Allen-Bradley ControlLogix Ethernet Driver Help

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Help version 1.087

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Overview

The Allen-Bradley ControlLogix Ethernet Driver provides an easy and reliable way to connect Allen-Bradley ControlLogix Ethernet controllers to OPC client applications, including HMI, SCADA, Historian, MES, ERP, and countless custom applications.

Supported Allen-Bradley Controllers

ControlLogix 5500 Series
Communications with ControlLogix can be accomplished through an EtherNet/IP communication module for Ethernet communications or through a 1761-NET-ENI module for Ethernet-to-serial communications using the controller's serial port.

CompactLogix 5300 Series
Ethernet communications with CompactLogix requires a processor with a built-in EtherNet/IP port such as the 1769-L35E. Communications with CompactLogix otherwise requires a 1761-NET-ENI module for Ethernet-to-serial communications using the controller's serial port.

FlexLogix 5400 Series
Communications with FlexLogix can be accomplished through a 1788-ENBT daughtercard for Ethernet communications or through a 1761-NET-ENI module for Ethernet-to-serial communications using the controller's serial port.

SoftLogix5800

The driver supports the Allen-Bradley SoftLogix5800 Series Controller up to firmware version 12 and requires an Ethernet card in the SoftLogix PC.

DataHighwayPlus Gateway

The driver supports the PLC-5 Series and SLC 500 Series with a Data Highway Plus interface. This is accomplished through a DH+ gateway and requires one of the aforementioned PLCs, an EtherNet/IP communication module, and a 1756-DHRIO-interface module (both residing in the ControlLogix rack).

ControlNet Gateway

The driver supports the PLC-5C Series. This is accomplished through a ControlNet gateway and requires the aforementioned PLC, an EtherNet/IP communication module, and a 1756-CNB/CNBR interface module (both residing in the ControlLogix rack).

1761-NET-ENI

The driver supports communications with the 1761-NET-ENI device. The ENI device adds extra flexibility in device networking and communications by providing an Ethernet-to-serial interface for both Full Duplex DF1 controllers and Logix controllers. In conjunction with the ENI device, this driver supports the following:

- ControlLogix 5500 Series*
- CompactLogix 5300 Series*
- FlexLogix 5400 Series*
- Micrologix Series
- SLC 500 Fixed I/O Processor
- SLC 500 Modular I/O Series
- PLC-5 Series

*These models require 1761-NET-ENI Series B or higher.

MicroLogix 1100

The driver supports communications with the MicroLogix 1100 (CH1 Ethernet) using EtherNet/IP.

Device Setup

Supported Devices

Device	Communications
ControlLogix 5550 / 5553 / 5555 / 5561 / 5562 / 5563 / 5564 / 5565 / 5571 / 5572 / 5573 / 5574 / 5575 processors	Via 1756-ENBT / ENET / EN2F / EN2T / EN2TR / EN3TR / EWEB / EN2TXT Ethernet module. Via Serial Gateway. Via 1761-NET-ENI Series B or higher using Channel 0 (Serial).
CompactLogix 5316 / 5318 / 5320 / 5323 / 5324 / 5327 / 5330 / 5331 / 5332 / 5333 / 5335 / 5336 / 5343 / 5345	Built-in EtherNet/IP port on processors with E suffix.* Via Serial Gateway. Via 1761-NET-ENI Series B or higher using Channel 0 (Serial).
FlexLogix 5433 / 5434 processors	Via 1788-ENBT Ethernet Daughtercard. Via Serial Gateway. Via 1761-NET-ENI Series B or higher using Channel 0 (Serial).
SoftLogix 5810 / 5830 / 5860 processors	Via SoftLogix EtherNet/IP Messaging module. Via Serial Gateway.
MicroLogix 1000 / 1200 / 1500	Via 1761-NET-ENI. Via EtherNet/IP Gateway.
MicroLogix 1100 / 1400	Via MicroLogix 1100 / 1400 Channel 1 (Ethernet). Via 1761-NET-ENI. Via EtherNet/IP Gateway.
SLC 500 Fixed I/O Processor	Via 1761-NET-ENI. Via EtherNet/IP Gateway.
SLC 500 Modular I/O Processors (SLC 5/01, SLC 5/02, SLC 5/03, SLC 5/04, SLC 5/05)	Via DH+ Gateway.** Via 1761-NET-ENI. Via EtherNet/IP Gateway.
PLC-5 series (excluding the PLC5/250 series)	Via DH+ Gateway. Via 1761-NET-ENI. Via EtherNet/IP Gateway
PLC-5/20C, PLC-5/40C, PLC-5/80C	Via ControlNet Gateway. Via 1761-NET-ENI. Via EtherNet/IP Gateway.

*For example, 1769-L35E.
**This driver supports any SLC 500 series PLC that supports DH+ or that can be interfaced to a DH+ network (such as the KF2 interface module).

Firmware Versions

Device	Version
ControlLogix 5550 (1756-L1)	11.35 - 13.34
ControlLogix 5553 (1756-L53)	11.28
ControlLogix 5555 (1756-L55)	11.32 - 16.04
ControlLogix 5561 (1756-L61)	12.31 - 20.11
ControlLogix 5562 (1756-L62)	12.31 - 20.11

ControlLogix 5563 (1756-L63)	11.26 - 20.11
ControlLogix 5564 (1756-L64)	16.03 - 20.11
ControlLogix 5565 (1756-L65)	16.03 - 20.11
ControlLogix 5571 (1756-L71)	20.11
ControlLogix 5572 (1756-L72)	19.11 - 20.11
ControlLogix 5573 (1756-L73)	18.12 - 20.11
ControlLogix 5574 (1756-L74)	19.11 - 20.11
ControlLogix 5575 (1756-L75)	18.12 - 20.11
CompactLogix 5316 (1769-L16)	20.11
CompactLogix 5318 (1769-L18)	20.11
CompactLogix 5320 (1769-L20)	11.27 - 13.18
CompactLogix 5323 (1769-L23)	17.05 - 20.11
CompactLogix 5324 (1769-L24)	20.11
CompactLogix 5327 (1769-L27)	20.11
CompactLogix 5330 (1769-L30)	11.27 - 13.18
CompactLogix 5331 (1769-L31)	16.22 - 20.11
CompactLogix 5332 (1769-L32)	16.22 - 20.11
CompactLogix 5333 (1769-L33)	20.11
CompactLogix 5335 (1769-L35)	16.22 - 20.11
CompactLogix 5336 (1769-L36)	20.11
CompactLogix 5343 (1768-L43)	15.07 - 20.11
CompactLogix 5345 (1768-L45)	16.24 - 20.11
FlexLogix 5433 (1794-L33)	11.25 - 13.33
FlexLogix 5434 (1794-L34)	11.25 - 16.02
SoftLogix 5800	11.11 - 19.00
ControlLogix, CompactLogix, and FlexLogix Serial Communications	1761-NET-ENI Series B or higher or Serial Gateway
MicroLogix 1100 (1763-L16AWA/BWA/BBB)	1.1

Communication Protocol

The Communications Protocol is EtherNet/IP (CIP over Ethernet) using TCP/IP.

Logix and Gateway Models

Logix and Gateway models support the following:

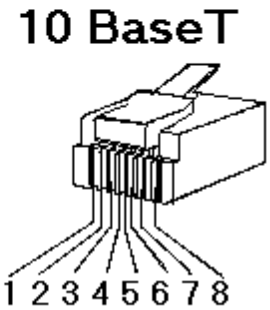
- Connected Messaging
- Symbolic Reads
- Symbolic Writes
- Symbol Instance Reads (V21 or higher)
- Physical (DMA) Reads (V20 or lower)
- Symbol Instance Writes

ENI Models

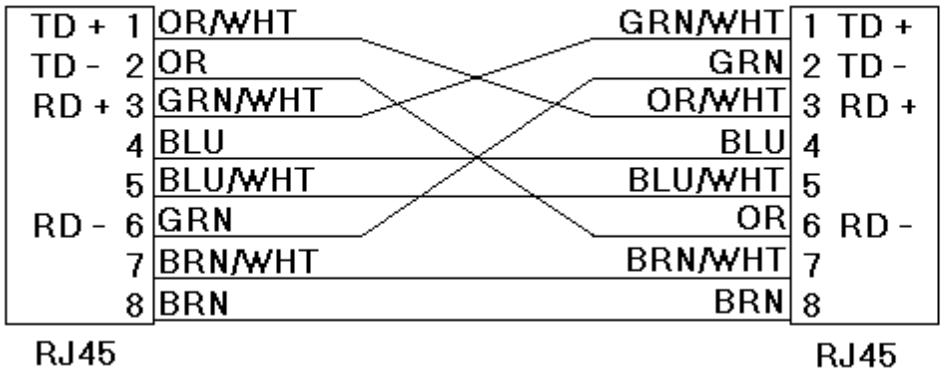
ENI models support unconnected messaging.

Cable Diagrams

Patch Cable (Straight Through)



Crossover Cable



Communications Routing

Routing provides a way to communicate with a remote device over various networks. It can be thought of as a bridge between the local device and a remote device even if they are on two different field bus networks. Access to a remote (destination) back plane allows for direct communication with the supported modules located on this back plane. Supported modules include the following:

- ControlLogix 5500 processor for ControlLogix applications.
- SoftLogix 5800 processor for SoftLogix applications.
- 1756-DHRIO interface module for DH+ Gateway applications.
- 1756-CNB or 1756-CNBR interface module for ControlNet Gateway applications.

A routing path is a series of back plane hops, whose last hop points to the destination back plane. Each hop requires a Logix back plane (not a Logix processor). An individual hop can utilize one of the following networks as its medium:

- ControlNet
- DH+
- TCP/IP (EtherNet/IP)

Important: Routing is not supported for ENI and MicroLogix 1100 models.

Connection Path Specification

The routing path is specified in the Device ID. As with non-routing applications, communication originates from the Allen-Bradley ControlLogix Ethernet Driver on the PC and is directed at the local Ethernet module. Once at this local Ethernet module, the Device ID specifies a way out of the module and onto the back plane, just like with non-routing applications. The routing path will then direct the message to the desired Logix back plane. The Device ID also determines what device will be communicated with (such as the ControlLogix processor, SoftLogix processor, DH+ node, or ControlNet node).

The routing path specification begins and ends with the left and right bracket respectively ([ ]). The path itself is a series of port/link address pairs, identical to the Communication Path syntax in RSLogix 5000 Message Configuration dialog.

Designator Type	Description	Formats	Range
Port ID	Specifies a way out of the interface module in question.*	Decimal	0-65535
Link Address	If the corresponding port is the back plane, then the link address is the slot number of the interface module which will go out. If the corresponding port is an interface module port, then the link address specifies a destination node as follows. - DH+/ControlNet: Node ID - EtherNet/IP communication module: IP address - SoftLogix EtherNet/IP module: IP address	Decimal	0-255

*For more information, refer to "Port Reference" below.

Single Hop
IP Address, Port ID0, [Link Address0, Port ID1, Link Address1, Port ID2], Link Address2.

Multi-Hop (N Hops)
IP Address, Port ID0, [Link Address0, Port ID1, Link Address1, Port ID2, Link Address2, ... Port ID(N+1), Link Address(N+1), Port ID(N+2)], Link Address(N+2).

Note 1: The last Port ID in the path (Port ID2 and Port ID(N+2) for single hop and multi-hop respectively) must be 1 (port for back plane).

Note 2: Port ID0 must be 1 (port for back plane). Link Address2 and Link Address (N+2) are the slot numbers of the remote Logix processor/1756-DHRIO module/1756-CNB module.

Port Reference

Interface Module	Port 1	Port 2	Port 3
Ethernet/IP Communication Module	Backplane	Ethernet Network	N/A
SoftLogix EtherNet/IP Messaging Module	Virtual Backplane	Ethernet Network	N/A
1756-DHRIO	Backplane	DH+ Network on Ch. A	DH+ Network on Ch. B
1756-CNB	Backplane	ControlNet Network	N/A

Application Notes

1. Messages cannot be routed in or out of the same interface module channel more than once within the path. Doing so will result in CIP Error 0x01 Ext. Error 0x100B.

2. For multiple channel interface modules, messages cannot be routed into and then immediately out of that same module (using different channels), regardless of whether the message is directed to the back plane first or avoids the back plane all together. As previously mentioned, the latter is not supported since each hop requires a ControlLogix back plane. An example would be to route a DH+ message from one DH+ link (such as Channel A of 1756-DHRIO) to another DH+ link (such as Channel B of same 1756-DHRIO) through one 1756-DHRIO-interface module. This is commonly referred to as Remote DH+ messaging and is not supported.

Routing Examples

The routing examples below include the entire Device ID minus the IP of the local 1756-ENBT. The perspective of the Device ID/Routing Path is from the local 1756-ENBT Module. Hop descriptions are in the following form:

Link Address (N), Port ID(N+1), Link Address(N+1), Port ID(N+2)

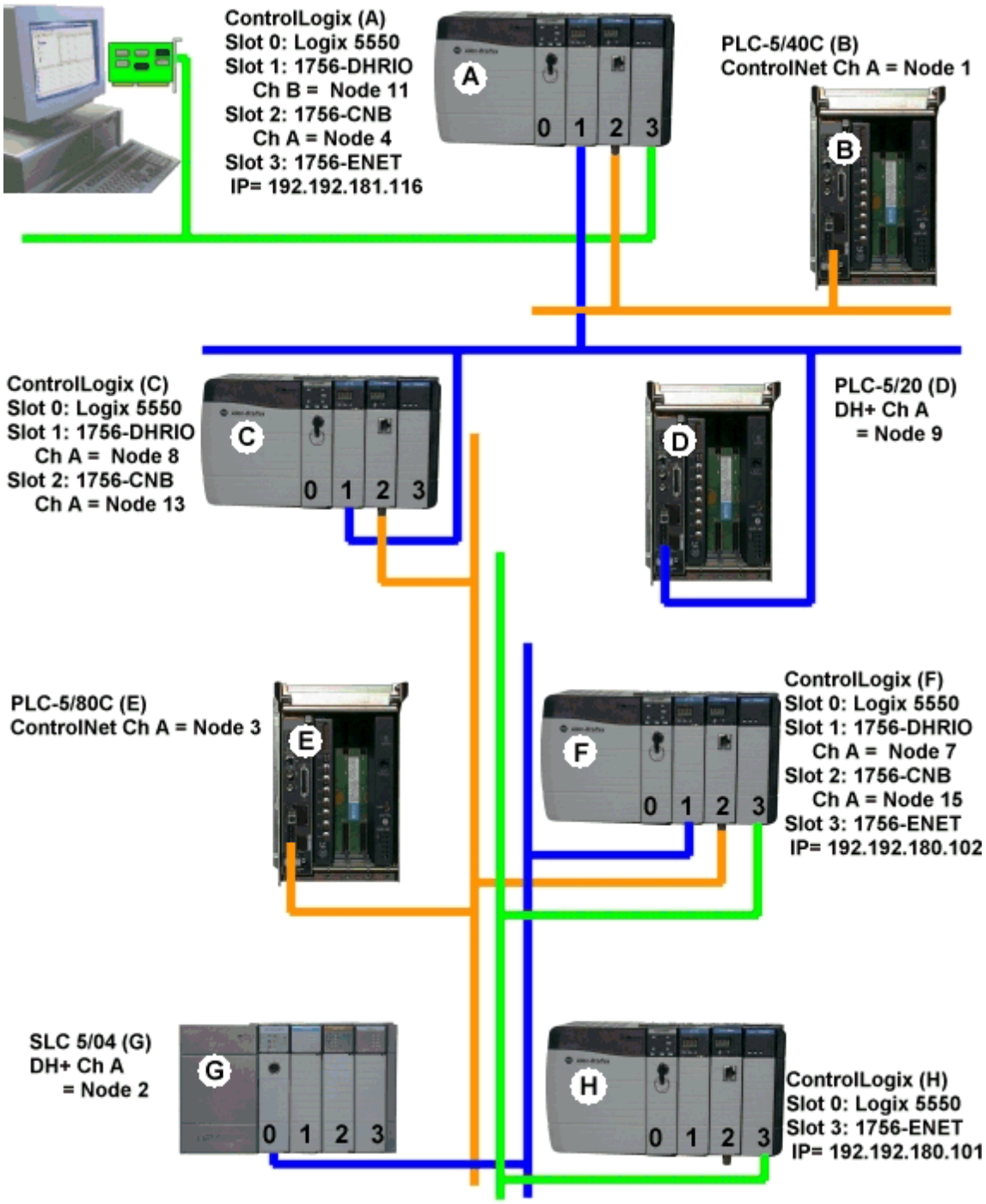
Note: For more information, refer to **Connection Path Specification**. For further details on building a connection/routing path, refer to Allen-Bradley Publication 1756-6.5.14, pp. 4-5 through 4-8.

In the illustration below, all DH+/ControlNet Node IDs are specified in Decimal format. The Node ID specified in the PLC and displayed in RSWho is in Octal format. Descriptions of the colors are as follows:

- Green = Ethernet
- Blue = DH+

- Orange = ControlNet

Note: For more information, refer to **DataHighwayPlus (TM) Gateway Setup** and **ControlNet Gateway Setup**.



Example 1
Logix5550 to PLC-5 via DH+ Gateway.

Destination Node	Model	Routing	Device ID less IP
PLC-5/20 (D)	DH+ Gateway	No	1,1.B.9

Example 2
Logix5550 to PLC-5C via CN Gateway.

Destination Node	Model	Routing	Device ID less IP
PLC-5/40C (B)	CN Gateway	No	1,2.A.1

Example 3
Logix5550 to Logix5550 via Routing over DH+.

Destination Node	Model	Routing	Device ID less IP
Logix5550 (C)	ControlLogix 5550	Yes	1,[1,2,8,1],0

Routing Path Breakdown for Example 3.

Hop	Segment	Description
1	1,2,8,1	Slot 1 (DHRIO) -> Port 2 (DH+ Ch A) -> DH+ Node 8 -> Logix C Back plane

Example 4
Logix5550 to PLC-5C via CN Gateway, Routing over DH+.

