
Expansion Data Memory	E00000-E32767	Word, Short, BCD	Read/Write
(current bank)	E00000-E32766	Long, DWord, LBCD, Float	
	Exxxxx.00-Exxxxx.15	Boolean	
Expansion Data Memory	E00000.512H-	String	Read/Write
(current bank) as String	E32767.002H		
with HiLo Byte Order	.l is string length, range 2 to 512 characters		
Expansion Data Memory	E00000.512L-E32767.002L	String	Read/Write
(current bank) as String with LoHi Byte Order	I is string length, range 2 to 512 characters		
Expansion Data Memory	E00000.256D- E32767.001D	String	Read/Write
(current bank) as String	.I is string length, range 1 to		
Using Only the High Order Byte of each Word	256 characters		
Expansion Data Memory	E00000.256E-E32767.001E	String	Read/Write
(current bank) as String	.I is string length, range 1 to		
Using Only the Low Order	256 characters		
Byte of each Word			
Expansion Data Memory	E00:00000-E12:32767	Word, Short, BCD	Read/Write
	E00:00000-E12:32766	Long, DWord, LBCD, Float	
	Ex:x.00-Exx:xxxxx.15	Boolean	
Expansion Data Memory as String with HiLo Byte Order	E00:00000.512H- E12:32767.002H	String	Read/Write
	.l is string length, range 2 to 512 characters		
Expansion Data Memory as String with LoHi Byte Order	E00:00000.512L- E12:32767.002L	String	Read/Write
	.I is string length, range 2 to 512 characters		
Expansion Data Memory as String Using Only the High Order	E00:00000.256D- E12:32767.001D	String	Read/Write
Byte of each Word	I is string length, range 1 to 256 characters		
Expansion Data Memory as String Using Only the Low	E00:00000.256E- E12:32767.001E	String	Read/Write
Order Byte of each Word	.l is string length, range 1 to 256 characters		
Holding Relay	H0000-H1535	Word, Short, BCD, Long,	Read/Write
g ,	H0000-H1534	DWord, LBCD, Float	
	Hxxxx.00-Hxxxx.15	Boolean	
Index Register	IR00-IR15	DWord, Long, LBCD, Float	Read/Write*
Task Flag	TK00-TK31	Boolean	Read Only
Timer	T0000-T4095	BCD, Word, Short	Read/Write
Timer Status	TS0000-TS4095	Boolean	Read/Write*
Working Relay	W000-W511	Word, Short, BCD, Long,	Read/Write
,	W000-W510	DWord, LBCD, Float	
	Wxxx.00-Wxxx.15	Boolean	

Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. Therefore, DWords D0 and D1 overlap at word D1 and writing to D0 also modifies the value held in D1. It is recommended that users utilize these data types so that

overlapping does not occur. When using DWords, users may want to use D0, D2, D4, and so on to prevent overlapping Words. The exception to this is IR tags, which are native 32-bit values with MSB to LSB byte ordering for the CJ1-series PLCs.

#### **BCD Support**

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example

D0D @ Short = -50 D0D @ Word = 8050 (MSB set) D0 @ BCD = 8050

D0D @ Short = 50 D0D @ Word = 50 D0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

# String Support

The CJ1 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- To address a string starting at D01000 with a length of 100 bytes and HiLo byte order, enter: D01000.100H
- 2. To address a string starting at D01100 with a length of 78 bytes and LoHi byte order, enter: D01100.078L
- 3. To address a string starting at D02000 with a length of 55 bytes and Only the High Order byte, enter: D02000.055D

 To address a string starting at D02200 with a length of 37 bytes and Only the Low Order byte, enter: D02200.037E

#### Array Support

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

Dxxxx [rows] [cols]
Dxxxx [cols]\*

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

#### Writing to CS, TS, DR, and IR Registers

CS and TS registers can be written to only when the device is in Monitor Mode or Programming Mode. DR and IR registers can be written to only when the device is in Programming Mode. CS, TS, DR, and IR registers cannot be written to in Run Mode. If the device is in Run Mode and a write is attempted to one of these registers, the value in the device does not change. The following occurs:

- If the device is in Run Mode and a write is attempted to a CS or TS register, an "unable to write" error message is returned.
- If the device is in Run Mode and a write is attempted to a DR or IR register, the write succeeds. Although
  no error message is returned, the value in the device does not change because the device is in Run
  Mode.

# CJ2 Addressing

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

For more information, refer below the table for notes and restrictions on <u>BCD Support</u>, <u>String Support</u>, and Array Support.