Destination Node	Model	Routing	Device ID less IP
PLC-5/80C (E)	CN Gateway	Yes	1,[1,2,8,1],2.A.3

Routing Path Breakdown for Example 4.

Hop	Segment	Description
1	1,2,8,1	Slot 1 (DHRIO) -> Port 2 (DH+ Ch A) -> DH+ Node 8 -> Logix C Back plane

Example 5
Logix5550 to Logix5550 via Routing over DH+, ControlNet

Destination Node	Model	Routing	Device ID less IP
Logix5550 (F)	ControlLogix 5550	Yes	1,[1,2,8,1,2,2,15,1],0

Routing Path Breakdown for Example 5.

Hop	Segment	Description
1	1,2,8,1	Slot 1 (DHRIO) -> Port 2 (DH+ Ch A) -> DH+ Node 8 -> Logix C Back plane
2	2,2,15,1	Slot 2 (CNB) -> Port 2 (CN Ch A) -> CN Node 15 -> Logix F Back plane

Example 6
Logix5550 to SLC 5/04 via Routing over DH+, ControlNet.

Destination Node	Model	Routing	Device ID less IP
SLC 5/04 (G)	DH+ Gateway	Yes	1,[1,2,8,1,2,2,15,1],1.A.2

Routing Path Breakdown for Example 6.

Hop	Segment	Description
1	1,2,8,1	Slot 1 (DHRIO) -> Port 2 (DH+ Ch A) -> DH+ Node 8 -> Logix C Back plane
2	2,2,15,1	Slot 2 (CNB) -> Port 2 (CN Ch A) -> CN Node 15 -> Logix F Back plane

Example 7
Logix5550 to Logix5550 via Routing over DH+, ControlNet, Ethernet.

Destination Node	Model	Routing	Device ID less IP
Logix5550 (H)	ControlLogix 5550	Yes	1,[1,2,8,1,2,2,15,1,3,2,192.192.180.101,1],0

Routing Path Breakdown for Example 7.

Hop	Segment	Description
1	1,2,8,1	Slot 1 (DHRIO) -> Port 2 (DH+ Ch A) -> DH+ Node 8 -> Logix C Back plane
2	2,2,15,1	Slot 2 (CNB) -> Port 2 (CN Ch A) -> CN Node 15 -> Logix F Back plane
3	3,2,192.192.180.101,1	Slot 3 (ENBT) -> Port 2 -> Remote1756-ENBT IP -> Logix H Back plane

Logix Device IDs

For information on ENI Device ID setup, refer to **1761-NET-ENI Setup**.

ControlLogix 5500 Ethernet

The Device ID specifies the device IP address, as well as the slot number in which the controller CPU resides. Device IDs are specified as the following:

<IP or Hostname>,1,[<Optional Routing Path>],<CPU Slot>

Designator	Designator Type*	Description	Formats	Range
IP/Host Name	N/A	IP Address or host name.	Decimal	0-255
1	Port ID	Port to backplane.	Decimal	1
Optional Routing Path	Multiple Link, Port pairs	Specifies a way out of the EtherNet/IP interface module and must equal 1 (port to the back plane).	Decimal	*
CPU Slot	Link Address	Slot Number of the ControlLogix processor.	Decimal	0-255

*For more information, refer to **Connection Path Specification**.

Example
123.123.123.123,1,0

This equates to an EtherNet/IP of 123.123.123.123. The Port ID is 1 and the CPU resides in slot 0.

CompactLogix 5300 Ethernet Device ID

The Device ID specifies the device IP address, as well as the slot number in which the controller CPU resides. Device IDs are specified as the following:

<IP or Hostname>,1,[<Optional Routing Path>],<CPU Slot>

Designator	Designator Type*	Description	Formats	Range
IP/Host Name	N/A	CompactLogix Ethernet IP Address or host name.	Decimal	0-255
1	Port ID	Port to backplane.	Decimal	1
Optional Routing Path	Multiple Link, Port pairs	Specifies a way out of the Ethernet port and must equal 1 (port to the back plane).	Decimal	*
CPU Slot	Link Address	Slot Number of the CompactLogix processor.	Decimal	0-255

*For more information, refer to **Connection Path Specification**.

Example
123.123.123.123,1,0

This equates to CompactLogix IP of 123.123.123.123. The Port ID is 1 and the CPU resides in slot 0.

FlexLogix 5400 Ethernet Device ID

The Device ID specifies the device IP address, as well as the slot number in which the controller CPU resides. Device IDs are specified as the following:

<IP or Hostname>,1,[<Optional Routing Path>],<CPU Slot>

Designator	Designator Type*	Description	Formats	Range
IP/Host Name	N/A	1788-ENBT IP Address or host name.	Decimal	0-255
1	Port ID	Port to backplane.	Decimal	1
Optional Rout-	Multiple Link, Port	Specifies a way out of the 1788-ENBT	Decimal	*

ing Path	pairs	interface module and must equal 1 (port to the back plane).		
CPU Slot	Link Address	Slot Number of the FlexLogix processor.	Decimal	0-255

*For more information, refer to **Connection Path Specification**.

Example
123.123.123.123,1,0

This equates to 1788-ENBT IP of 123.123.123.123. The Port ID is 1 and the CPU resides in slot 0.

SoftLogix 5800 Device ID

The Device ID specifies the SoftLogix PC IP address, as well as the virtual slot number in which the controller CPU resides. Device IDs are specified as the following:

<IP or Hostname>,1,[<Optional Routing Path>],<CPU Slot>

Designator	Designator Type*	Description	Formats	Range
IP/Host Name	N/A	SoftLogix PC NIC IP Address or host name.	Decimal	0-255
1	Port ID	Port to backplane.	Decimal	1
Optional Routing Path	Multiple Link, Port pairs	Specifies a way out of the EtherNet/IP Messaging module and must equal 1 (port to the virtual back plane).	Decimal	*
CPU Slot	Link Address	Slot Number of the SoftLogix processor in the virtual backplane.	Decimal	0-255

*For more information, refer to **Connection Path Specification**.

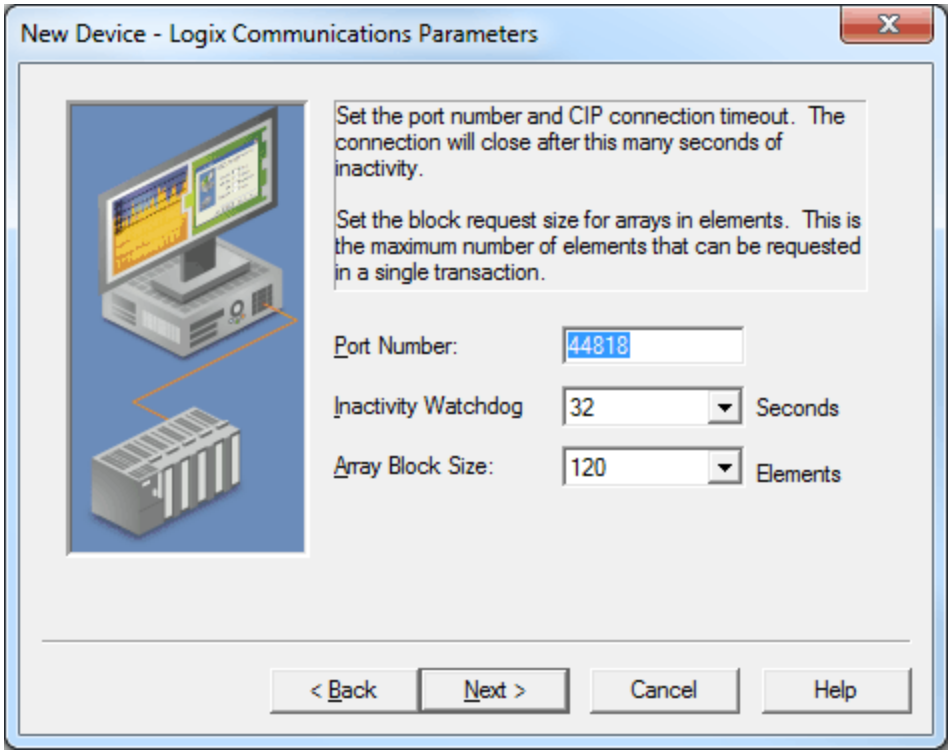
Example
123.123.123.123,1,1

This equates to SoftLogix PC IP Address of 123.123.123.123. The Port ID is 1 and the CPU resides in slot 1.

Note: For information on supplementing a Device ID with a routing path to a remote back plane, refer to **Communications Routing**.

See Also: **SoftLogix 5800 Connection Notes**

Logix Communications Parameters



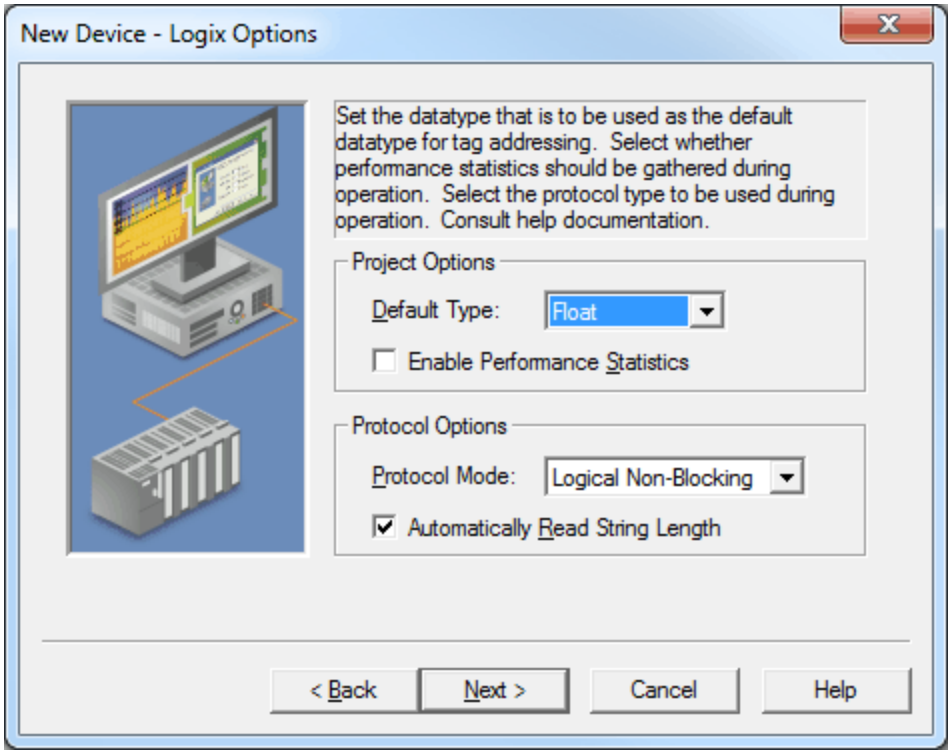
Descriptions of the parameters are as follows:

- **Port Number:** This parameter specifies the port number that the device is configured to use. The default setting is 44818.
- **Inactivity Watchdog:** This parameter specifies the amount of time a connection can remain idle (without Read/Write transactions) before being closed by the controller. In general, the larger the watchdog value, the more time it will take for connection resources to be released by the controller and vice versa. The default setting is 32 seconds.

  Note: If the Event Log error "CIP Connection timed-out while uploading project information" occurs frequently, increase the Inactivity Watchdog value. Otherwise, an Inactivity Watchdog value of 32 seconds is preferred.
- **Array Block Size:** This parameter specifies the maximum number of array elements to read in a single transaction. The value is adjustable and ranges from 30 to 3840 elements. The default setting is 120 elements.

  Note: For Boolean arrays, a single element is considered a 32-element bit array. Thus, setting the block size to 30 elements translates to 960 bit elements, whereas 3840 elements translate to 122880 bit elements.

Logix Options



Descriptions of the parameters are as follows:

- **Default Type:** This parameter specifies the data type that will be assigned to a Client/Server Tag when the default type is selected during tag addition, modification, or import. The default setting is Float. For more information, refer to **Default Data Type Conditions**.

  Note: Since the majority of I/O module tags are not bit-within-Word/DWord tags, it is advised that the Default Type be set to the majority data type as observed in the .ACD project. For example, if 75% of alias I/O module tags are INT tags, set the Default Type to INT.
- **Enable Performance Statistics:** The Allen-Bradley ControlLogix Ethernet Driver has the ability to gather communication statistics to help determine the driver's performance. When checked, this option will be enabled. The driver will then track the number and types of Client/Server Tag updates. On restart of the server application, the results will be displayed in the server's Event Log. The default setting is disabled.

  Note: Once a project configuration is designed for optimal performance, it is recommended that users disable Performance Statistics. Furthermore, since the statistics are outputted to the Event Log on shutdown, the server will need to be re-launched to view the results.
- **Protocol Mode:** This parameter specifies how Logix Tag data will be read from the controller. This option should only be changed by advanced users who are looking to increase Client/Server Tag update performance. Options include Symbolic Mode, Logical Non-Blocking Mode and Logical Blocking Mode. The server project is interchangeable between these three modes. The default setting is Logical Non-Blocking Mode. For more information, refer to **Choosing a Protocol Mode**.

  Note: Logical Non-Blocking Mode and Logical Blocking Mode are not available to Serial Gateway models.
- **Automatically Read String Length:** When checked, the driver will automatically read the LEN member of the STRING structure whenever the DATA member is read. The DATA string will be terminated at the first null character encountered, the character whose position equals the value of LEN, or the maximum string length of DATA (whichever occurs first). When unchecked, the driver will bypass the LEN member read and terminate the DATA string at either the first null character encountered or the maximum string length of DATA (whichever occurs first). Therefore, if LEN is reduced by an external source without modification to DATA, the driver will not terminate DATA according to this reduced length. The default setting is checked.

Default Data Type Conditions

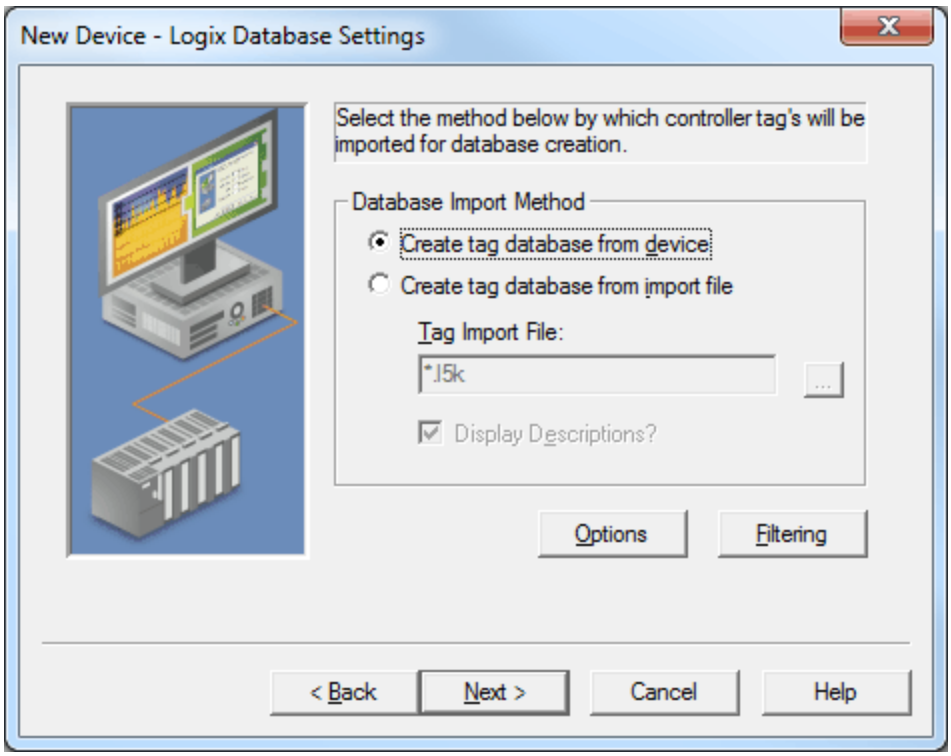
Client/Server Tags are assigned the default data type when any of the following conditions occur:

1. A Dynamic Tag is created in the client with Native as its assigned data type.
2. A Static Tag is created in the server with Default as its assigned data type.
3. In offline automatic tag generation, when an unknown data type is encountered in the L5K/L5X file for UDT members and Alias Tags.
4. In offline automatic tag generation, when an alias of the following type is encountered in the L5K/L5X:

   a. Alias of an alias.

   b. Alias of non bit-within-Word/DWord I/O module tag. For example, if tag "AliasTag" references I/O module tag "Local:5:C.ProgToFaultEn" @ BOOL, the data type for "AliasTag" cannot be resolved and thus this Default Type is assigned to it. On the other hand, if "Alias Tag" references I/O module tag "Local:5:C.C-h0Config.RangeType.0" @ BOOL, the data type can be resolved because of the . (dot) BIT that defines it as a bit-within-Word/DWord. Aliases of bit-within-Word/DWord I/O module tags are automatically assigned the Boolean data type.

Logix Database Settings



Descriptions of the parameters are as follows:

- **Create Tag Database from Device:** This option retrieves tags directly from the controller over the same Ethernet connection that is used for data access. Although it is fast, comprehensive, and imports all tags (including I/O tags), this option requires access to the controller and does not import descriptions. Timer/Counter CTL bits are imported.

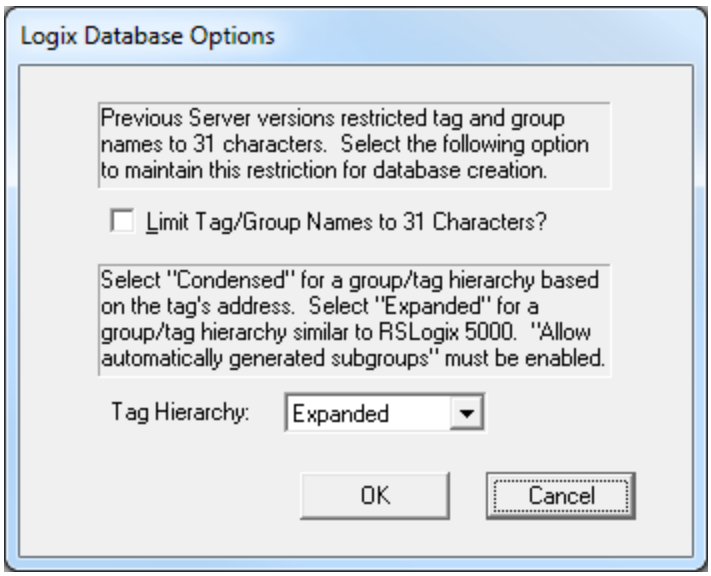
  Note 1: Add-On Instruction In/Out parameters are not automatically generated, whether creating the tag database from the controller or from an import file.

  Note 2: This feature is not available to Serial Gateway models.
- **Create Tag Database from Import File:** This option retrieves tags directly from an RSLogix L5K/L5X file. Although access to the controller is not necessary, descriptions are imported, and users have the ability to work offline, this option is slow and does not import I/O tags. Timer/Counter CTL bits are not imported.

  Note: Add-On Instruction In/Out parameters are not automatically generated, whether creating the tag database from the controller or from an import file.

- **Tag Import File:** This parameter specifies the exact location of the L5K/L5X import file from which tags will be imported. This file will be used when Automatic Tag Database Generation is instructed to create the tag database. All tags, including Global and Program, will be imported and expanded according to their respective data types.
- **Display Descriptions:** When checked, this option imports tag descriptions. Descriptions will be imported for non-structure, non-array tags only. If necessary, a description will be given to tags with long names stating the original tag name.

Logix Database Options



Descriptions of the parameters are as follows:

- **Limit Tag/Group Names to 31 Characters?:** When checked, this parameter limits the tag and group names to 31 characters. Before OPC server version 4.70, tag and group name lengths were restricted to 31 characters; however, the current length restriction of 256 characters can fit Logix 40 character Logix Tag names. The default setting is unchecked.

  Note: If an older OPC server version was used to import tags via L5K/L5X import, inspect the Event Log or scan the server project to see if any tags were cut due to the character limit. If so, it is recommended that this option be enabled in order to preserve the server tag names. OPC client tag references will not be affected. If not chosen, new longer tag names will be created for those that were clipped. OPC clients referencing the clipped tag would have to be changed in order to reference the new tag.

  If an older OPC server version was used to import tags via L5K/L5X import and no tags were clipped due to the 31 character limit, do not select this option. Similarly, if tags were imported via L5K/L5X with OPC server version 4.70 or above, do not select this option.
- **Tag Hierarchy:** This parameter specifies the tag hierarchy. Options include Condensed and Expanded. The default setting is Expanded. Descriptions of the options are as follows:

  - **Condensed Mode:** In this mode, the server tags created by automatic tag generation follow a group/tag hierarchy consistent with the tag's address. Groups are created for every segment preceding the period.
  - **Expanded Mode:** In this mode, the server tags created by automatic tag generation follow a group/tag hierarchy consistent with the tag hierarchy in RSLogix 5000. This is the default setting. Groups are created for every segment preceding the period as in Condensed mode, but groups are also created to represent logical groupings.

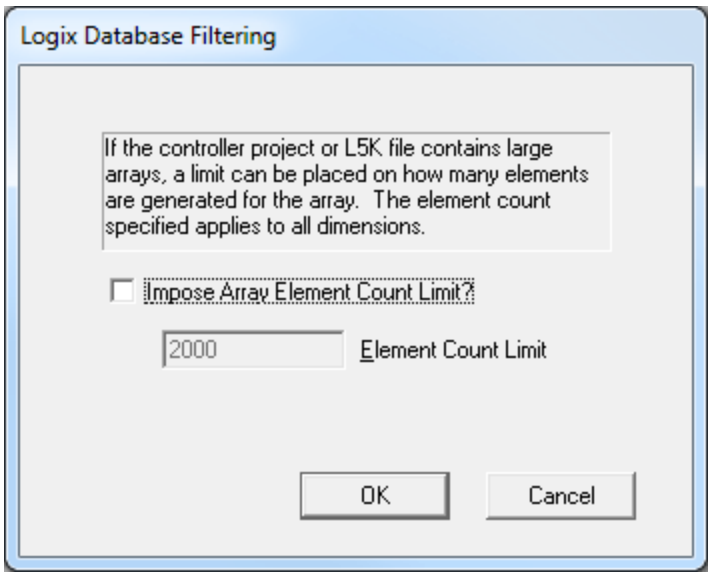
    Note: For more information on the groups created, refer to **Tag Hierarchy**.

  Note: To enable this functionality, check **Allow Automatically Generated Subgroups** in Device

Properties.

See Also: Controller-to-Server Name Conversions

Logix Database Filtering



Descriptions of the parameters are as follows:

- **Impose Array Element Count Limit:** When checked, an array element count limit will be imposed. Tags in the controller can be declared with very large array dimensions. By default, arrays are completely expanded during the tag generation process, thus becoming time consuming for large arrays. By imposing a limit, only a specified number of elements from each dimension will be generated. Limits only takes effect when the array dimension size is exceeds the limit. The default setting is unchecked.
- **Element Count Limit:** This parameter is used to specify the element count limit. The default setting is 2000.

1761-NET-ENI Setup

1761-NET-ENI provides a means of communicating with ControlLogix, CompactLogix, FlexLogix, MicroLogix, SLC 500, and PLC-5 Series PLCs on Ethernet with the Allen-Bradley ControlLogix Ethernet Driver.

Requirements

MicroLogix, SLC 500, or PLC-5 series PLC supporting Full Duplex DF1 utilizing the CH0 RS232 Channel.
1761-NET-ENI Device Series A, B, C, or D.

ControlLogix, CompactLogix or FlexLogix PLC utilizing the CH0 RS232 Channel.
1761-NET-ENI Device Series B and newer.

Note 1: For communications parameters, database settings, and project/protocol options, ENI ControlLogix, CompactLogix, and FlexLogix users should refer to the "Logix Setup" book in the Table of Contents.

Note 2: To turn on the **CompactLogix Routing** option (located in the utility's **ENI IP Addr** tab), use the ENI / ENIW utility supplied by Allen-Bradley. This was tested on an ENI module with Firmware revision 2.31.

Important: The ENI module has a limited number of TCP connections. As such, users should avoid applications that communicate with the module (such as RSLinx/RSWho) so that connections will be available for the driver.

ENI Device ID

The Device ID specifies the IP address of the 1761-NET-ENI. Device IDs are specified as the following:

<IP Address>

Designator	Designator Type	Description	Formats	Range
IP Address	N/A	1761-NET-ENI IP Address	Decimal	0-255

Example
123.123.123.123

This equates to an ENI IP of 123.123.123.123. Since the device only supports Full Duplex DF1, a Node ID is not required.

Note: For more information on communications parameters, refer to **Logix Communications Parameters**.

DataHighwayPlus (TM) Gateway Setup

DH+ Gateway provides a means of communicating with SLC 500 and PLC-5 series PLC on DH+ with the Allen-Bradley ControlLogix Ethernet Driver.

Requirements

Ethernet/IP Interface module.
1756-DHRIO Interface Module with appropriate channel configured for DH+.
SLC500 or PLC-5 series PLC on DH+ Network.

Note: DH+ Gateway models do not support automatic tag database generation.

DH+ Gateway Device ID

The Device ID specifies the device IP address as well as the DH+ parameters necessary for making a connection. Device IDs are specified as the following:

<IP or Hostname>,1,[<Optional Routing Path>],<DHRIO Slot>.<DHRIO Channel>.<DH+ Node ID (dec)>

Designator	Designator Type*	Description	Formats	Range
IP/Host Name	N/A	IP Address or host name.	Decimal	0-255
1	Port ID	Port to backplane.	Decimal	1
Optional Routing Path	Multiple Link, Port pairs	Specifies a way out of the EtherNet/IP interface module and must equal 1 (port to the back plane).	Decimal	*
DHRIO Slot	Link Address	Slot Number of the 1756-DHRIO interface module.	Decimal	0-255
DHRIO Channel		DH+ Channel to use.	Alpha	A and B
DH+ Node ID		DH+ Node ID of target PLC in Decimal Format.**	Decimal	0-99

*For more information, refer to **Connection Path Specification**.
**For more information, refer to "Node ID Octal Addressing" below.

Example
123.123.123.123,1,2.A.3

This equates to an EtherNet/IP of 123.123.123.123. The DH+ card resides in slot 2: use DH+ Channel A and addressing target DH+ Node ID 3 (dec).

Node ID Octal Addressing

The DH+ Node ID is specified in Octal format in the PLC and requires a conversion to Decimal format for use in the DH+ Gateway Device ID. The Node ID can be located in RSWho within RSLinx. It is displayed in Octal format.

Example
DH+ Node 10 (octal) in RSWho = DH+ Node 8 (decimal) in DH+ Gateway Device ID.

It is important to verify communications with the proper controller. In the example above, if 10 was entered as the DH+ Node ID in the DH+ Gateway Device ID, then communications would take place with Node 12 (octal equivalent of 10 decimal) and not Node 10 (octal). If Node 12 (octal) does not exist, then the DHRIO module would return DF1 STS 0x02. This means that the link layer could not guarantee delivery of the packet. In short, the DH+ Node could not be located on the DH+ network.

Note 1: For information on supplementing a Device ID with a routing path to a remote DH+ node, refer to **Communications Routing**.

Note 2: For more information on communications parameters, refer to **ENI DF1/DH+/ControlNet Gateway Communications Parameters**.

ControlNet (TM) Gateway Setup

ControlNet Gateway provides a means of communicating with PLC-5C series PLCs on ControlNet with the Allen-Bradley ControlLogix Ethernet Driver.

Requirements

Ethernet/IP Interface Module.
1756-CNB or 1756-CNBR Interface Module.
PLC-5C series PLC on ControlNet Network.

Note: ControlNet Gateway models do not support automatic tag database generation.

ControlNet Gateway Device ID

The Device ID specifies the device IP address in addition to the ControlNet parameters necessary for making a connection. Device IDs are specified as the following:

<IP or Hostname>,1,[<Optional Routing Path>],<CNB Slot>.<CNB Channel>.<ControlNet Node ID (dec)>

Designator	Designator Type*	Description	Formats	Range
IP/Host Name	N/A	IP Address or host name.	Decimal	0-255
1	Port ID	Port to backplane.	Decimal	1
Optional Routing Path	Multiple Link, Port pairs	Specifies a way out of the EtherNet/IP communication module and must equal 1 (port to the back plane).	Decimal	*
CNB Slot	Link Address	Slot Number of the 1756-CNB/CNBR interface module.	Decimal	0-255
CNB Channel	Port ID	The ControlNet Channel to use.	Alpha	A and B
ControlNet Node ID	Link Address	ControlNet Node ID of target PLC in Decimal Format.**	Decimal	0-99

*For more information, refer to **Connection Path Specification**.
**For more information, refer to "Node ID Octal Addressing" below.

Example
123.123.123.123,1,2.A.3

This equates to an EtherNet/IP of 123.123.123.123. The ControlNet card resides in slot 2: use ControlNet Channel A and addressing target ControlNet Node ID 3.

Node ID Octal Addressing

The ControlNet Node ID is specified in Octal format in the PLC and requires a conversion to Decimal format for use in the ControlNet Gateway Device ID. The Node ID can be located in RSWho within RSLinx. It is displayed in Octal format.

Example
CN Node 10 (octal) in RSWho = CN Node 8 (decimal) in ControlNet Gateway Device ID.

It is important to verify communications with the proper controller. In the example above, if 10 was entered as the ControlNet Node ID in the ControlNet Gateway Device ID, communications will take place with Node 12 (octal equivalent of 10 decimal), not Node 10 (octal). If Node 12 (octal) does not exist, then the CNB module will return DF1 STS 0x02. This means that the link layer could not guarantee delivery of the packet. In short, the ControlNet Node could not be located on the ControlNet network.

Note 1: For more information on supplementing a Device ID with a routing path to remote ControlNet node, refer to **Communications Routing**.

Note 2: For more information on communications parameters, refer to **ENI DF1/DH+/ControlNet Gateway Communications Parameters**.

EtherNet/IP Gateway Setup

EtherNet/IP Gateway provides a means of communicating with MicroLogix, SLC 500, and PLC-5 series PLC on EtherNet/IP with the Allen-Bradley ControlLogix Ethernet Driver.

Requirements

2 or more Ethernet/IP Interface modules (such as 1756-ENBT).
MicroLogix, SLC500, or PLC-5 series PLC with EtherNet/IP connectivity.

Note: EtherNetIP Gateway models do not support automatic tag database generation.

EtherNet/IP Gateway Device ID

The Device ID specifies the local device IP address as well as the remote EtherNet/IP address necessary for making a connection. Device IDs are specified as the following:

<IP or Hostname>,1,[<Optional Routing Path>],<ENBT Slot>.<ENBT Channel>.<Remote IP>

Designator	Designator Type*	Description	Formats	Range
IP/Host Name	N/A	IP Address or host name of the local EtherNet/IP interface module.	Decimal	0-255
1	Port ID	Port to backplane.	Decimal	1
Optional Routing Path	Multiple Link, Port pairs	Specifies a way out of the EtherNet/IP interface module and must equal 1 (port to the back plane).	Decimal	*
ENBT Slot	Link Address	The slot number of the second EtherNet/IP interface module.	Decimal	0-255
ENBT Channel	Port ID	The EtherNet/IP port to use.	Alpha	A and B
Remote IP Address	Link Address	The remote IP address of the target PLC.	Decimal	0-255

*For more information, refer to **Connection Path Specification**.

Example
123.123.123.123,1,2.A.192.168.1.10

This equates to a local IP of 123.123.123.123. The second EtherNet/IP card resides in slot 2: use port A and addressing target device with IP 192.168.1.10.

Note 1: For information on supplementing a Device ID with a routing path to a remote EtherNet/IP device, refer to **Communications Routing**.

Note 2: For more information on communications parameters, refer to **ENI DF1/DH+/ControlNet Gateway Communications Parameters**.

Note 3: When configuring the Device ID, users should verify that the device can be detected using the same route through RSLinx.

Serial Gateway Setup

Serial Gateway provides a means of communicating with ControlLogix, CompactLogix, FlexLogix, and SoftLogix PLCs on a serial network with the Allen-Bradley ControlLogix Ethernet Driver.

Requirements

Ethernet/IP Interface module.
Local CPU with a serial port.
Remote ControlLogix, CompactLogix, FlexLogix, or SoftLogix CPU with a serial port.

Note 1: Local and Remote CPUs must be on the same serial network.

Note 2: Serial Gateway models do not support automatic tag database generation.

Serial Gateway Device ID

The Device ID specifies the local device IP address as well as the remote device Station ID necessary for making a connection. Device IDs are specified as the following:

<IP or Hostname>,1,[<Optional Routing Path>],<CPU Slot>.<Serial Port Channel>.<Station ID (dec)>

Designator	Designator Type*	Description	Formats	Range
IP/Host Name	N/A	IP Address or host name.	Decimal	0-255
1	Port ID	Port to backplane.	Decimal	1
Optional Routing Path	Multiple Link, Port pairs	Specifies a way out of the EtherNet/IP interface module and must equal 1 (port to the back plane).	Decimal	*
CPU Slot	Link Address	Slot Number of the CPU module that contains the Serial Port used for communications.	Decimal	0-255
Serial Port Channel		Serial Port Channel to use.	Alpha	A and B
Station ID		DF1 Station ID of target PLC in Decimal Format.**	Decimal	0-255

*For more information, refer to **Connection Path Specification**.

Example
123.123.123.123,1,0.A.3

This equates to an EtherNet/IP of 123.123.123.123. The CPU card resides in slot 0: use Channel A (Serial Port) and addressing target Station ID 3 (dec).

Note 1: For information on supplementing a Device ID with a routing path to a remote serial node, refer to **Communications Routing**.

Note 2: For more information on communications parameters, refer to **Logix Communications Parameters**.

Note 3: When configuring the Device ID, users should verify that the device can be detected using the same route through RSLinx.

MicroLogix 1100 Setup

MicroLogix 1100 Device ID

The Device ID specifies the IP address of the MicroLogix 1100. Device IDs are specified as the following:

<IP or Hostname>

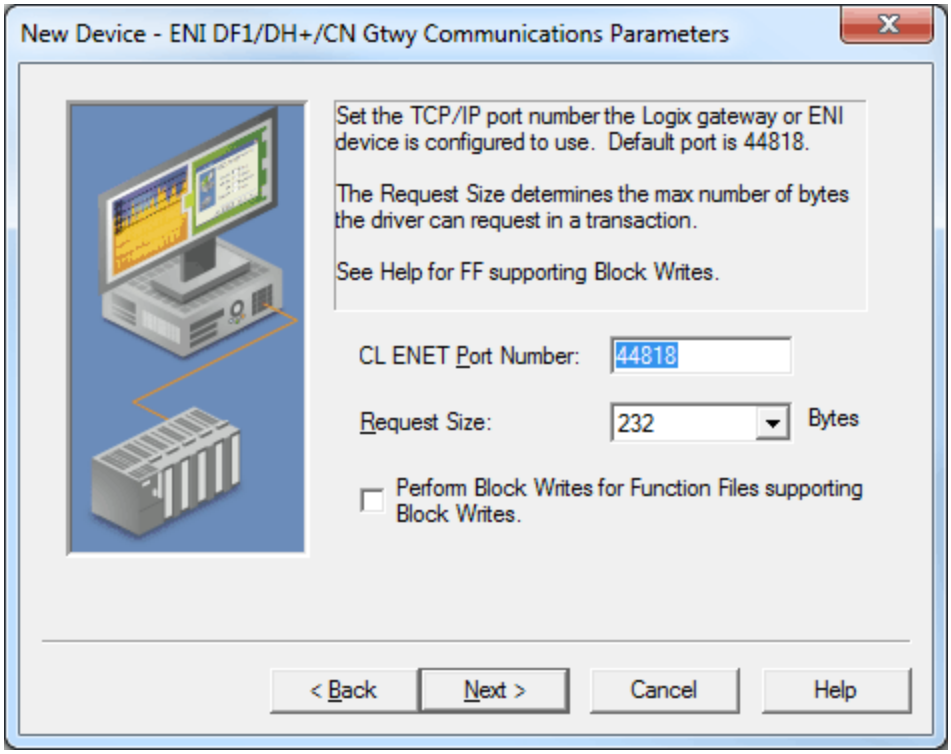
Designator	Designator Type	Description	Formats	Range
IP/Host Name	N/A	IP Address or host name.	Decimal	0-255

Example
123.123.123.123

This equates to an IP of 123.123.123.123.