Device Type	Range	Data Type	Access
Auxiliary Relay	A000-A447	Word, Short, BCD	Read Only
	A000-A446	Long, DWord, LBCD, Float	Read/Write
	A448-A1471	Word, Short, BCD	Read Only
	A448-A1470	Long, DWord, LBCD, Float	Read Only
	A10000-A11535	Word, Short, BCD	Read/Write
	A10000-A11534	Long, DWord, LBCD, Float	Read Only
	A000.00-A000.15-A447.00-	Boolean	
	A447.15	Boolean	
	A448.00-A448.15-	Boolean	
	A1471.00-A1471.15		
	A10000.00-A10000.15-		
	A11535.00-A11535.15		
Auxiliary Relay as String	A000.512H-A447.002H	String	Read Only
with HiLo Byte Order	A448.512H-A1471.002H	String	Read/Write
	A10000.512H-A11535.002H	String	Read Only
	.I is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.512L-A447.002L	String	Read Only
with LoHi Byte Order	A448.512L-A1471.002L	String	Read/Write
	A10000.512L-A11535.002L	String	Read Only

<sup>\*</sup>This method assumes that "rows" is equal to one.

Device Type	Range	Data Type	Access
	.l is string length, range 2 to 512 characters		
Auxiliary Relay as String	A000.256D-A447.001D	String	Read Only
Using Only the High Order	A448.256D-A1471.001D	String	Read/Write
Byte of each Word	A10000.256D-A11535.001D	String	Read Only
	.I is string length, range 1 to 256 characters		
Auxiliary Relay as String	A000.256E-A447.001E	String	Read Only
Using Only the Low Order	A448.256E-A1471.001E	String	Read/Write
Byte of each Word	A10000.256E-A11535.001E	String	Read Only
	I is string length, range 1 to 256 characters		
CIO	CIO0000-CIO6143	Word, Short, BCD	Read/Write
	CIO0000-CIO6142	Long, DWord, LBCD, Float	
	CIOxxxx.00-CIOxxxx.15	Boolean	
CIO Memory as String with HiLo Byte Order	CIO0000.512H- CIO6143.002H	String	Read/Write
ŕ	.I is string length, range 2 to 512 characters		
CIO Memory as String with LoHi Byte Order	CIO0000.512L- CIO6143.002L	String	Read/Write
,	.I is string length, range 2 to 512 characters		
CIO Memory as String Using Only the High Order Byte of	CIO0000.256D- CIO6143.001D	String	Read/Write
each Word	.I is string length, range 1 to 256 characters		
CIO Memory as String Using Only the Low Order	CIO0000.256E- CIO6143.001E	String	Read/Write
Byte of each Word	.l is string length, range 1 to 256 characters		
Counter	C0000-C4095	BCD, Word, Short	Read/Write
Counter Status	CS0000-CS4095	Boolean	Read/Write*
Data Memory	D00000-D32767	Word, Short, BCD	Read/Write
•	D00000-D32766	Long, DWord, LBCD, Float	
	Dxxxxx.00-Dxxxxx.15	Boolean	
	See also String Support		
Data Memory as String with HiLo Byte Order	D00000.512H- D32767.002H	String	Read/Write
, , , , , , ,	.l is string length, range 2 to 512 characters		
Data Memory as String	D00000.512L-D32767.002L	String	Read/Write
with LoHi Byte Order	.l is string length, range 2 to 512 characters		
Data Memory as String	D00000.256D-	String	Read/Write
Using Only the High Order Byte of	D32767.001D		
each Word	I is string length, range 1 to 256 characters		
Data Memory as String	D00000.256E-D32767.001E	String	Read/Write
Using Only the Low Order Byte of each Word	.l is string length, range 1 to 256 characters		

Device Type	Range	Data Type	Access
Data Register	DR00-DR15	Word, Short, BCD	Read/Write*
	DR00-DR14	Long, DWord, LBCD, Float	
Expansion Data Memory	E00000-E32767	Word, Short, BCD	Read/Write
(current bank)	E00000-E32766	Long, DWord, LBCD, Float	
,	Exxxxx.00-Exxxxx.15	Boolean	
Expansion Data Memory	E00000.512H-E32767.002H	String	Read/Write
(current bank) as String	.I is string length, range 2 to		
with HiLo Byte Order	512 characters		
Expansion Data Memory	E00000.512L-E32767.002L	String	Read/Write
(current bank) as String	.I is string length, range 2 to		
with LoHi Byte Order	512 characters		
Expansion Data Memory	E00000.256D-E32767.001D	String	Read/Write
(current bank) as String	.I is string length, range 1 to		
Using Only the High Order Byte of each Word	256 characters		
Expansion Data Memory	E00000.256E-E32767.001E	String	Read/Write
(current bank) as String	.I is string length, range 1 to		
Using Only the Low Order	256 characters		
Byte of each Word			
Expansion Data Memory	E00:00000-E24:32767	Word, Short, BCD, Long,	Read/Write
	E00:00000-E24:32766	DWord, LBCD, Float	
	Ex:x.00-Exx:xxxxx.15	Boolean	
Expansion Data Memory as	E00:00000.512H-	String	Read/Write
String with HiLo Byte Order	E24:32767.002H		
	.l is string length, range 2 to 512 characters		
Expansion Data Memory as	E00:00000.512L-	String	Read/Write
String with LoHi Byte Order	E24:32767.002L		
	.l is string length, range 2 to 512 characters		
Expansion Data Memory as	E00:00000.256D-	String	Read/Write
String Using Only the High Order	E24:32767.001D		
Byte of each Word	I is string length, range 1 to 256 characters		
Expansion Data Memory as	E00:00000.256E-	String	Read/Write
String Using Only the Low	E24:32767.001E		
Order Byte of each Word	I is string length, range 1 to 256 characters		
Holding Relay	H0000-H1535	Word, Short, BCD, Long,	Read/Write
	H0000-H1534	DWord, LBCD, Float	
	Hxxxx.00-Hxxxx.15	Boolean	
Index Register	IR00-IR15	DWord, Long, LBCD, Float	Read/Write*
Task Flag	TK00-TK127	Boolean	Read Only
Timer	T0000-T4095	BCD, Word, Short	Read/Write
Timer Status	TS0000-TS4095	Boolean	Read/Write*
Working Relay	W000-W511	Word, Short, BCD, Long,	Read/Write
•	W000-W510	DWord, LBCD, Float	
	Wxxx.00-Wxxx.15	Boolean	