Note: For more information on communications parameters, refer to **ENI DF1/DH+/ControlNet Gateway Communications Parameters**.

ENI DF1/DH+/ControlNet Gateway Communications Parameters



Descriptions of the parameters are as follows:

- **CL ENET Port Number:** This parameter specifies the port number that the remote device is configured to use (such as 1756-ENBT). The default setting is 44818.
- **Request Size:** This parameter specifies the number of bytes that may be requested from a device at one time. To refine the performance of this driver, configure the request size to one of the following settings: 32, 64, 128, or 232. The default setting is 232 bytes.
- **Perform Block Writes for Function Files Supporting Block Writes:** Function files are structure-based files (much like PD and MG data files) and are unique to the MicroLogix 1100, 1200 and 1500. Supported function files include the following: High Speed Counter (HSC), Real-Time Clock (RTC), Channel 0 Communication Status File (CS0), Channel 1 Communication Status File (CS1), and I/O Module Status File (IOS). For more information, refer to "Block Writes" below.

  For applicable function files, data can be written to the device in a single operation. By default, when data is written to a function file sub element (field within the function file structure), a write operation occurs immediately for that tag. For such files as the RTC file, whose sub elements include hour (HR), minute (MIN) and second (SEC), individual writes are not always acceptable. With such sub elements relying solely on time, values must be written in one operation to avoid time elapsing between sub elements writes. For this reason, there is the option to "block write" these sub elements. The default setting is unchecked.

Block Writes

Block writing involves writing to the device the values of every Read/Write sub element in the function file in a single write operation. It is not necessary to write to every sub element before performing a block write. Sub elements that are not affected (written to) will have their current value written back to them. For example, if the current (last read) date and time is 1/1/2001, 12:00.00, DOW = 3 and the hour is changed to 1 o'clock, then the values written to the device would be 1/1/2001, 1:00.00, DOW = 3. For more information, refer to the instructions below.

1. To start, locate the **Function File Options** tab in **Device Properties**. Then, select the **Perform Block Writes for Function Files Supporting Block Writes** checkbox to notify the driver to utilize block writes on function files that support block writes.

   Note: Changes will take effect upon clicking **OK** or **Apply**.

2. Next, write the desired value to the sub element tag in question. The sub element tag will immediately take on the value written to it.

   Note: After a sub element is written to at least once in block write mode, the tag's value will not originate from the controller, but instead from the driver's write cache. After the block write is done, all sub element tag values will originate from the controller.

3. Once the entire desired sub elements are written to, perform the block write that will send these values to the controller. To instantiate a block write, reference tag address *RTC:<element>._SET*. Setting this tag's value to 'true' will cause a block write to occur based on the current (last read) sub elements and the sub elements affected (written to). Immediately after setting the tag to 'true', it will be automatically reset to "false." This is the default state and performs no action.

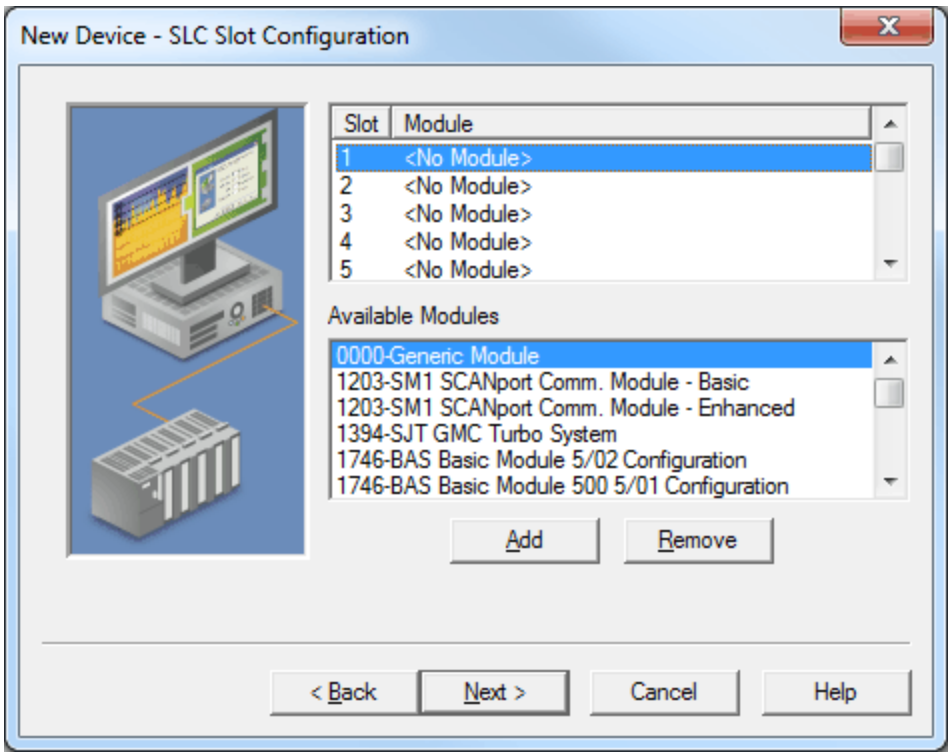
Applicable Function Files/Sub Elements

RTC	
Year	YR
Month	MON
Day	DAY
Day of Week	DOW
Hour	HR
Minute	MIN
Second	SEC

See Also: Function File Listing

SLC 500 Slot Configuration

For I/O to be accessed, SLC5/01/02/03/04/05 models (modular I/O racks) must be configured for use with the Allen-Bradley ControlLogix Ethernet Driver. Up to 30 slots can be configured per device.



Descriptions of the parameters are as follows:

- **Add:** When clicked, this button will add the selected module to the selected slot.

  Note: Before adding a module, users must know the number of input and output words in each slot. This

is necessary for the driver to correctly address the I/O. Only the number of input and output words in slots (up to the slot of interest) are needed to address I/O in that slot. For example, if users are only going to access slot 3, all slots up to 3 (slots 1 and 2) must be configured if they contain any I/O and slot 3 (but not slot 4 or greater).

- **Remove:** When clicked, this button will remove the selected model from the selected slot.

SLC 500 Modular I/O Selection Guide

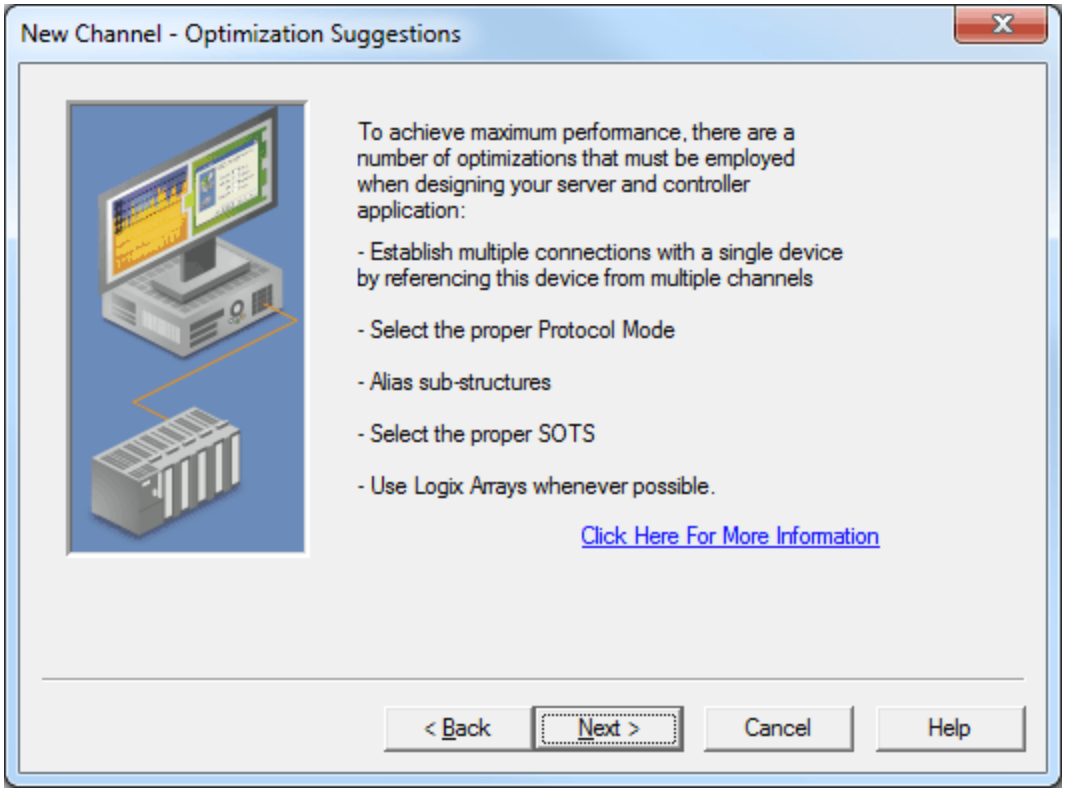
The following table lists the number of input and output words available for each I/O module in the Slot Configuration list.

Module Type	Input Words	Output Words
1746-I*8 Any 8 pt Discrete Input Module	1	0
1746-I*16 Any 16 pt Discrete Input Module	1	0
1746-I*32 Any 32 pt Discrete Input Module	2	0
1746-O*8 Any 8 pt Discrete Output Module	0	1
1746-O*16 Any 16 pt Discrete Output Module	0	1
1746-O*32 Any 32 pt Discrete Output Module	0	2
1746-IA4 4 Input 100/120 VAC	1	0
1746-IA8 8 Input 100/120 VAC	1	0
1746-IA16 16 Input 100/120 VAC	1	0
1746-IB8 8 Input (Sink) 24 VDC	1	0
1746-IB16 16 Input (Sink) 24 VDC	1	0
1746-IB32 32 Input (Sink) 24 VDC	2	0
1746-IG16 16 Input [TTL] (Source) 5VDC	1	0
1746-IM4 4 Input 200/240 VAC	1	0
1746-IM8 8 Input 200/240 VAC	1	0
1746-IM16 16 Input 200/240 VAC	1	0
1746-IN16 16 Input 24 VAC/VDC	1	0
1746-ITB16 16 Input [Fast] (Sink) 24 VDC	1	0
1746-ITV16 16 Input [Fast] (Source) 24 VDC	1	0
1746-IV8 8 Input (Source) 24 VDC	1	0
1746-IV16 16 Input (Source) 24 VDC	1	0
1746-IV32 32 Input (Source) 24 VDC	2	0
1746-OA8 8 Output (Triac) 100/240 VAC	0	1
1746-OA16 16 Output (Triac) 100/240 VAC	0	1
1746-OB8 8 Output [Trans] (Source) 10/50 VDC	0	1
1746-OB16 16 Output [Trans] (Source) 10/50 VDC	0	1
1746-OB32 32 Output [Trans] (Source) 10/50 VDC	0	2
1746-OBP16 16 Output [Trans 1 amp] (SRC) 24 VDC	0	1
1746-OV8 8 Output [Trans] (Sink) 10/50 VDC	0	1
1746-OV16 16 Output [Trans] (Sink) 10/50 VDC	0	1
1746-OV32 32 Output [Trans] (Sink) 10/50 VDC	0	2
1746-OW4 4 Output [Relay] VAC/VDC	0	1
1746-OW8 8 Output [Relay] VAC/VDC	0	1
1746-OW16 16 Output [Relay] VAC/VDC	0	1
1746-OX8 8 Output [Isolated Relay] VAC/VDC	0	1
1746-OVP 16 16 Output [Trans 1 amp] (Sink) 24VDC3	0	1
1746-IO4 2 In 100/120 VAC 2 Out [Rly] VAC/VDC3	1	1
1746-IO8 4 In 100/120 VAC 4 Out [Rly] VAC/VDC4	1	1
1746-IO12 6 In 100/120 VAC 6 Out [Rly] VAC/VDC	1	1
1746-NI4 4 Ch Analog Input	4	0
1746-NIO4I Analog Comb 2 in & 2 Current Out	2	2
1746-NIO4V Analog Comb 2 in & 2 Voltage Out	2	2
1746-NO4I 4 Ch Analog Current Output	0	4

1746-NO4V 4 Ch Analog Voltage Output	0	4
1746-NT4 4 Ch Thermocouple Input Module	8	8
1746-NR4 4 Ch Rtd/Resistance Input Module	8	8
1746-HSCE High Speed Counter/Encoder	8	1
1746-HS Single Axis Motion Controller	4	4
1746-OG16 16 Output [TLL] (SINK) 5 VDC	0	1
1746-BAS Basic Module 500 5/01 Configuration	8	8
1746-BAS Basic Module 5/02 Configuration	8	8
1747-DCM Direct Communication Module (1/4 Rack)	2	2
1747-DCM Direct Communication Module (1/2 Rack)	4	4
1747-DCM Direct Communication Module (3/4Rack)	6	6
1747-DCM Direct Communication Module (Full Rack)	8	8
1747-SN Remote I/O Scanner	32	32
1747-DSN Distributed I/O Scanner 7 Blocks	8	8
1747-DSN Distributed I/O Scanner 30 Blocks	32	32
1747-KE Interface Module, Series A	1	0
1747-KE Interface Module, Series B	8	8
1746-NI8 8 Ch Analog Input, Class 1	8	8
1746-NI8 8 Ch Analog Input, Class 3	16	12
1746-IC16 16 Input (Sink) 48 VDC	1	0
1746-IH16 16 Input [Trans] (Sink) 125 VDC	1	0
1746-OAP12 12 Output [Triac] 120/240 VDC	0	1
1746-OB6EI 6 Output [Trans] (Source) 24 VDC	0	1
1746-OB16E 16 Output [Trans] (Source) Protected	0	1
1746-OB32E 32 Output [Trans] (Source) 10/50 VDC	0	2
1746-OBP8 8 Output [Trans 2 amp] (Source) 24 VDC	0	1
1746-IO12DC 6 Input 12 VDC, 6 Output [Rly	1	1
1746-INI4I Analog 4 Ch. Isol. Current Input	8	8
1746-INI4VI Analog 4 Ch. Isol. Volt./Current Input	8	8
1746-INT4 4 Ch. Isolated Thermocouple Input	8	8
1746-NT8 Analog 8 Ch Thermocouple Input	8	8
1746-HSRV Motion Control Module	12	8
1746-HSTP1 Stepper Controller Module	8	8
1747-MNET MNET Network Comm Module	0	0
1747-QS Synchronized Axes Module	32	32
1747-QV Open Loop Velocity Control	8	8
1747-RCIF Robot Control Interface Module	32	32
1747-SCNR ControlNet SLC Scanner	32	32
1747-SDN DeviceNet Scanner Module	32	32
1394-SJT GMC Turbo System	32	32
1203-SM1 SCANport Comm Module - Basic	8	8
1203-SM1 SCANport Comm Module - Enhanced	32	32
AMCI-1561 AMCI Series 1561 Resolver Module	8	8

Performance Optimizations

Although the Allen-Bradley ControlLogix Ethernet Driver is fast, a few guidelines may be applied to optimize the application and gain maximum performance.



For more information on optimization at the communication and application levels, select a link from the list below.

Optimizing Your Communications
Optimizing Your Application
Performance Statistics and Tuning
Performance Tuning Example

Optimizing Your Communications

As with any programmable controller, there are a variety of ways to enhance the performance and system communications.

Protocol Mode

The Protocol Mode determines how Logix Tag data will be accessed from the controller. There are three types of protocol modes: Symbolic, Logical Non-Blocking and Logical Blocking. Descriptions are as follows:

- **Symbolic Mode:** Each Client/Server Tag address is represented in the packet by its ASCII character name.
- **Logical Non-Blocking Mode:** Each Client/Server Tag is represented by its logical memory address in the PLC.
- **Logical Blocking Mode:** The Logix Tag is accessed as a single chunk of data. Each Client/Server Tag (such as MYTIMER.ACC) has a corresponding Logix Tag (MYTIMER). Many Client/Server Tags can belong to the same Logix Tag, as in the case of structures. On every read cycle, the Logix Tag is read, its block is updated in the driver cache and all Client/Server Tags are updated from this cache.

Logical Non-Blocking Mode is generally recommended because it is the most efficient mode for gathering and processing Logix Tag data. Symbolic Mode is recommended for backward compatibility, whereas Logical Non-Blocking Mode is recommended for projects containing a small number of references to UDT and/or predefined structure Logix Tags. Although Logical Blocking Mode can be efficient, it can also hurt performance if used incorrectly. For more information on each mode's benefits and detriments, refer to **Choosing a Protocol Mode**.

Tag Division Tips
Users should designate one or more devices for Logical Blocking purposes and one or more devices for Logical Non-Blocking purposes. This will improve performance because different tags in a project are often better suited for different modes. When utilizing tag division, users should do the following:

1. Assign server tags referencing Atomic Logix Tags (array or non-array) to the Logical Non-Blocking device.
2. Assign server tags referencing a Structure Logix Tag composed of one-third* or less of the Structure Tag to the Logical Non-Blocking device(s). For example, if there are 55** or less member tags referencing a PID_ENHANCED Logix Tag, all these tags should be assigned to the Logical Non-Blocking device.
3. Assign server tags referencing a Structure Logix Tag composed of one-third* or more of the Structure Tag to the Logical Blocking device(s). For example, if there are more than 55** member tags referencing a PID_ENHANCED Logix Tag, all of those tags should be assigned to the Logical Blocking device.

*One-third is not an exact limit, but rather a figure that has held true in a number of studies.
**A PID_ENHANCED structure has 165 tags; thus, one-third equals 55 tags.

UDT Substructure Aliasing
If a UDT contains large substructures and one-third or more of the substructure members are referenced in the client, refer to the following instructions to optimize reads for the substructure.

1. Create an alias of the substructure in RSLogix 5000. Then, assign server tags referencing the rest of the UDT substructure to a Logical Blocking device.
2. Next, assign the server tags referencing the rest of the UDT (but not the substructure) to a Logical Non-Blocking device.

System Overhead Time Slice
The System Overhead Time Slice (SOTS) is the percentage of time allocated to perform communication tasks (such as OPC driver communications) that is set in RSLogix 5000. 100% SOTS is the percentage of time for controller tasks (such as ladder logic). The default SOTS is 10%. In every 10 ms program scan that occurs, the controller will spend 1 ms processing Allen-Bradley ControlLogix Ethernet Driver requests (if the controller has a continuous task). The value of SOTS defines the task's priority. If controller tasks are a high priority, the SOTS should be set below 30%. If the communication tasks are high priority, the SOTS should be set at or above 30%. For the best balance of communications performance and CPU utilization, set the SOTS to 10% to 40%.

Multi-Request Packets
The Allen-Bradley ControlLogix Ethernet Driver has been designed to optimize reads and writes. For non-array, non-string tags (which only request one element), requests are blocked into a single transaction. This provides drastic improvement in performance over single tag transactions. The only limitation is the number of data bytes that can fit in a single transaction.

Important: In Symbolic Mode, each tag's ASCII string value is inserted into the request packet until no more tag requests fit. For optimum performance, users should keep the tag names' size to a minimum. The smaller the tag name, the more tags that will fit in a single transaction, and the fewer transactions needed to process all tags.

Array Elements Blocked (Symbolic and Logical Non-Blocking Modes Only)
To optimize the reading of atomic array elements, read a block of the array in a single request instead of individually. The more elements read in a block, the greater the performance. Since transaction overhead and processing consumes the most time, do as few transactions as possible while scanning as many desired tags as possible. This is the essence of array element blocking.

Block sizes are specified as an element count. A block size of 120 elements means that a maximum of 120 array elements will be read in one request. The maximum block size is 3840 elements. Boolean arrays are treated differently: in protocol, a Boolean array is a 32-bit array. Thus, requesting element 0 is requesting bits 0 through 31. To maintain consistency in discussion, a Boolean array element will be considered a single bit. In summary, the maximum number of array elements (based on block size of 3840) that can be requested is as follows:122880 BOOL, 3840 SINT, 3840 INT, 3840 DINT and 3840 REAL.

As discussed in **Logix Communication Parameters**, the block size is adjustable and should be chosen based on the project at hand. For example, if array elements 0-26 and element 3839 are tags to be read, then using a block size of 3840 is not only overkill, but detrimental to the driver's performance. This is because all elements between 0 and 3839 will be read on each request, even though only 28 of those elements are of importance. In this case, a block size of 30 is more appropriate. Elements 0-26 would be serviced in one request and element 3839 would be serviced on the next.

Optimizing Strings

In the Logical Addressing modes, a write to STRING.DATA will also write to STRING.LEN with the proper length value.

Automatically Read String Length

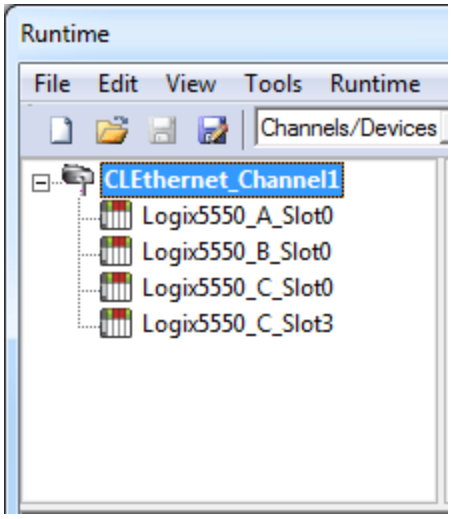
In this driver, string tags are structures with separate character data and length components. As such, the driver will automatically read a string tag in two transactions: one in Logical Protocol Mode for the string character data (DATA) and one in Symbolic Mode for the string length (LEN). When the "Automatically Read String Length" option is unchecked, a single transaction will be made to read the string character data. In this case, the Symbolic Mode read for string length will be bypassed. In a project with many string tags, this can significantly reduce the time required to read all tags.

Note: For more information on the "Automatically Read String Length" option, refer to **Logix Options**.

Optimizing Your Application

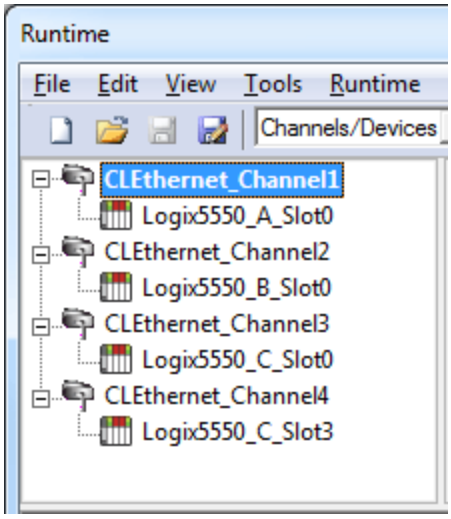
The Allen-Bradley ControlLogix Ethernet Driver has been designed to provide the best performance with the least amount of impact on the system's overall performance. While the Allen-Bradley ControlLogix Ethernet Driver is fast, there are a couple of guidelines that can be used in order to optimize the application and gain maximum performance.

The server refers to communications protocols like Allen-Bradley ControlLogix Ethernet as a channel. Each channel defined in the application represents a separate path of execution in the server. Once a channel has been defined, a series of devices must then be defined under that channel. Each of these devices represents a single Allen-Bradley Logix CPU from which data will be collected. While this approach to defining the application will provide a high level of performance, it won't take full advantage of the Allen-Bradley ControlLogix Ethernet Driver or the network. An example of how the application may appear when configured using a single channel is shown below.



Each device appears under a single channel, called "CLEthernet_Channel1". In this configuration, the driver must move from one device to the next as quickly as possible in order to gather information at an effective rate. As more devices are added or more information is requested from a single device, the overall update rate begins to suffer.

If the Allen-Bradley ControlLogix Ethernet Driver could only define one single channel, then the example shown above would be the only option available; however, the Allen-Bradley ControlLogix Ethernet Driver can define up to 256 channels. Using multiple channels distributes the data collection workload by simultaneously issuing multiple requests to the network. An example of how the same application may appear when configured using multiple channels to improve performance is shown below.



Each device has now been defined under its own channel. In this new configuration, a single path of execution is dedicated to the task of gathering data from each device. If the application has 256 or fewer devices, it can be optimized exactly how it is shown here.

The performance will improve even if the application has more than 256 devices. While 256 or fewer devices may be ideal, the application will still benefit from additional channels. Although by spreading the device load across all channels will cause the server to move from device to device again, it can now do so with far less devices to process on a single channel.

Performance Statistics and Tuning

The Performance Statistics feature provides benchmarks and statistics about the Allen-Bradley ControlLogix Ethernet application's performance. Because Performance Statistics is an additional layer of processing, it can affect the server's performance. As such, the default setting is off. To enable the Performance Statistics feature, open Device Properties and select the **Logix Options** tab. Then, check the **Enable Performance Statistics** box.

Types of Performance Statistics

Performance Statistics provide meaningful numerical results across three scopes: device, channel, and driver. Descriptions of the types are as follows:

- **Device:** These statistics provide the data access performance on a particular device.
- **Channel:** These statistics provide the average data access performance for all the devices under a given channel with Performance Statistics enabled.
- **Driver:** These statistics provide the average data access performance for all devices using the Allen-Bradley ControlLogix Ethernet Driver with Performance Statistics enabled.

Choosing a Statistic Type

The type of statistics needed depends on the application. In general, driver statistics provide a true measure of the application's performance, whereas channel and device statistics are most relevant while tuning the application. For example, will moving 10 certain tags from Device A to Device B increase the performance of Device A? Will moving Device A from Channel 1 to Channel 2 increase the performance of Channel 1? These questions are good examples of situations when device and channel statistics should be used.

Locating Statistics

Server statistics are outputted to the server's Event Log upon shutdown. To view the results, shut down the server and then restart it.

Differences Between Server Statistics and Performance Statistics

Performance Statistics provide the makeup of the types of reads performed (such as symbolic vs. symbol instance vs. physical, or device reads vs. cache reads) whereas server statistics provide a general read count value.

Tuning the Application for Increased Performance

For information on increasing device and channel statistic results, refer to the instructions below. For more information, refer to **Optimizing Your Communications**.

1. Server Tags referencing Atomic Logix Tags (array or non-array) should be assigned to Logical Non-Blocking devices.
2. Server Tags referencing a Structure Logix Tag composed of one-third or less of the Structure Tag should be assigned to Logical Non-Blocking devices.
3. Server Tags referencing a Structure Logix Tag composed of one-third or more of the Structure Tag should be assigned to Logical Blocking devices.

4. If Symbolic Mode is used, Logix names should be kept to a minimum length.
5. Logix Arrays should be used as often as possible.
6. Only the necessary amount of System Overhead Time Slice for Ladder Logic/FBD should allocated in order to leave the rest for driver communications.
7. For projects that read a large number of string tags in Logical Mode, uncheck the "Automatically Read String Length" option located in the **Logix Options** tab of **Device Properties**.

For information on increasing driver statistic results, refer to the instructions below. For more information, refer to **Optimizing Your Application**.

1. Devices should be spread across channels. More than one device should not be put on a channel unless necessary.
2. Load should be spread evenly across devices. A single device should not be overloaded unless necessary.
3. The same Logix Tag should not be referenced across different devices.

Note: Although these general rules can help optimize performance, it ultimately depends on the application. The scan rate can obscure results: if tag requests are light, Read and Write transactions can complete before the next request comes in. In this case, Logical Blocking and Logical Non-Blocking will have the same Performance Statistics results. If tag requests are high (many tags or high scan rates), transaction completion time may take longer. This is when the strengths and weaknesses of Logical Blocking and Logical Non-Blocking become apparent. Performance Statistics can help tune the application for maximum performance. For an example, refer to **Performance Tuning Example**.

Performance Tuning Example

Statistics can be applied to any application. In the example below, the Quick Client is used in the performance tuning process. The idea is that all the tags used in the project will be read at the same time at a fast scan rate. Although this is not realistic, it does provide an accurate benchmark to the project layout in the server (tags belonging to specific devices, devices belonging to specific channels, and so forth).

The statistics gathered are relative. Users should start with a server project layout, gather the statistics, and then tune. It is recommended that more than one trial be used to properly assess the results for a given layout. Once the most efficient layout is determined, the client application can be built with reassurance that the server is optimal.

Caution: Performance results obtained using the Quick Client do not equate to performance results obtained using a client application: several factors will produce discrepancies. Although performance tuning with the client application is more accurate than with the Quick Client, the tuning required will not only affect the server project but the client application as well. Thus, it is recommended that the Quick Client be used to tune the application before the client application is developed.

Note: The tuning process described below assumes that all tags are being read at a fast scan rate. Writes will hinder the performance.

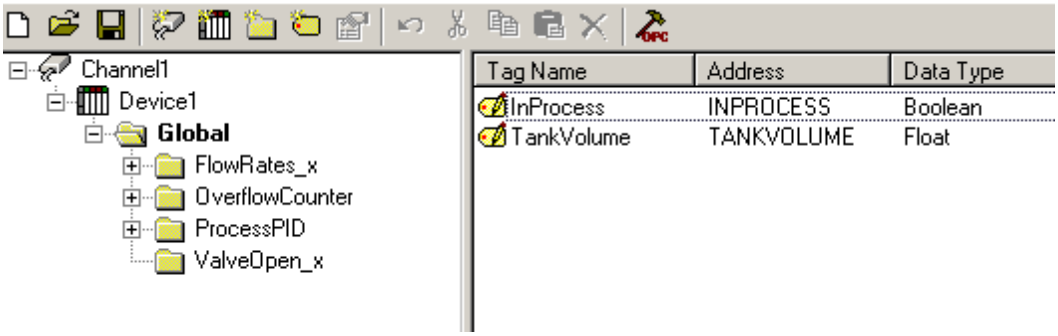
1. In the controller project displayed below, there are the following:

   2 Atomics
   1 Atomic Array
   1 UDT
   1 UDT Array
   1 Pre-Defined Type

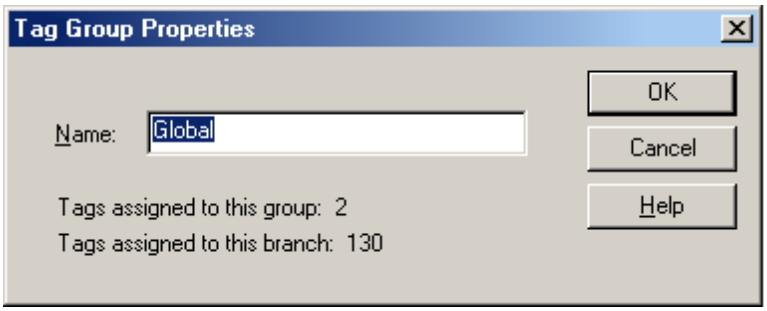
   Note: Overhead Time Slice (OTS) = 10%.

P	Tag Name	Alias For	Base Tag	Type
	InProcess			BOOL
☐	⊞ OverflowCounter			COUNTER
☐	⊞ ValveOpen			DINT[10]
☐	⊞ ProcessPID			PIDLoop
☐	⊞ FlowRates			ProcessVariable[2]
☐	TankVolume			REAL
☐				

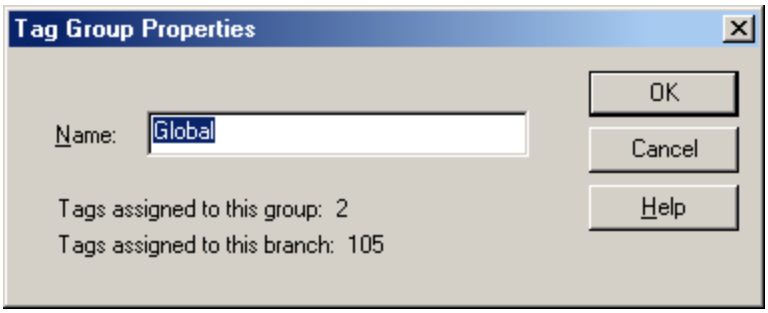
2. After performing Automatic Tag Database Generation from this controller, the server will produce the following project.



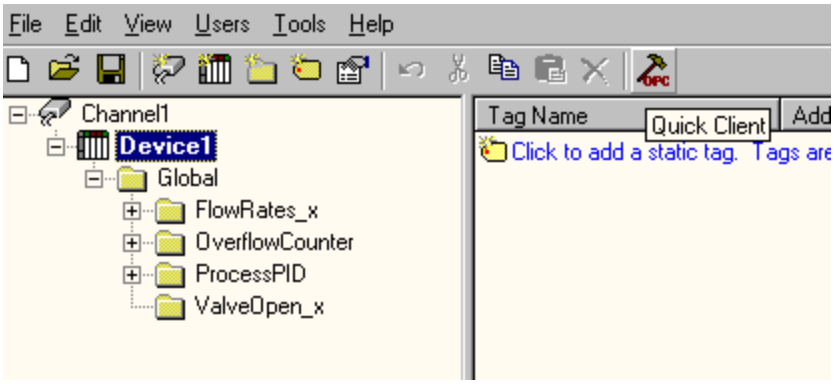
Note: The "Global" tag group contains 130 tags.



3. In order to illustrate the benefits of tag division, this example will not reference all tags. More than one-third of the ProcessPID tags, less than one-third of the FlowRates tags, and all other tags will be referenced. As such, the new tag count is 105.



4. Next, prepare the client for the test. To do so, launch the Quick Client from the server application by clicking on the icon as shown below.



5. Once the project is loaded, remove all groups except those containing tags of interest. Statistics and System tags, for example, are not needed.

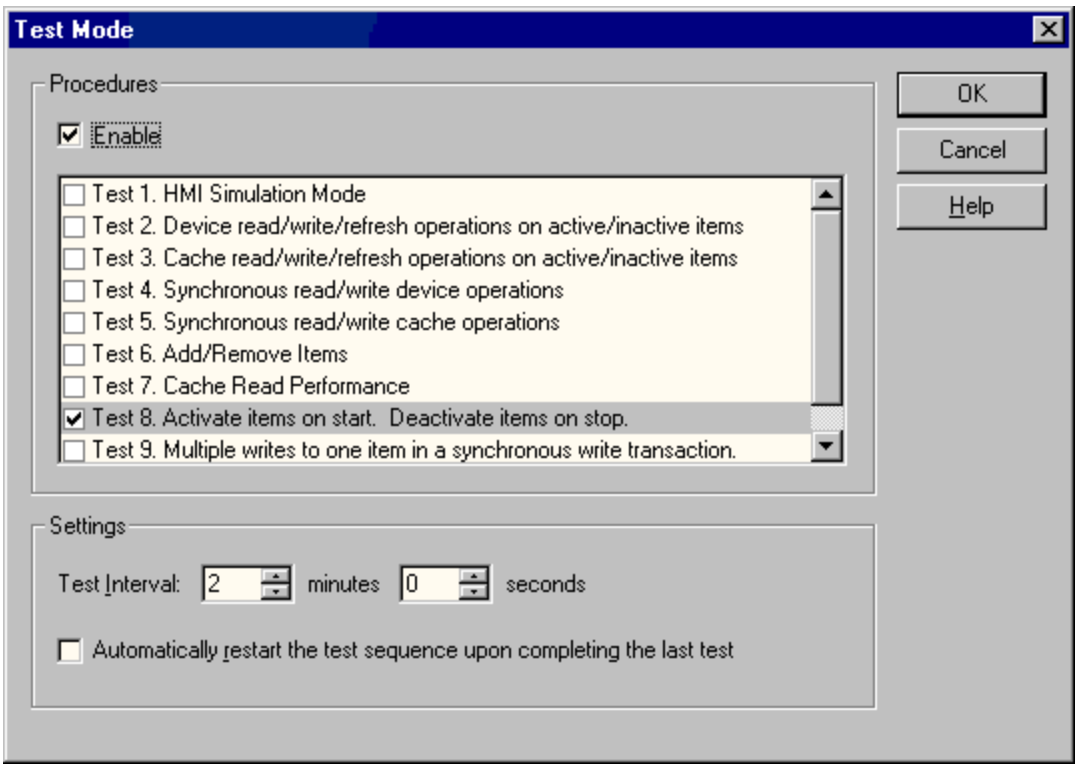
   Note: For small projects, set the **Group Update Rate** to 0-10 ms. For large projects, set the rate to 10-50 ms.