• Use caution when modifying 32-bit values (DWord, Long, LBCD, and Float). Each address for which these data types are allowed starts at a word offset within the device. Therefore, DWords D0 and D1 overlap at word D1 and writing to D0 also modifies the value held in D1. It is recommended that users utilize these data types so that overlapping does not occur. When using DWords, users may want to use D0, D2, D4, and so on to prevent overlapping Words. The exception to this is IR tags, which are native 32-bit values with MSB to LSB byte ordering for the CJ2-series PLCs.

# **BCD Support**

16-bit and 32-bit data can be referenced as signed and unsigned BCD values.

Unsigned BCD support is accomplished by appending a 'D' to any Word or DWord tag address or by using the BCD and LBCD data types. The value range is as follows:

Word as unsigned BCD 0 - 9999

DWord as unsigned BCD 0 - 99999999

Signed BCD support is accomplished by appending a 'D' to any Short or Long tag address. The most significant bit of the Short/Long is set to 1 for negative values, 0 for positive values. The value range is as follows:

Short as signed BCD ±7999

Long as signed BCD ±79999999

#### Example

D0D @ Short = -50 D0D @ Word = 8050 (MSB set) D0 @ BCD = 8050

D0D @ Short = 50 D0D @ Word = 50 D0 @ BCD = 50

Note: Boolean, Float, and String data types do not support appending 'D' to the tag address. Furthermore, 'D' cannot be appended to BCD or LBCD tags, or tags with a default data type of BCD or LBCD (such as Counter and Timer tags).

#### String Support

The CJ2 model supports reading and writing numerous device types as an ASCII string. When using data memory for string data, each register contains two bytes (two characters) 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 512 characters and is entered in place of a bit number. The string length cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 512. The length must be entered as an even number. The range of registers spanned by the string cannot exceed the range of the device type. The byte order is specified by appending either a "H" or "L" to the address.

When using one byte of ASCII data per register, the length of the string can be from 1 to 256 characters and is entered in place of a bit number. The string length times 2 cannot exceed the request size that has been assigned to the device up to a request size of 512. For request size values greater than 512, string length cannot exceed 256. The range of registers spanned by the string cannot exceed the range of the device type. The byte to use within a register is specified by appending either a "D" or "E" to the address. For more information, refer to Setup.

#### **Examples**

- To address a string starting at D01000 with a length of 100 bytes and HiLo byte order, enter: D01000.100H
- 2. To address a string starting at D01100 with a length of 78 bytes and LoHi byte order, enter: D01100.078L

- 3. To address a string starting at D02000 with a length of 55 bytes and Only the High Order byte, enter: D02000.055D
- To address a string starting at D02200 with a length of 37 bytes and Only the Low Order byte, enter: D02200.037E

# **Array Support**

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

Dxxxx [rows] [cols]
Dxxxx [cols]\*

\*This method assumes that "rows" is equal to one.

Rows multiplied by cols multiplied by data size in bytes (2 for Word, Short, and BCD; 4 for DWord, Long, LBCD, and Float) cannot exceed the request size that has been assigned to the device. For example, a 10 X 10 array of words results in an array size of 200 bytes, which would require a request size of at least 256.

#### Writing to CS, TS, DR, and IR Registers

CS and TS registers can be written to only when the device is in Monitor Mode or Programming Mode. DR and IR registers can be written to only when the device is in Programming Mode. CS, TS, DR, and IR registers cannot be written to in Run Mode. If the device is in Run Mode and a write is attempted to one of these registers, the value in the device will not change. The following will occur:

- If the device is in Run Mode and a write is attempted to a CS or TS register, an "unable to write" error message will be returned.
- If the device is in Run Mode and a write is attempted to a DR or IR register, the write will succeed.

  Although no error message will be returned, the value in the device will not change because the device is in Run Mode.

# **Event Log Messages**

The following information concerns messages posted to the Event Log pane in the main user interface. Consult the OPC 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.

Tip: Messages that originate from a data source (such as third-party software, including databases) are presented through the Event Log. Troubleshooting steps should include researching those messages online and in vendor documentation.

Device responded with error. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>.

# **Error Type:**

Warning

#### **Possible Cause:**

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device responded with local node error. | Main error = <code>, Sub error = <code>.

# **Error Type:**

Warning

#### **Possible Cause:**

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device responded with destination node error. | Main error = <code>, Sub error = <code>.

#### **Error Type:**

Warning

#### **Possible Cause:**

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

# Device responded with a communications error. | Main error = <code>, Sub error = <code>.

#### Error Type:

Warning

#### Possible Cause:

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device cannot process command. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>.

# **Error Type:**

Warning

#### Possible Cause:

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device responded with routing table error. | Main error = <code>, Sub error = <code>.

# Error Type:

Warning

#### Possible Cause:

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device responded with a command format error. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>.

#### Error Type:

Warning

#### Possible Cause:

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

# See Also:

Main and Sub Error Codes

Device responded with a command parameter error. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>.

# **Error Type:**

Warning

#### **Possible Cause:**

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device responded with read not possible. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>.

#### Error Type:

Warning

#### **Possible Cause:**

The error codes indicate possible causes.

#### **Possible Solution:**

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device responded with error in unit. | Main error = <code>, Sub error = <code>.

#### **Error Type:**

Warning

#### **Possible Cause:**

The error codes indicate possible causes.

# Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device cannot accept command. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>.

# **Error Type:**

Warning

#### **Possible Cause:**

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

# See Also:

Main and Sub Error Codes

# Access right denied. | Tag address = '<address>', Main error = <code>, Sub error = <code>.

# **Error Type:**

Warning

#### **Possible Cause:**

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

Device responded with write not possible. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>.

#### Error Type:

Warning

#### Possible Cause:

The error codes indicate possible causes.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description possible solutions and corrections.

#### See Also:

Main and Sub Error Codes

# Device deactivated due to network settings conflict with another device. | Other device = '<device>'.

# **Error Type:**

Warning

#### Possible Cause:

The network parameters for the device were changed during run time and conflict with another device. Communication with this device is not possible until the conflict is resolved.

#### Possible Solution:

Change one or more of the following: channel network adapter, port number or device ID.

#### See Also:

**FINS Networks** 

# The current project was created with an older version of this driver. Examine device properties to validate network parameters.

# **Error Type:**

Warning

#### Possible Cause:

The current project was created using a version of this driver that checked for network parameter conflicts during runtime. This version only performs runtime checks on parameters that can be changed with system tags. All other parameters are now checked when device properties are edited.

#### Possible Solution:

Examine the properties of each device. Make any change a device properties to trigger validation. Once all the devices and properties are validated, save the project.

#### Note:

This solution does not have to be repeated; new devices that are added to the project are validated automatically.

#### See Also:

**FINS Networks** 

# Unable to write to tag. The device is in run mode. | Tag address = '<address>'.

#### Error Type:

Warning

#### **Possible Cause:**

The device is in Run Mode. CS and TS registers can only be written when the device is in Programming Mode.

#### Possible Solution:

Set the device to Programming Mode.

Device responded with network relay error. | Net address = <address>, Node address = <address>, Main error = <code>, Sub error = <code>, End code = <code>.

# **Error Type:**

Warning

#### **Possible Cause:**

The error codes provide information about the end code word bits 6, 7, and 15.

#### Possible Solution:

Refer to Main and Sub Error Codes for a description corrections and solutions.

#### Note:

A network relay error in combination with other conditions and configuration can cause a remote network error.

#### See Also:

**FINS Network Configuration** 

# Device responded with fatal CPU unit error. | End code = <code>.

# **Error Type:**

Warning

#### **Possible Cause:**

The error codes provide information about the end code word bits 6, 7, and 15.

#### **Possible Solution:**

Refer to Main and Sub Error Codes for a description corrections and solutions.

#### See Also:

Main and Sub Error Codes

# Device responded with non-fatal CPU unit error. | End code = <code>.

#### **Error Type:**

Warning

# **Possible Cause:**

The error codes provide information about the end code word bits 6, 7, and 15.

# Possible Solution:

Refer to Main and Sub Error Codes for a description corrections and solutions.

# See Also:

Main and Sub Error Codes

Failed to set device back to Run Mode following write to tag. | Tag address = '<address>'.