6. Next, click **Tools** | **Test Mode**.

7. Then, select **Test 8. Activate items on start. Deactivate items on stop** and then set a test interval.

   Note: Since this project is fairly small, the interval has been set to 2 minutes. For larger projects, the interval should be increased in order to get a more accurate reading.

8. Next, click to select **Enable**.



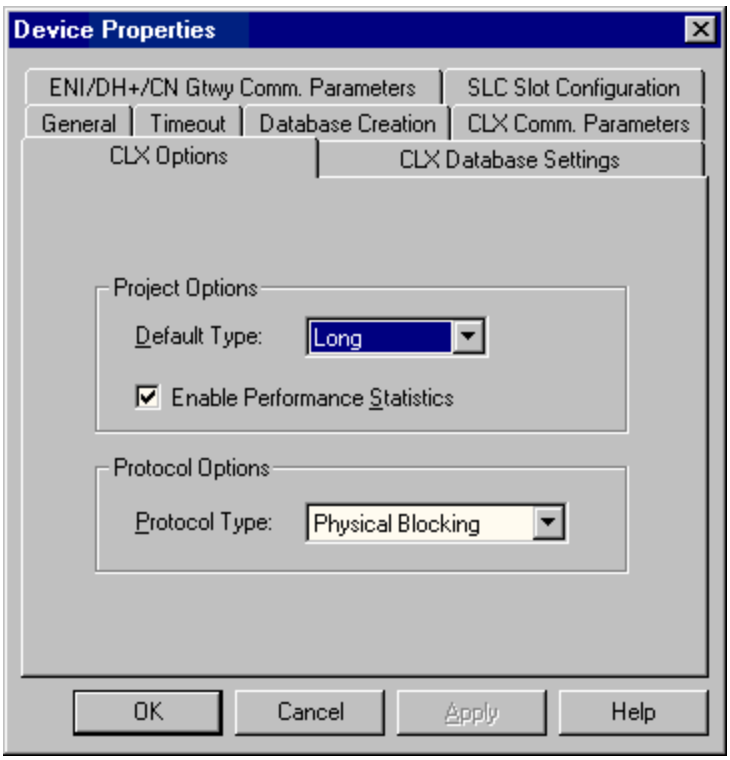
9. Return to **Tools** | **Test Mode** and then disable test mode. All tags should be deactivated.

10. Disconnect the Quick Client so that time trials can begin.

11. Shutdown the server.

12. Next, launch the server and set the **Protocol Mode** to **Logical Blocking**. This is the default setting.

13. Select **Enable Performance Statistics**.



14. Connect to the server using the Quick Client. Then, click **Tools** | **Test Mode**. Enable test mode.

    Note: Data reading will begin. When the test interval expires, all tags will be deactivated and the driver will cease all statistics gathering. The results can then be viewed.

15. Disconnect the Quick Client from the server and then shutdown the server.

16. Next, re-launch the server and search its Event Log for statistics. The image below displays the first trial utilizing Logical Blocking for the device.

```
DEVICE Channel1:Device1 STATISTICS
Physical Block Device Reads = 40932
Physical Block Cache Reads = 661734
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 13644
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 80
Total tags read = 716390, Elapsed Time = 119969 ms
DEVICE Channel1:Device1 PERFORMANCE: AvgTagReadPerSec = 5972.26
```

    Note: The image below displays the first trial utilizing Logical Blocking for the channel and driver.

```
DRIVER STATISTICS (ALL CHANNELS)
Physical Block Device Reads = 40932
Physical Block Cache Reads = 661734
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 13644
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 80
Total tags read = 716390, Elapsed Time = 119969 ms
DRIVER PERFORMANCE: AvgTagReadPerSec = 5972.26
Closing project C:\RDM\Support\ControlLogix Ethernet\CL_DEFAULT.opf
CHANNEL Channel1 STATISTICS
Physical Block Device Reads = 40932
Physical Block Cache Reads = 661734
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 13644
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 80
Total tags read = 716390, Elapsed Time = 119969 ms
CHANNEL Channel1 PERFORMANCE: AvgTagReadPerSec = 5972.26
```

Note: This is the control set for comparisons.

17. In the server, set the **Protocol Mode** to **Logical Non-Blocking**.
18. Connect to the server using Quick Client. Then, click **Tools** | **Test Mode** and enable test mode.

    Note: Data reading will begin. When the test interval expires, all tags will be deactivated and the driver will cease all statistics gathering. The results can then be viewed.

19. Disconnect the Quick Client from the server and then shutdown the server.
20. Next, re-launch the server and then search its Event Log for statistics. The image below displays the second trial utilizing Logical Non-Blocking for the device.

```
DEVICE Channel1:Device1 STATISTICS
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 8254
Physical Non Block, Array Block Cache Reads = 174419
Physical Non Block Device Reads = 261716
Symbolic, Array Block Device Reads = 2
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 63
Total tags read = 444454, Elapsed Time = 119969 ms
DEVICE Channel1:Device1 PERFORMANCE: AvgTagReadPerSec = 3705.23
```

Note: The image below displays the second trial utilizing Logical Non-Blocking for the channel and driver.

```
DRIVER STATISTICS (ALL CHANNELS)
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 8254
Physical Non Block, Array Block Cache Reads = 174419
Physical Non Block Device Reads = 261716
Symbolic, Array Block Device Reads = 2
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 63
Total tags read = 444454, Elapsed Time = 119969 ms
DRIVER PERFORMANCE: AvgTagReadPerSec = 3705.23
Closing project C:\RDM\Support\ControlLogix Ethernet\CL_DEFAULT.opf
CHANNEL Channel1 STATISTICS
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 8254
Physical Non Block, Array Block Cache Reads = 174419
Physical Non Block Device Reads = 261716
Symbolic, Array Block Device Reads = 2
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 63
Total tags read = 444454, Elapsed Time = 119969 ms
CHANNEL Channel1 PERFORMANCE: AvgTagReadPerSec = 3705.23
```

21. From the server, set the **Protocol Mode** to **Symbolic** in order to see how the performance fared prior to Allen-Bradley ControlLogix Ethernet Driver version 4.6.0.xx.

22. Connect to the server using the Quick Client. Then, click **Tools** | **Test Mode** and enable test mode.

    Note: Data reading will begin. When the test interval expires, all tags will be deactivated and the driver will cease all statistics gathering. The results can then be viewed.

23. Disconnect the Quick Client from the server and then shutdown the server.

24. Next, re-launch the server and search its Event Log for statistics. The image below displays the third trial utilizing Symbolic for the device.

```
DEVICE Channel1:Device1 STATISTICS
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 0
Symbolic, Array Block Device Reads = 1744
Symbolic, Array Block Cache Reads = 36613
Symbolic Device Reads = 54985
Total tags read = 93342, Elapsed Time = 120063 ms
DEVICE Channel1:Device1 PERFORMANCE: AvgTagReadPerSec = 777.442
```

The image below displays the third trial utilizing Symbolic for the channel and driver.

```
DRIVER STATISTICS (ALL CHANNELS)
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 0
Symbolic, Array Block Device Reads = 1744
Symbolic, Array Block Cache Reads = 36613
Symbolic Device Reads = 54985
Total tags read = 93342, Elapsed Time = 120063 ms
DRIVER PERFORMANCE: AvgTagReadPerSec = 777.442
Closing project C:\RDM\Support\ControlLogix Ethernet\CL_DEFAULT.opf
CHANNEL Channel1 STATISTICS
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 0
Symbolic, Array Block Device Reads = 1744
Symbolic, Array Block Cache Reads = 36613
Symbolic Device Reads = 54985
Total tags read = 93342, Elapsed Time = 120063 ms
CHANNEL Channel1 PERFORMANCE: AvgTagReadPerSec = 777.442
```

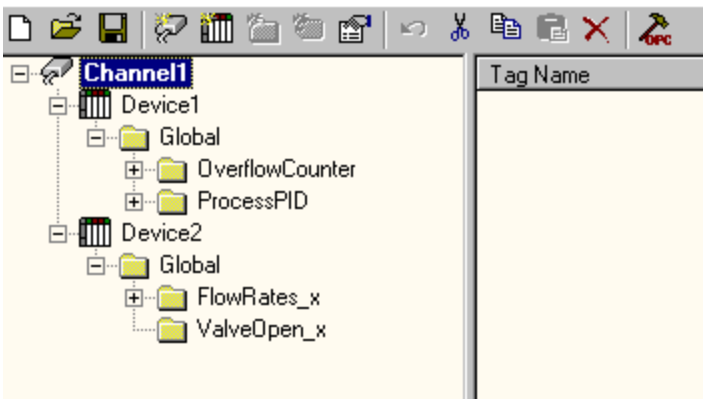
Note: It appears that Logical Blocking is most optimal for the given application.

Optimizing Channel Communications

Channel communications can be optimized by moving tags for Logical Blocking in one device and tags for Logical Non-Blocking in another. This is called tag division.

Logical Blocking (Device 1)
ProcessPID
OverflowCounter

Logical Non-Blocking (Device 2)
FlowRate
ValveOpen
InProcess
Tank Volume



1. Repeat Steps 4 through 15. In Step 11, make sure that Device 1 is Logical Blocking and Device 2 is Logical Non-Blocking.

2. Launch the server and search the server Event Log for statistics. The image below displays the fourth trial utilizing tag division for the device.

```
DEVICE Channel1:Device1 STATISTICS
Physical Block Device Reads = 13866
Physical Block Cache Reads = 610104
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 6933
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 76
Total tags read = 630979, Elapsed Time = 119782 ms
DEVICE Channel1:Device1 PERFORMANCE: AvgTagReadPerSec = 5268.43
DEVICE Channel1:Device2 STATISTICS
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 6933
Physical Non Block, Array Block Cache Reads = 69375
Physical Non Block Device Reads = 27732
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 4
Total tags read = 104044, Elapsed Time = 119969 ms
DEVICE Channel1:Device2 PERFORMANCE: AvgTagReadPerSec = 867.373
```

Note: The image below displays the fourth trial utilizing tag division for the channel and driver.

```
DRIVER STATISTICS (ALL CHANNELS)
Physical Block Device Reads = 13866
Physical Block Cache Reads = 610104
Physical Non Block, Array Block Device Reads = 6933
Physical Non Block, Array Block Cache Reads = 69375
Physical Non Block Device Reads = 34665
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 80
Total tags read = 735023, Elapsed Time = 119969 ms
DRIVER PERFORMANCE: AvgTagReadPerSec = 6126.77
Closing project C:\RDM\Support\ControlLogix Ethernet\CL_DEFAULT.opf
CHANNEL Channel1 STATISTICS
Physical Block Device Reads = 13866
Physical Block Cache Reads = 610104
Physical Non Block, Array Block Device Reads = 6933
Physical Non Block, Array Block Cache Reads = 69375
Physical Non Block Device Reads = 34665
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 80
Total tags read = 735023, Elapsed Time = 119969 ms
CHANNEL Channel1 PERFORMANCE: AvgTagReadPerSec = 6126.77
```

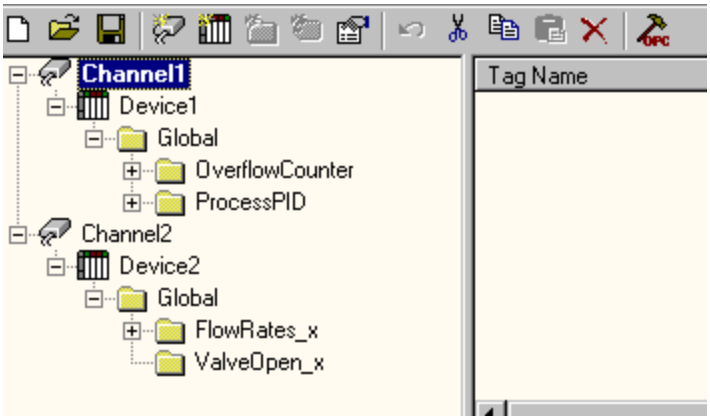
Note: The individual device statistics do not look impressive because the two devices are running on separate statistic counters. The key to this test is that the channel and driver statistics are better (6126) than using one channel/one device with either Logical Blocking (5972) or Logical Non-Blocking (3705).

Optimize Application

The application can be optimized by moving Device 1 to one channel and Device 2 to another.

Logical Blocking (Channel1.Device 1
ProcessPID
OverflowCounter

Logical Non-Blocking (Channel2.Device 2)
FlowRate
ValveOpen
InProcess
Tank Volume



1. Repeat Steps 4 through 15. In Step 11, make sure Channel1.Device 1 is Logical Blocking and Channel2.Device 2 is Logical Non-Blocking.
2. Launch the server and search the server Event Log for statistics. The image below displays the fifth trial utilizing Logix Tag coupled with multiple channels for Channel 1.Device1.

```
CHANNEL Channel1 STATISTICS
Physical Block Device Reads = 14542
Physical Block Cache Reads = 639848
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 7271
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 80
Total tags read = 661741, Elapsed Time = 119968 ms
CHANNEL Channel1 PERFORMANCE: AvgTagReadPerSec = 5517.4
DEVICE Channel1:Device1 STATISTICS
Physical Block Device Reads = 14542
Physical Block Cache Reads = 639848
Physical Non Block, Array Block Device Reads = 0
Physical Non Block, Array Block Cache Reads = 0
Physical Non Block Device Reads = 7271
Symbolic, Array Block Device Reads = 0
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 80
Total tags read = 661741, Elapsed Time = 119968 ms
DEVICE Channel1:Device1 PERFORMANCE: AvgTagReadPerSec = 5517.4
```

Note: The image below displays the fourth trial utilizing Logix Tag for Channel2.Device2.

```
CHANNEL Channel2 STATISTICS
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 7280
Physical Non Block, Array Block Cache Reads = 72800
Physical Non Block Device Reads = 29120
Symbolic, Array Block Device Reads = 1
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 4
Total tags read = 109205, Elapsed Time = 119968 ms
CHANNEL Channel2 PERFORMANCE: AvgTagReadPerSec = 910.52
DEVICE Channel2:Device2 STATISTICS
Physical Block Device Reads = 0
Physical Block Cache Reads = 0
Physical Non Block, Array Block Device Reads = 7280
Physical Non Block, Array Block Cache Reads = 72800
Physical Non Block Device Reads = 29120
Symbolic, Array Block Device Reads = 1
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 4
Total tags read = 109205, Elapsed Time = 119968 ms
DEVICE Channel2:Device2 PERFORMANCE: AvgTagReadPerSec = 910.52
```

Note: The image below displays the fourth trial utilizing tag division for the driver.

```
DRIVER STATISTICS (ALL CHANNELS)
Physical Block Device Reads = 14542
Physical Block Cache Reads = 639848
Physical Non Block, Array Block Device Reads = 7280
Physical Non Block, Array Block Cache Reads = 72800
Physical Non Block Device Reads = 36391
Symbolic, Array Block Device Reads = 1
Symbolic, Array Block Cache Reads = 0
Symbolic Device Reads = 84
Total tags read = 770946, Elapsed Time = 119968 ms
DRIVER PERFORMANCE: AvgTagReadPerSec = 6426.26
```

Results

Server Project Layout	Driver Performance (Reads/Sec)	Improvement Over Symbolic
Single Channel Single Device with Logical Blocking	5972	768%
Single Channel Single Device with Logical Non-Blocking	3705	476%
Single Channel Single Device with Symbolic	777	N/A
Single Channel Multiple Devices with Tag Division	6126	788%
Multiple Channels Multiple Devices with Tag Division	6426	827%

Conclusions

The project began with a single channel and a single device, which is the default behavior for a single controller. All tags were imported from this controller to this channel.device. All three protocol modes were then tested to see which would provide the best performance. In this case, Logical Blocking Protocol was the best. The best protocol depends on the application at hand. When performance is crucial, it is worth performing Logical Blocking and Logical Non-Blocking trials to determine which is the best protocol mode for the application. Symbolic

protocol is not necessary since it will never meet the performance caliber of either of the other protocol modes. It is shown here for the sake of the example.

Measures were taken to optimize communications using the tips outlined in **Optimizing Your Communications**. Most notably, tag division was used to place the Logical Blocking type tags in a device assigned Logical Blocking and the Logical Non-Blocking type tags in a device assigned Logical Non-Blocking. Furthermore, both devices resided on the same channel. The results show an improvement over using Logical Blocking on a single device. This is because some tags lend themselves better to one protocol mode over another. For example, reading an entire COUNTER will benefit from Logical Blocking over Logical Non-Blocking since it's much faster reading the COUNTER as a block then as individual members.

Measures were also taken to optimize the application by placing devices on their own channel. Using the devices created in the previous trial, a Logical Blocking device was placed on one channel and a Logical Non-Blocking device on another. The results show improvement over the single channel/multiple devices scenario from the previous trial. This reinforces the idea that performance is improved by having as few devices per channel and as many channels as necessary.

After using these three optimization methods, the project has an 827% performance increase over Allen-Bradley ControlLogix Ethernet Driver version earlier than 4.6.0.xx. Tag division and multiple channels improved the performance by 107%. The performance increases will be more apparent with larger projects.

Data Types Description

Data Types	Description
Boolean	Single bit
Byte	Unsigned 8 bit value
Char	Signed 8 bit value
Word	Unsigned 16 bit value
Short	Signed 16 bit value
DWord	Unsigned 32 bit value
Long	Signed 32 bit value
BCD	Two byte packed BCD, four decimal digits
LBCD	Four byte packed BCD, eight decimal digits
Float	32 bit IEEE Floating point
Double	64 bit IEEE Floating point
Date	64 bit Date/Time
String	Null terminated character array

Note: For a description of Logix platform-specific data types, refer to **Logix Advanced Addressing**.

Address Descriptions

Address specifications vary depending on the model in use. For the model of interest's address information, refer to the table below.