# **Error Type:**

Warning

# Main and Sub Error Codes

Main Code	Sub Code	Check Point	Probable Cause	Correction
00: Normal completion	00: Normal completion			
	01: Service can-		Service was canceled.	Check the capacity of the destination area in the third node.
	celed	Data link status	Service was canceled.	Check the status of the data link.
	01: Local node not in network	Network status of local node	Local node is not participating in the network.	Connect the node to the network.
	02: Token timeout	Maximum node address	Token does not arrive.	Set the local node to within the maximum node address.
01: Local node error	03: Retries failed		Send was not possible during the specified number of retries.	Execute a communications test between the nodes and re-examine the system environment if it fails.
	04: Too many send frames	Number of enabled send frames	Cannot send because maximum number of event frames exceeded.	Check event execution on the network and reduce the number of events per cycle. Increase the maximum number of event frames.
	05: Node address range error	Node address	Node address setting error occurred.	Check the settings of the rotary switches to be sure that the address is within range and that each address is set only once in the same network.
	06: Node address duplic- ation	Node addresses	The same node address has been set twice in the same network.	Change the address of one of the nodes with the same address.
02: Destin- ation node error*	01: Destination node not in network	INS indicator on unit	The destination node is not in the network.	Add the destination node to the network.
	02: Unit missing	Instruction con- trol data	There is no unit with the specified unit address.	Check the destination unit address.
	03: Third node missing	Instruction control data	The third node does not exist.	Check the unit address of the third node. Check the node address of the third node in the send data for CMND (490).
		Command data	Broadcasting was specified.	Specify only one node for the third node.
	04: Destination node busy		The destination node is busy.	Increase the number of retries or review the system so that the destination node does not receive so many messages.
	05: Response timeout		The message was destroyed by noise.	Increase the number of retries or test communications between nodes to see if there is too much

Main Code	Sub Code	Check Point	Probable Cause	Correction
				noise.
		Instruction con- trol data	The response monitor time is too short.	Increase the length of the response monitor time.
		Error history	The send / receive frame was discarded.	Take appropriate measures based on the error history.
	01: Com- munications con- troller error	Unit / board indicators	An error occurred in the communications controller.	Take appropriate measures based on the operation manuals for the related units / boards.
	02: CPU unit error	CPU unit indicators at destination node	A CPU error occurred in the destination CPU unit.	Clear the error from the CPU unit based on its operation manuals.
03: Con- troller error	03: Controller error	Board indic- ators	A response was not returned because an error occurred in the board.	Check network com- munications status and restart the board. If the prob- lem persists, replace the board.
	04: Unit number error	Unit number	The unit number was set incorrectly.	Set the rotary switches cor- rectly, being sure the unit numbers are within range and that each number is used only once.
04: Service	01: Undefined command	Command code	The unit / board does not support the specified command code.	Check the command code.
unsupported	02: Not sup- ported by model / version	Unit model and version	The command cannot be executed because the model or version is incorrect.	Check the model number and version.
	01: Destination address setting error	Routing table	The destination network or node address is not set in the routing tables.	Register the destination network and node in the routing tables.
05: Routing	02: No routing tables	Routing table	Relaying is not possible because there are no routing tables.	Set routing tables in the source node, designation node and relay nodes.
table error	03: Routing table error	Routing table	There is an error in the routing tables.	Set the routing tables correctly.
	04: Too many relays	Network con- figuration	An attempt was made to send to a network that was over 3 networks away	Reconstruct the networks or change the routing tables so that commands are sent within a range of 3 networks or less.
	01: Command too long	Command data	The command is longer than the maximum permissible length.	Check the command format and correct the command data.
10: Com- mand format error	02: Command too short	Command data	The command is shorter than the minimum permissible length.	Check the command format and correct the command data.
	03: Elements / data don't match	Command data	The designated number of elements differs from the number of write data items.	Check the number of elements and set data for each element.
	04: Command format error	Command data	An incorrect format was used.	Check the command format and correct the command data.
	05: Header error	Routing table	Either the relay table in the	Set the routing tables correctly.

Main Code	Sub Code	Check Point	Probable Cause	Correction
			local node or the local network table in the relay node is incorrect.	
	01: Area classification missing	Memory area code in com- mand data	The specified word does not exist in the memory area or there is no EM Area.	Check the memory areas and parameter codes in the command and correct the command data.
	02: Access size error	Access size specification in command data	The access size specification is incorrect or an odd word address is specified.	Check the memory areas and access size and correct the access size.
	03: Address range error	Starting address in command data	The start address in command process is beyond the accessible area.	Check the area being processed and set the correct range.
	04: Address range exceeded	Starting address and number of ele- ments in com- mand data	The end address in command process is beyond the accessible area.	Check the area being processed and set the correct range.
		Data link tables	The total number of words is beyond the limit.	Correct the data link tables.
11: Para- meter error	06: Program missing	Program num- ber in com- mand data	FFFF Hex was not specified.	Specify FFFF Hex.
	09: Relational error	Command data	A large-small relationship in the elements in the command data is incorrect.	Check the command data and correct the relationship between the elements.
		Data link table	A node not set in the common link parameters is set as a refresh parameter.	Correct the data link tables.
	0A: Duplicate data access	I/O access in CPU unit	Differential monitoring was specified during data tracing or data tracing was specified during differential monitoring.	Cancel the current process or wait until it ends before executing the command.
		Data link tables	The same node address is specified more than once.	Correct the data link tables.
	0B: Response too long	Number of ele- ments in com- mand data	The response format is longer than the maximum permissible length.	Check the command format and correct the number of elements.
	0C: Parameter error	Parameters in command data	There is an error in one of the parameter settings.	Check the command data and correct the parameters.
		Data link table file	There is an error in the file.	Check the contents of the file.
20: Read	02: Protected		The program area is protected.	Release protection from a Programming Device and then execute the command.
	03: Table missing	Table	A table has not been registered.	Register a table.
not possible			There is an error in the table.	Correct the table.
	04: Data missing		The search data does not exist.	
	05: Program	Program num-	A non-existing program num-	Check the program numbers

Main Code	Sub Code	Check Point	Probable Cause	Correction
	missing	ber in com- mand data	ber has been specified.	and specify a valid one.
	06: File missing	File name and file device	The file does not exist at the specified file device.	Check the path and file name and correct them.
	07: Data mis- match	Contents of memory being compared	A data being compared is not the same.	Check memory contents and use the correct data.
			A file read operation failed.	Check the contents of the file.
	01: Read Only		The specified area is read only.	If the area is protected using a switch setting, release protection and then execute the command. If the area is permanently read only, the command cannot be executed.
	02: Protected Cannot write data link table		The program area is protected.	Release protection from a Programming Device and then execute the command.
		PLC Setup	Writing is not possible because automatic data link table generation has been specified.	Change the PLC Setup so that the data link tables can be manually written.
	03: Cannot register	Number of files in file device	The file cannot be created because the limit has been exceeded.	Delete any unnecessary files or create more file memory.
21: Write not possible		Number of files open	The maximum number of files has already been opened for the system limit.	Close one or more files and then execute the command.
	05: Program missing	Program num- ber in com- mand data	A non-existing program number has been specified.	Check the program numbers and specify a valid one.
	06: File missing	File name	The file does not exist at the specified file device.	Correct the file name and then execute the command.
	07: File name already exists	File name	A file with the same name already exists in the specified file device.	Change the name of the file being written and then execute the command.
	08: Cannot change	Contents of memory being changed	The change cannot be made because doing so would create a problem.	Verify that the rotary switch labeled "UNIT No." is set for the unit number.  Verify the two rotary switches labeled "NODE No." are set for Node No, typically the same as the right-most octet of the device's IP address.

Main Code	Sub Code	Check Point	Probable Cause	Correction
	01: Not possible		The mode is incorrect.	Check the mode.
	during execution	Data link status	The data link is operating.	Check the status of the data links.
	02: Not possible		The mode is incorrect.	Check the mode.
	while running	Data link status	The data links are active.	Check the status of the data links.
22: Not	03: Wrong PLC mode		The PLC is in PROGRAM mode.	Check the modes of the PLC and computer.
executable in current	04: Wrong PLC mode		The PLC is in DEBUG mode.	Check the modes of the PLC and computer.
mode	05: Wrong PLC mode		The PLC is in MONITOR mode.	Check the modes of the PLC and computer.
	06: Wrong PLC mode		The PLC is in RUN mode.	Check the modes of the PLC and computer.
	07: Specified node not polling node		The specified node is not the polling node.	Check node functioning as the polling node for the network.
	08: Step cannot be executed		The mode is incorrect.	Check step status.
	01: File device missing	Unit con- figuration	The specified memory does not exist as a file device.	Mount memory or format EM as file memory.
23: No such device	02: Memory missing		There is no file memory.	Check the file memory to see if it is mounted.
	03: Clock miss- ing		There is no clock.	Check the model.
24: Cannot start / stop	01: Table miss- ing	Data link tables	The data link tables have not been registered or they contain an error.	Set the data link tables.
	02: Memory error	Contents of memory being processed	The contents of memory contains an error.	Transfer the correct contents to memory.
	03: I/O setting error	I/O Unit con- figuration	The registered I/O tables do not agree with the actual I/O configuration.	Correct the I/O tables or the I/O configuration.
	04: Too many I/O points	Number of I/O in registered I/O tables	There are too many I/O points and remote I/O points registered.	Change the registered I/O table so that it is within the limit.
25: Unit error	05: CPU bus error	CPU bus line	An error occurred in data transfer between the CPU and a CPU Bus unit.	Check units, boards, and cables to be sure they are connected correctly and then execute the ERROR CLEAR command.
	06: I/O duplication	Rack num- bers, unit num- bers and I/O addresses in PLC Setup	The same number / address was set more than once.	Check the PLC Setup and correct the numbers / addresses so that each is used only once.
	07: I/O bus error	I/O bus line	An error occurred in data transfer between the CPU and an I/O unit.	Check units, boards, and cables to be sure they are connected correctly and then execute the ERROR CLEAR command.
	09: SYSMAC BUS / 2 error	SYSMAC BUS / 2 trans-	An error occurred in data transfer on the SYSMAC	Check units, boards, and