Protocol Class	Models	Help Link
Logix-Ethernet	ControlLogix 5500 Ethernet, CompactLogix 5300, Ethernet, FlexLogix 5400 Ethernet, SoftLogix 5800	**Logix Addressing**
DH+ Gateway	DH+ Gateway: PLC-5 DH+ Gateway: SLC 5/04	**PLC-5 Series Addressing** **SLC 500 Modular I/O Addressing**
ControlNet Gateway	ControlNet Gateway: PLC-5C	**PLC-5 Series Addressing**
1761-NET-ENI	ENI: ControlLogix 5500, ENI: CompactLogix 5300, ENI: FlexLogix 5400 ENI: MicroLogix ENI: SLC 500 Fixed I/O ENI: SLC 500 Modular I/O ENI: PLC-5	**Logix Addressing** **MicroLogix Addressing** **SLC 500 Fixed I/O Addressing** **SLC 500 Modular I/O Addressing** **PLC-5 Series Addressing**
MicroLogix 1100 Ethernet	MicroLogix 1100	**MicroLogix Addressing**
MicroLogix 1400 Ethernet	MicroLogix 1400	**MicroLogix Addressing**

Note: For more information on the controller's pre-defined data types, refer to the device's documentation.

Logix Addressing

For more information on these models' tag-based addressing and relationship to the Allen-Bradley ControlLogix Ethernet Driver, refer to **Logix Tag-Based Addressing**.

ControlLogix 5500 Addressing for Ethernet

ControlLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

ControlLogix 5500 Addressing for ENI

ControlLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

ControlLogix 5500 Addressing for Serial Gateway

ControlLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

CompactLogix 5300 Addressing for Ethernet

CompactLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

CompactLogix 5300 Addressing for ENI

CompactLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

CompactLogix 5300 Addressing for Serial Gateway

CompactLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

FlexLogix 5400 Addressing for Ethernet

FlexLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

FlexLogix 5400 Addressing for ENI

FlexLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

FlexLogix 5400 Addressing for Serial Gateway

FlexLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

SoftLogix 5800 Addressing

SoftlLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

SoftLogix 5800 Addressing for Serial Gateway

SoftlLogix is a member of the Logix family and part of Rockwell Automation's Integrated Architecture. This means it uses a tag or symbol based addressing structure. Logix Tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

MicroLogix Addressing

Micrologix Addressing for EtherNet/IP Gateway

The actual number of addresses available depends on the model of the PLC. The ranges have been opened up to allow for maximum flexibility with future models. If the driver finds at Runtime that an address is not present in the device, it will post an error message and then remove the tag from its scan list. For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
ASCII Files
String Files
Long Files
MicroLogix PID Files
MicroLogix Message Files

For information on function files, select a link from the list below.

High Speed Counter File (HSC)
Real-Time Clock File (RTC)
Channel 0 Communication Status File (CS0)
Channel 1 Communication Status File (CS1)
I/O Module Status File (IOS)

MicroLogix Addressing for ENI

The actual number of addresses available depends on the model of the PLC. The ranges have been opened up to allow for maximum flexibility with future models. If the driver finds at Runtime that an address is not present in the device, it will post an error message and then remove the tag from its scan list. For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files

Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
ASCII Files
String Files
Long Files
MicroLogix PID Files
MicroLogix Message Files

For information on function files, select a link from the list below.

High Speed Counter File (HSC)
Real-Time Clock File (RTC)
Channel 0 Communication Status File (CS0)
Channel 1 Communication Status File (CS1)
I/O Module Status File (IOS)

MicroLogix 1100 Addressing

The actual number of addresses available depends on the model of the PLC. The ranges have been opened up to allow for maximum flexibility with future models. If the driver finds at Runtime that an address is not present in the device, it will post an error message and then remove the tag from its scan list. For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
String Files
Long Files
MicroLogix PID Files
MicroLogix Message Files

For information on function files, select a link from the list below.

High Speed Counter File (HSC)
Real-Time Clock File (RTC)
Channel 0 Communication Status File (CS0)
Channel 1 Communication Status File (CS1)
I/O Module Status File (IOS)

MicroLogix 1400 Addressing

The actual number of addresses available depends on the model of the PLC. The ranges have been opened up to allow for maximum flexibility with future models. If the driver finds at Runtime that an address is not present in the device, it will post an error message and then remove the tag from its scan list. For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files

ASCII Files
String Files
Long Files
MicroLogix PID Files
MicroLogix Message Files

For information on function files, select a link from the list below.

High Speed Counter File (HSC)
Real-Time Clock File (RTC)
Channel 0 Communication Status File (CS0)
Channel 1 Communication Status File (CS1)
I/O Module Status File (IOS)

SLC 500 Fixed I/O Addressing

SLC 500 Fixed I/O Addressing for EtherNet/IP Gateway

For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files

SLC 500 Fixed I/O Addressing for ENI

For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files

SLC 500 Modular I/O Addressing

SLC 500 Modular I/O Addressing for DH+

The actual number of addresses available depends on the model of the PLC. The ranges have been opened up to allow for maximum flexibility with future models. If the driver finds at Runtime that an address is not present in the device, it will post an error message and then remove the tag from its scan list. For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
ASCII Files
String Files

SLC 500 Modular I/O Addressing for EtherNet/IP Gateway

The actual number of addresses available depends on the model of the PLC. The ranges have been opened up to allow for maximum flexibility with future models. If the driver finds at Runtime that an address is not present in

the device, it will post an error message and then remove the tag from its scan list. For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
ASCII Files
String Files

SLC 500 Modular I/O Addressing for ENI

The actual number of addresses available depends on the model of the PLC. The ranges have been opened up to allow for maximum flexibility with future models. If the driver finds at Runtime that an address is not present in the device, it will post an error message and then remove the tag from its scan list. For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
ASCII Files
String Files

PLC-5 Series Addressing

PLC-5 Series Addressing for ControlNet

For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
ASCII Files
String Files
BCD Files
PID Files
Message Files
Block Transfer Files

PLC-5 Series Addressing for DH+

For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files

Control Files
Integer Files
Float Files
ASCII Files
String Files
BCD Files
PID Files
Message Files
Block Transfer Files

PLC-5 Series Addressing for EtherNet/IP Gateway

For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
ASCII Files
String Files
BCD Files
PID Files
Message Files
Block Transfer Files

PLC-5 Series Addressing for ENI

For more information on file-specific addressing, select a link from the list below.

Output Files
Input Files
Status Files
Binary Files
Timer Files
Counter Files
Control Files
Integer Files
Float Files
ASCII Files
String Files
BCD Files
PID Files
Message Files
Block Transfer Files

Logix Tag-Based Addressing

Rockwell Automation's Integrated Architecture uses a tag or symbol-based addressing structure that is commonly referred to as Logix Tags (or Native Tags). These tags differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

Note: Throughout this help file, Logix Tags will be assumed to be global in nature unless specified otherwise.

The Allen-Bradley ControlLogix Ethernet Driver allows users to access the controller's atomic data types: BOOL, SINT, INT, DINT, LINT, and REAL. Although some of the pre-defined types are structures, they are ultimately based on these atomic data types. Thus, all non-structure (atomic) members of a structure are accessible. For example, a TIMER cannot be assigned to a server tag but an atomic member of the TIMER can be assigned to the tag (such as TIMER.EN, TIMER.ACC, and so forth). If a structure member is a structure itself, both structures would have to be expanded to access an atomic member of the substructure. This is more common with user and module-defined types and is not found in any of the pre-defined types.

Atomic Data Type	Description		Range
BOOL	Single bit value	VT_ BOOL	0, 1
SINT	Signed 8 bit value	VT_UI1	-128 to 127
INT	Signed 16 bit value	VT_I2	-32,768 to 32,767
DINT	Signed 32 bit value	VT_I4	-2,147,483,648 to 2,147,483,647
LINT	Signed 64 bit value	VT_I8	–9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
REAL	32 bit IEEE Floating point	VT_R4	1.1755 E-38 to 3.403E38, 0, -3.403E-38 to -1.1755

See Also: Logix Advanced Addressing

Client/Server Tag Address Rules
Logix Tag names correspond to Client/Server Tag addresses. Logix Tag names (entered via RSLogix5000) follow the IEC 1131-3 identifier rules. Client/Server Tag addresses follow these same rules. They are as follows:

- Must begin with an alphabetic (A-Z, a-z) character or an underscore (_).
- Can only contain alphanumeric characters and underscores.
- Can have as many as 40 characters.
- Cannot have consecutive underscores.
- Are not case sensitive.

Client/Server Tag Name Rules
Tag name assignment in the server differs from address assignment in that names cannot begin with an underscore.

Note: Logix Tag names should be kept to a minimum in size for optimum performance. The smaller the name, the more requests that will be able fit in a single transaction.

Important: Symbolic Mode users should keep the Client/Server Tag addresses below 400 characters. For example, tagarray[1,2,4].somestruct.substruct_array[3].basetag.[4] is 57 characters in length. Since a packet can only hold 500 data bytes, any overhead bytes that need to be added to the packet can greatly diminish the room available to the characters themselves. By keeping the address below 400, the tag request will remain complete and valid.

See Also: Performance Optimizations

Address Formats

There are several ways to address a Logix Tag statically in the server or dynamically from a client. The format used depends on the type and usage of the tag. For example, the bit format would be used when accessing a bit within a SINT-type tag. For information on address format and syntax, refer to the table below.

Note: All formats except for Array and String are native to RSLogix5000. Therefore, when referencing an atomic data type, an RSLogix 5000 tag name could be copied and pasted into the server's tag address field and be valid.

Format	Syntax	Example	Notes
Standard	<logix tag name>	tag_1	Tag cannot be an array.
Array Element	<logix Array Tag name> [dim 1, dim2, dim 3]	tag_1 [2, 58, 547] tag_1 [0, 3]	Dimension Range = 1 to 3 | Element Range = 0 to 65535
Array w/o Offset*	<logix Array Tag name> {# columns} <logix Array Tag name> {# rows}{# columns}	tag_1 {8} tag_1 {2}{4}	Dimension Range = 1 to 2 | Element Range = 1 to 65535 The number of elements to Read/Write equals # of rows times # of columns. If no rows are specified, # of rows will default to 1. The array begins at a zero offset (array index equals 0 for all dimensions).
Array w/ Offset*	<logix array element tag> {# columns} <logix array element tag> {# rows}{# columns}	tag_1 [2, 3] {10} tag_1 [2, 3] 2}{5}	The array begins at an offset specified by the dimensions in the array element tag. The array always covers the highest dimension. Thus, tag_1[2,3]{10}

			would produce an array of elements tag_1[2,3] -> tag_1[2,13]
Bit	<logix tag name>.bit <logix tag name>.[bit]	tag_1.0 tag_1.[0]	Bit Range = 0 to 31 If tag is an array, it must be a BOOL array, otherwise tag cannot be an array.
String	<logix tag name>/<Maximum string length>	tag_1.Data/4 Stringtag_1.Data SINTarraytag_1/16	Length Range = 1 to 65535 The maximum number of characters that can Read/Write to the string.

*Since this format may request more than one element, the order in which array data is passed depends on the dimension of the Logix Array Tag. For example, if rows times cols = 4 and the Controller Tag is a 3X3 element array, then the elements that are being referenced are array_tag [0,0], array_tag [0,1], array_tag [0,2], and array_tag [1,0] in that exact order. The results would be different if the Controller Tag were a 2X10 element array.

Note: For more information on how elements are referenced for 1, 2 and 3 dimensional arrays, refer to **Ordering of Array Data**.

Tag Scope

Global Tags

Global Tags are Logix Tags that have global scope in the controller. Any program or task can access Global Tags; however, the number of ways a Global Tag can be referenced depends on its Logix data type and the address format being used.

Program Tags

Program Tags are identical to Global Tags except that a Program Tag's scope is local to the program in which it is defined. Program Tags follow the same addressing rules and limitations as Global Tags, but are prefixed with the following notation:

Program: <program name> .

For example, Logix Tag "tag_1" in program "prog_1" would be addressed as "Program:prog_1.tag_1" in a Client/Server Tag address.

Structure Tag Addressing

Logix Structure Tags (Global or Program) are tags with one or more member tags. Member tags can be atomic or structured in nature.

<stucture name> . <atomic-type tag>

This implies that a substructure would be addressed as:

<structure name> . <substructure name> .<atomic-type tag>

Arrays of structures would be addressed as:

<structure array name> [dim1, dim2, dim3] . <atomic-type tag>

This implies that an array of substructures would be addressed as:

<structure name> . <substructure array name> [dim1, dim2, dim3] . <atomic-type tag>

Note: The examples above are only a few of the addressing possibilities that involve structures, and are displayed to provide an introduction to structure addressing. For more information, refer to Allen-Bradley or Rockwell documentation.

Predefined Term Tags

The tags displayed in the table below can be used to obtain general processor information from a PLC.

Tag Name	Description
#MODE	A description of the PLC's current key switch mode. Possible string values include Program, Run,

	Remote Program, Remote Run, and Remote Debug. Supported data types include String.
#PLCTYPE	An integer value that corresponds to the "ProdType" attribute specified in the PLC's EDS file. Supported data types include all but String.
#REVISION	Firmware revision displayed as "<major>.<minor>". Supported data types include String.
#PROCESSORNAME	The processor name that corresponds to the "ProdName" attribute specified in the PLC's EDS file. Supported data types include String.
#STATUS	Indicates the PLC's status. Possible values include OK (1) and Faulted (0). Supported data types include all but date.
#PRODUCTCODE	An integer value that corresponds to the "ProdCode" attribute specified in the PLC's EDS file. Supported data types include all but String.
#VENDORID	An integer value that corresponds to the "VendCode" attribute specified in the PLC's EDS file. Supported data types include all but String.

Addressing Atomic Data Types

Below are suggested usages and addressing possibilities for a Logix data type given the address formats available. Examples are also given for reinforcement. Click on **Advanced** for advanced addressing possibilities for the given atomic data type.
Note: Empty cells do not necessarily indicate a lack of support.

Atomic Data Type	Standard	Array Element	Array with or without Offset	Bit	String
BOOL					
Client/Server Data Type Advanced	Boolean	Boolean (BOOL 1 dimensional array)	Boolean Array (BOOL 1 dimensional array)		
Client/Server Tag Example	BOOLTAG	BOOLARR[0]	BOOLARR[0]{32}		
SINT					
Client/Server Data Type Advanced	Byte, Char	Byte, Char	Byte Array, Char Array (SINT 1/2/3 dimensional array)	Boolean (Bit w/i SINT)	String (SINT 1/2/3 dimensional array)
Client/Server Tag Example	SINTTAG	SINTARR[0]	SINTARR[0]{4}	SINTTAG.0	SINTARR/4
INT					
Client/Server Data Type Advanced	Word, Short	Word, Short	Word Array, Short Array (INT 1/2/3 dimensional array)	Boolean (Bit w/i INT)	*
Client/Server Tag Example	INTTAG	INTARR[0]	INTARR[0]{4}	INTTAG.0	
DINT					
Client/Server Data Type Advanced	DWord, Long	DWord, Long	DWord Array, Long Array	Boolean (Bit w/i DINT)	**
Client/Server Tag Example	DINTTAG	DINTARR[0]	DINTARR[0]{4}	DINTTAG.0	
LINT					
Client/Server Data Type Advanced	Double, Date	Double, Date	Double Array		
Client/Server Tag Example	LINTTAG	LINTARR[0]	LINTARR[0]{4}		
REAL					
Client/Server Data Type	Float	Float	Float Array	***	***

Advanced					
Client/Server Tag Example	REALTAG	REALARR[0]	REALARR[0]{4}		

*See Also: Advanced Addressing INT.
**See Also: Advanced Addressing DINT.
***See Also: Advanced Addressing REAL.

Addressing Structure Data Types

Only the atomic structure members can be addressed at the structure level. For more information, refer to the examples below.

Logix Tag
MyTimer @ TIMER

Client/Server Tag
1. Invalid

TimerTag address = MyTimer
TimerTag data type = ??

2. Valid
TimerTag address = MyTimer.ACC
TimerTag data type = DWord

Addressing STRING Data Type

STRING is a pre-defined Logix data type whose structure contains two members: DATA and LEN. DATA is an array of SINTs and stores the characters of the STRING. LEN is a DINT and represents the number of characters in DATA to display to a client.

Because LEN and DATA are atomic members, they must be referenced independently from a client/server. The syntax is as shown below.

Description	Syntax	Example
STRING Value	DATA/<Maximum STRING length >	MYSTRING.DATA/82
Actual STRING length	LEN	MYSTRING.LEN

Reads

The STRING read from DATA will be terminated by the following:

a. The first null terminator encountered.

b. The value in LEN if a) doesn't occur first.

c. The <Maximum STRING length > if either a) or b) doesn't occur first.

Example
MYSTRING.DATA contains "Hello World" in the PLC, but LEN is manually set to 5. A read of MYSTRING.DATA/82 will display "Hello". If LEN is set to 20, MYSTRING.DATA/82 will display "Hello World".

Writes

When a STRING value is written to DATA, the driver will also write to LEN with the length of DATA written. If the write to LEN fails for any reason, the write operation to DATA will be considered failed as well (despite the fact that the DATA write to the controller succeeded).

Note: This behavior was designed specifically for Logix Tags of type STRING or a custom derivative of it. The following precautions apply to users who wish to implement their own STRING in UDTs.

- If a UDT exists that has a DATA member referenced as a STRING and a LEN member referenced as a DINT, the write to LEN will succeed regardless of the intentions of LEN for the given UDT. Care must be taken when designing UDTs to avoid this possibility if LEN is not intended to be the length of DATA.
- If a UDT exists that has a DATA member referenced as a STRING but does not have a LEN member, the write to LEN will fail silently without consequence to DATA.

Example

MYSTRING.DATA/82 holds the value "Hello World." MYSTRING.LEN holds 11. If the value "Alarm Triggered" is written to MYSTRING.DATA/82, 15 will be written to MYSTRING.LEN. If the write to MYSTRING.LEN fails, MYSTRING.LEN will hold its previous value of 11 while MYSTRING.DATA/82 displays the first 11 characters ("Alarm Trigg"). If the write to MYSTRING.DATA/82 fails, neither tag is affected.