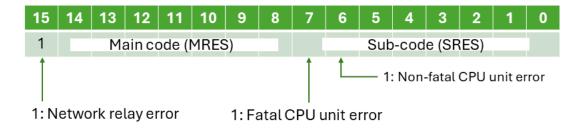
Main Code	Sub Code	Check Point	Probable Cause	Correction
		mission path	BUS / 2 line.	cables to be sure they are connected correctly and then execute the ERROR CLEAR command.
	0A: CPU Bus unit error	CPU Bus unit transmission path	An error occurred in data transfer for a CPU Bus unit.	Check units, boards, and cables to be sure they are connected correctly and then execute the ERROR CLEAR command.
	0D: SYSMAC BUS No. duplic- ation	Word settings	The same word is allocated more than once.	Check the I/O tables and correct the allocations.
	0F: Memory error	Status of memory being processed	A memory error has occurred in internal memory, a memory card, or EM file memory.	For internal memory, write the correct data and then execute the command. For a memory card or EM file memory, the file data has been destroyed. Execute the FILE MEMORY FORMAT command. If the problem persists, replace the memory.
	10: SYSMAC BUS terminator missing		Terminators have not been set.	Set the terminators correctly.
	01: No protection	Command protection for program area	The specified area is not protected.	An attempt was made to clear protection on an area that is not protected, i.e., there is no reason to clear protection.
	02: Incorrect password		An incorrect password has been specified.	Specify the correct password.
			The specified area is protected.	Clear protection from a Programming Device and then execute the command.
	04: Protected	Number of commands being executed	The node receiving the command is already processing 5 commands.	Wait for current processing to end or force the end of a current process and then execute the command.
26: Com- mand error	05: Service already execut- ing		The service is being executed.	Wait for the service to end or force the end of the service and then execute the command.
	06: Service stopped		The service is not being executed.	If necessary, start the service.
	07: No execution right	LNK indicator on unit / Board	The right to execute the service has not been obtained.	The local node is not in the data link. Execute the command from a node that is participating in the data link.
			A response was not returned because a buffer error occurred.	Restart the board. If the prob- lem persists, replace the board.
	08: Settings not complete	Settings required before exe- cution	The settings required before executing the service have not been made.	Make the required settings.

Main Code	Sub Code	Check Point	Probable Cause	Correction
	09: Necessary items not set	Command data	The required elements have not been set in the command data.	Check the command format and set the required elements in the command data.
	0A: Number already defined	Action num- bers and trans- ition numbers of program in program area	The specified action / transition number has already been registered in a previous program.	Check the action / transition numbers to ones that are not being used and then execute the command.
	0B: Error not clear	Cause of error being cleared	The cause of the error has not been removed.	Remove the cause of the error and then execute ERROR CLEAR.
30: Access right error	01: No access right		The access right is held by another device. (Online editing is being executed from another node or ACCESS RIGHT ACQUIRE or ACCESS RIGHT FORCE ACQUIRE has been executed by another node.)	Wait until the access right is released and then execute the command. ACCESS RIGHT ACQUIRE or ACCESS RIGHT FORCE ACQUIRE can be executed to obtain the access right, but this may adversely affect processing by the node that previously held the access right.
40: Cancel	01: Service can- celled		Service was cancelled with CANCEL (ABORT) command.	

<sup>\*</sup> A destination node error in combination with other conditions and configuration can cause a Remote Network Error.

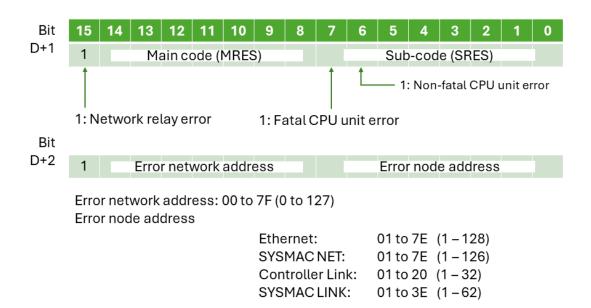
# **Flags**

There are specific flags in the end code word (bits 6, 7, and 15) that may also be ON. The following diagram displays the contents of the end code word.



If bit 6 or 7 is ON, an error has occurred in the destination CPU unit. If this occurs, refer to the operation manuals for the CPU unit where the error occurred and then remove the cause of the error.

If bit 15 is ON, an error has occurred during a network relay operation. The end code contains an additional two-byte (one word) network relay error code that can be used to determine the location of the relay error. The following diagram displays the response data of a network relay error. This information can be used to determine the node where the error occurred so that appropriate measures may be taken.



# **Remote Network Error**

When using gateway devices; if there is a break in communications on the Remote FINS network, it is advantageous to set the device into error state (particularly if using Media Level Redundancy).

The following conditions and configuration, when they occur, are considered a remote network error and the device enters error state.

- 1. Network Relay Error bit in end code word is set.
- 2. Main code (MRES) in end code word equals destination node error (02).
- 3. The device FINS network configuration source network address number or destination network address number parameters have a value of 1 to 127, which indicates a remote network address.

#### See Also:

Main and Sub Error Codes
FINS Network Configuration

# Index

#### Α

Access right denied. | Tag address = '<address>', Main error = <code>, Sub error = <code>. 74
Address Descriptions 19
Address specifications 19
Attempts Before Timeout 10
Auto-Demotion 11
Automatic Address Generation 15

# В

BCD 18 Boolean 18

# C

C1000H Addressing 26

C2000H Addressing 30

C200H Addressing 19

C500 Addressing 23

Channel Assignment 8

Channel Properties - Advanced 8

Channel Properties - Ethernet Communications 5

Channel Properties - General 5

Channel Properties - Write Optimizations 6

Check Point 77

CJ1 Addressing 62

CJ2 Addressing 66

Combined Address Conversion 15

Communications Parameters 6, 13

Communications Timeouts 10

Connect Timeout 10

CS1 Addressing 57

CV1000 Addressing 37

CV2000 Addressing 42

CV500 Addressing 33

CVM1-CPU01 Addressing 46

CVM1-CPU11 Addressing 50

CVM1-CPU21 Addressing 53

#### D

Data Collection 9

Data Types Description 18

Demote on Failure 11

**Demotion Period 11** 

Destination 12

Device cannot accept command. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>. 73

Device cannot process command. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>. 72

Device deactivated due to network settings conflict with another device. | Other device = '<device>'. 74

Device Properties - Auto-Demotion 11

Device Properties – Redundancy 13

Device Properties - Timing 10

Device responded with a command format error. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>. 72

Device responded with a command parameter error. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>. 73

Device responded with a communications error. | Main error = <code>, Sub error = <code>. 72

Device responded with destination node error. | Main error = <code>, Sub error = <code>. 71

Device responded with error in unit. | Main error = <code>, Sub error = <code>. 73

Device responded with error. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>. 71

Device responded with fatal CPU unit error. | End code = <code>. 75

Device responded with local node error. | Main error = <code>, Sub error = <code>. 71

Device responded with network relay error. | Net address = <address>, Node address = <address>, Main error = <code>, Sub error = <code>, End code = <code>. 75

Device responded with non-fatal CPU unit error. | End code = <code>. 75

Device responded with read not possible. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>. 73

Device responded with routing table error. | Main error = <code>, Sub error = <code>. 72

Device responded with write not possible. | Tag address = '<address>', Data size = <byte number>, Main error = <code>, Sub error = <code>. 74

Diagnostics 5

Discard Requests when Demoted 11

Do Not Scan, Demand Poll Only 9

Driver 8

**Duplicate Devices 17** 

Duty Cycle 6

DWord 18

# Ε

**Ethernet Communications 14** 

Ethernet Settings 6

# Event Log Messages 71

# F

Failed to set device back to Run Mode following write to tag. | Tag address = '<address>'. 76 FINS Messages 14 FINS Network Configuration 11 FINS Networks 14 Float 18

# G

General 8

#### ı

ID 9
Identification 5
Initial Updates from Cache 10
Inter-Device Delay 8
IP Address Table 15

# L

LBCD 18 Long 18

# М

Main and Sub Error Codes 77

Main Code 77

Model 9

Multihoming 17

# Ν

Network Adapter 6
Network Adapter Cards 17
NIC 17
Non-Normalized Float Handling 8

# 0

Optimization Method 6

Overview 4

# R

Redundancy 13

Remote Network Error. 85

Replace with Zero 8

Request Size 13

Request Timeout 10

Respect Tag-Specified Scan Rate 9

Routing Tables 16

Run Mode Settings 12

# S

Scan Mode 9

Setup 4

Short 18

Simulated 9

Source 11

String 18

Sub Code 77

Supported Devices 4

# Т

Tag Counts 5

The current project was created with an older version of this driver. Examine device properties to validate network parameters. 74

Timeouts to Demote 11

Timing 10

# U

Unable to write to tag. The device is in run mode. | Tag address = '<address>'. 75 Unmodified 8

# W

Word 18
Write All Values for All Tags 6
Write Only Latest Value for All Tags 6
Write Only Latest Value for Non-Boolean Tags 6