Automatically Read String Length

In the Logical Addressing modes, reading STRING.DATA will cause an automatic read of STRING.LEN in Symbolic Mode. This may be bypassed by unchecking the "Automatically Read String length" option. For more information, refer to **Logix Options**.

Ordering of Logix Array Data

1. Dimensional Arrays - array [dim1]
1 dimensional array data is passed to and from the controller in ascending order.
for (dim1 = 0; dim1 < dim1_max; dim1++)

Example: 3 element array
array [0]
array [1]
array [2]

2. Dimensional Arrays - array [dim1, dim2]
2 dimensional array data is passed to and from the controller in ascending order.
for (dim1 = 0; dim1 < dim1_max; dim1++)
for (dim2 = 0; dim2 < dim2_max; dim2++)

Example: 3X3 element array
array [0, 0]
array [0, 1]
array [0, 2]
array [1, 0]
array [1, 1]
array [1, 2]
array [2, 0]
array [2, 1]
array [2, 2]

3. Dimensional Arrays - array [dim1, dim2, dim3]
3 dimensional array data is passed to and from the controller in ascending order.
for (dim1 = 0; dim1 < dim1_max; dim1++)
for (dim2 = 0; dim2 < dim2_max; dim2++)
for (dim3 = 0; dim3 < dim3_max; dim3++)

Example: 3X3x3 element array
array [0, 0, 0]
array [0, 0, 1]
array [0, 0, 2]
array [0, 1, 0]
array [0, 1, 1]
array [0, 1, 2]
array [0, 2, 0]
array [0, 2, 1]
array [0, 2, 2]
array [1, 0, 0]
array [1, 0, 1]
array [1, 0, 2]
array [1, 1, 0]
array [1, 1, 1]
array [1, 1, 2]
array [1, 2, 0]
array [1, 2, 1]
array [1, 2, 2]
array [2, 0, 0]
array [2, 0, 1]
array [2, 0, 2]
array [2, 1, 0]
array [2, 1, 1]
array [2, 1, 2]
array [2, 2, 0]
array [2, 2, 1]

array [2, 2, 2]

Logix Advanced Addressing

Advanced Addressing is available for the following atomic data types. Select a link from the list below for more information on a specific data type.

BOOL
SINT
INT
DINT
LINT
REAL

Advanced Addressing: BOOL

Format	Supported Data Types	Notes
Standard	Boolean Byte, Char Word, Short, BCD DWord, Long, LBCD Float*	None.
	Boolean	The Controller Tag must be a 1 dimensional array.
Array w/o Offset	Boolean Array	1. The Controller Tag must be a 1 dimensional array. 2. The number of elements must be a factor of 8.
Array w/o Offset	Byte Array, Char Array Word Array, Short Array, BCD Array DWord Array, Long Array, LBCD Array Float Array*	Not supported.
Array w/ Offset	Boolean Array	1. The Controller Tag must be a 1 dimensional array. 2. The offset must lie on 32-bit boundary. 3. The number of elements must be a factor of 8.
Bit	Boolean	1. The Controller Tag must be a 1 dimensional array. 2. The range is limited from 0 to 31.
String	String	Not supported.

*The Float value will equal face value of the Controller Tag in Float form (non-IEEE Floating point number).

Examples

Examples highlighted in yellow signify common use cases.

BOOL Controller Tag - booltag = true

Server Tag Address	Format	Data Type	Notes
booltag	Standard	Boolean	Value = true
booltag	Standard	Byte	Value = 1
booltag	Standard	Word	Value = 1
booltag	Standard	DWord	Value = 1
booltag	Standard	Float	Value = 1.0
booltag [3]	Array Element	Boolean	Invalid: Tag not an array.
booltag [3]	Array Element	Word	Invalid: Tag not an array.
booltag {1}	Array w/o Offset	Word	Invalid: Not supported.
booltag {1}	Array w/o Offset	Boolean	Invalid: Not supported.
booltag [3] {32}	Array w/ Offset	Boolean	Invalid: Tag not an array.
booltag . 3	Bit	Boolean	Invalid: Tag not an array.
booltag / 1	String	String	Invalid: Not supported.
booltag / 4	String	String	Invalid: Not supported.

BOOL Array Controller Tag - bitarraytag = [0,1,0,1]

Server Tag Address	Format	Data Type	Notes

bitarraytag	Standard	Boolean	Invalid: Tag cannot be an array.
bitarraytag	Standard	Byte	Invalid: Tag cannot be an array.
bitarraytag	Standard	Word	Invalid: Tag cannot be an array.
bitarraytag	Standard	DWord	Invalid: Tag cannot be an array.
bitarraytag	Standard	Float	Invalid: Tag cannot be an array.
bitarraytag [3]	Array Element	Boolean	Value = true
bitarraytag [3]	Array Element	Word	Invalid: Bad data type.
bitarraytag {3}	Array w/o Offset	Word	Invalid: Tag cannot be an array.
bitarraytag {1}	Array w/o Offset	Word	Invalid: Tag cannot be an array.
bitarraytag {1}	Array w/o Offset	Boolean	Invalid: Array size must be a factor of 8.
bitarraytag {32}	Array w/o Offset	Boolean	Value = [0,1,0,1,...]
bitarraytag [3] {32}	Array w/ Offset	Boolean	Offset must begin on 32-bit boundary.
bitarraytag[0]{32}	Array w/ Offset	Boolean	Value = [0,1,0,1,...]
bitarraytag[32]{64}	Array w/ Offset	Boolean	Value = [...] *values not provided above*
bitarraytag . 3	Bit	Boolean	Value = true
bitarraytag / 1	String	String	Invalid: Not supported.
bitarraytag / 4	String	String	Invalid: Not supported.

Advanced Addressing: SINT

Format	Supported Data Types	Notes
Standard	Boolean* Byte, Char Word, Short, BCD DWord, Long, LBCD Float***	None.
Array Element	Byte, Char Word, Short, BCD DWord, Long, LBCD Float***	The Controller Tag must be an array.
Array w/o Offset	Boolean Array	1. Use this case to have the bits within an SINT in array form. **Note:** This is not an array of SINTs in Boolean notation. 2. Applies to bit-within-SINT only. Example: tag_1.0{8}. 3. .bit + array size cannot exceed 8 bits. Example: tag_1.1{8} exceeds an SINT, tag_1.0{8} does not.
Array w/o Offset	Byte Array, Char Array Word Array, Short Array, BCD Array** DWord Array, Long Array, LBCD Array** Float Array**,***	If accessing more than a single element, the Controller Tag must be an array.
Array w/ Offset	Byte Array, Char Array Word Array, Short Array, BCD Array** DWord Array, Long Array, LBCD Array** Float Array**,***	The Controller Tag must be an array.
Bit	Boolean	1. The range is limited from 0 to 7. 2. If the Controller Tag is an array, the bit class reference must be prefixed by an array element class reference. Example: tag_1 [2,2,3].0.
String	String	1. If accessing a single element, the Controller Tag need not be an array. **Note:** The value of the string will be the ASCII equivalent of the SINT value. Example: SINT = 65dec = "A". 2. If accessing more than a single element, the Controller Tag must be an array. The value of the string will

		be the null-terminated ASCII equivalent of all the SINTs in the string. 1 character in string = 1 SINT

*non-zero values will be clamped to true.
**Each element of the array corresponds to an element in the SINT array. Arrays are not packed.
*** Float value will equal face value of Controller Tag in Float form (non-IEEE Floating point number).

Examples

Examples highlighted in yellow signify common use cases.

SINT Controller Tag - sinttag = 122 (decimal)

Server Tag Address	Format	Data Type	Notes
sinttag	Standard	Boolean	Value = true
sinttag	Standard	Byte	Value = 122
sinttag	Standard	Word	Value = 122
sinttag	Standard	DWord	Value = 122
sinttag	Standard	Float	Value = 122.0
sinttag [3]	Array Element	Boolean	Invalid: Tag not an array. Also, Boolean is invalid.
sinttag [3]	Array Element	Byte	Invalid: Tag not an array.
sinttag {3}	Array w/o Offset	Byte	Invalid: Tag not an array.
sinttag {1}	Array w/o Offset	Byte	Value = [122]
sinttag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
sinttag [3] {1}	Array w/ Offset	Byte	Invalid: Tag not an array.
sinttag . 3	Bit	Boolean	Value = true
sinttag . 0 {8}	Array w/o Offset	Boolean	Value = [0,1,0,1,1,1,1,0] Bit value of 122
sinttag / 1	String	String	Value = "z"
sinttag / 4	String	String	Invalid: Tag not an array.

SINT Array Controller Tag - sintarraytag [4,4] = [[83,73,78,84],[5,6,7,8],[9,10,11,12],[13,14,15,16]]

Server Tag Address	Format	Data Type	Notes
sintarraytag	Standard	Boolean	Invalid: Tag cannot be an array.
sintarraytag	Standard	Byte	Invalid: Tag cannot be an array.
sintarraytag	Standard	Word	Invalid: Tag cannot be an array.
sintarraytag	Standard	DWord	Invalid: Tag cannot be an array.
sintarraytag	Standard	Float	Invalid: Tag cannot be an array.
sintarraytag [3]	Array Element	Byte	Invalid: Server Tag missing dimension 2 address.
sintarraytag [1,3]	Array Element	Boolean	Invalid: Boolean not allowed for array elements.
sintarraytag [1,3]	Array Element	Byte	Value = 8
sintarraytag {10}	Array w/o Offset	Byte	Value = [83,73,78,84,5,6,7,8,9,10]
sintarraytag {2} {5}	Array w/o Offset	Word	Value = [83,73,78,84,5] [6,7,8,9,10]
sintarraytag {1}	Array w/o Offset	Byte	Value = 83
sintarraytag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
sintarraytag [1,3] {4}	Array w/ Offset	Byte	Value = [8,9,10,11]
sintarraytag . 3	Bit	Boolean	Invalid: Tag must reference atomic location.
sintarraytag [1,3] . 3	Bit	Boolean	Value = 1
sintarraytag [1,3] . 0 {8}	Array w/o Offset	Boolean	Value = [0,0,0,1,0,0,0,0]
sintarraytag / 1	String	String	Value = "S"
sintarraytag / 4	String	String	Value = "SINT"

Advanced Addressing: INT

Format	Supported Data Types	Notes
Standard	Boolean* Byte, Char**	None.

	Word, Short, BCD DWord, Long, LBCD Float****	
Array Element	Byte, Char** Word, Short, BCD DWord, Long, LBCD Float****	The Controller Tag must be an array.
Array w/o Offset	Boolean Array	1. Use this case to have the bits within an INT in array form. **Note:** This is not an array of INTs in Boolean notation. 2. Applies to bit-within-INT only. Example: tag_1.0{16}. 3. .bit + array size cannot exceed 16 bits. Example: tag_1.1{16} exceeds an INT, tag_1.0{16} does not.
Array w/o Offset	Byte Array, Char Array** Word Array, Short Array, BCD Array DWord Array, Long Array, LBCD Array***Float Array***,****	If accessing more than a single element, the Controller Tag must be an array.
Array w/ Offset	Byte Array, Char Array** Word Array, Short Array, BCD Array DWord Array, Long Array, LBCD Array*** Float Array***,****	The Controller Tag must be an array.
Bit	Boolean	1. The range is limited from 0 to 15. 2. If the Controller Tag is an array, the bit class reference must be prefixed by an array element class reference. Example: tag_1 [2,2,3].0.
String	String	1. If accessing a single element, the Controller Tag need not be an array. **Note:** The value of the string will be the ASCII equivalent of the INT value (clamped to 255). Example: INT = 65dec = "A". 2. If accessing more than a single element, the Controller Tag must be an array. The value of the string will be the null-terminated ASCII equivalent of all the INTs (clamped to 255) in the string. 1 character in string = 1 INT, clamped to 255 INT strings are not packed. For greater efficiency, use SINT strings or the STRING structure instead.

*non-zero values will be clamped to true.
**Values exceeding 255 will be clamped to 255.
***Each element of the array corresponds to an element in the INT array. Arrays are not packed.
****Float value will equal face value of Controller Tag in Float form (non-IEEE Floating point number).

Examples

Examples highlighted in yellow signify common use cases.

INT Controller Tag - inttag = 65534 (decimal)

Server Tag Address	Class	Data Type	Notes
inttag	Standard	Boolean	Value = true
inttag	Standard	Byte	Value = 255
inttag	Standard	Word	Value = 65534
inttag	Standard	DWord	Value = 65534
inttag	Standard	Float	Value = 65534.0

inttag [3]	Array Element	Boolean	Invalid: Tag not an array. Also, Boolean is invalid.
inttag [3]	Array Element	Word	Invalid: Tag not an array.
inttag {3}	Array w/o Offset	Word	Invalid: Tag not an array.
inttag {1}	Array w/o Offset	Word	Value = [65534]
inttag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
inttag [3] {1}	Array w/ Offset	Word	Invalid: Tag not an array.
inttag . 3	Bit	Boolean	Value = true
inttag . 0 {16}	Array w/o Offset	Boolean	Value = [0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1] Bit value of 65534
inttag / 1	String	String	Value = unprintable character = 255 decimal.
inttag / 4	String	String	Invalid: Tag not an array.

INT Array Controller Tag - intarraytag [4,4] = [[73,78,84,255],[256,257,258,259],[9,10,11,12],[13,14,15,16]]

Server Tag Address	Class	Data Type	Notes
intarraytag	Standard	Boolean	Invalid: Tag cannot be an array.
intarraytag	Standard	Byte	Invalid: Tag cannot be an array.
intarraytag	Standard	Word	Invalid: Tag cannot be an array.
intarraytag	Standard	DWord	Invalid: Tag cannot be an array.
intarraytag	Standard	Float	Invalid: Tag cannot be an array.
intarraytag [3]	Array Element	Word	Invalid: Server Tag missing dimension 2 address.
intarraytag [1,3]	Array Element	Boolean	Invalid: Boolean not allowed for array elements.
intarraytag [1,3]	Array Element	Word	Value = 259
intarraytag {10}	Array w/o Offset	Byte	Value = [73,78,84,255,255,255,255,255,9,10]
intarraytag {2} {5}	Array w/o Offset	Word	Value = [73,78,84,255,256] [257,258,259,9,10]
intarraytag {1}	Array w/o Offset	Word	Value = 73
intarraytag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
intarraytag [1,3] {4}	Array w/ Offset	Word	Value = [259,9,10,11]
intarraytag . 3	Bit	Boolean	Invalid: Tag must reference atomic location.
intarraytag [1,3] . 3	Bit	Boolean	Value = 0
intarraytag [1,3] . 0 {16}	Array w/o Offset	Boolean	Value = [1,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0] Bit value for 259
intarraytag / 1	String	String	Value = "I"
intarraytag / 3	String	String	Value = "INT"

Advanced Addressing: DINT

Format	Supported Data Types	Notes
Standard	Boolean* Byte, Char** Word, Short, BCD*** DWord, Long, LBCD Float ****	None.
Array Element	Byte, Char** Word, Short, BCD*** DWord, Long, LBCD Float ****	The Controller Tag must be an array.
Array w/o Offset	Boolean Array	1. Use this case to have the bits within an DINT in array form. **Note:** This is not an array of DINTs in Boolean notation. 2. Applies to bit-within-DINT only. Example: tag_1.0{32}. 3. .bit + array size cannot exceed 32 bits. Example: tag_1.1{32} exceeds an DINT, tag_1.0{32} does not.
Array w/o Offset	Byte Array, Char Array**	If accessing more than a single element, the Controller

	Word Array, Short Array, BCD Array*** DWord Array, Long Array, LBCD Array Float Array ****	Tag must be an array.
Array w/ Offset	Byte Array, Char Array** Word Array, Short Array, BCD Array*** DWord Array, Long Array, LBCD Array Float Array ****	The Controller Tag must be an array.
Bit	Boolean	1. The range is limited from 0 to 31. 2. If Controller Tag is an array, bit class reference must be prefixed by an array element class reference. Example: tag_1 [2,2,3].0.
String	String	1. If accessing a single element, the Controller Tag need not be an array. **Note:** The value of the string will be the ASCII equivalent of the DINT value (clamped to 255). Example: SINT = 65dec = "A". 2. If accessing more than a single element, the Controller Tag must be an array. The value of the string will be the null-terminated ASCII equivalent of all the DINTs (clamped to 255) in the string. 1 character in string = 1 DINT, clamped to 255 **Note:** DINT strings are not packed. For greater efficiency, use SINT strings or the STRING structure instead.

*non-zero values will be clamped to true.
**Values exceeding 255 will be clamped to 255.
***Values exceeding 65535 will be clamped to 65535.
****Float value will equal face value of Controller Tag in Float form (non-IEEE Floating point number).

Examples

Examples highlighted in yellow signify common use cases.

DINT Controller Tag - dinttag = 70000 (decimal)

Server Tag Address	Format	Data Type	Notes
dinttag	Standard	Boolean	Value = true
dinttag	Standard	Byte	Value = 255
dinttag	Standard	Word	Value = 65535
dinttag	Standard	DWord	Value = 70000
dinttag	Standard	Float	Value = 70000.0
dinttag [3]	Array Element	Boolean	Invalid: Tag not an array. Also, Boolean is invalid.
dinttag [3]	Array Element	DWord	Invalid: Tag not an array.
dinttag {3}	Array w/o Offset	DWord	Invalid: Tag not an array.
dinttag {1}	Array w/o Offset	DWord	Value = [70000]
dinttag {1}	Array w/o Offset	Boolean	Invalid: Bad data type
dintag [3] {1}	Array w/ Offset	DWord	Invalid: Tag not an array.
dinttag . 3	Bit	Boolean	Value = false
dinttag . 0 {32}	Array w/o Offset	Boolean	Value = [0,0,0,0,1,1,1,0,1,0,0,0,1,0,0,0,1,0,...0] Bit value for 70000
dinttag / 1	String	String	Value = unprintable character = 255 decimal
dinttag / 4	String	String	Invalid: Tag not an array.

DINT Array Controller Tag - dintarraytag [4,4] = [[68,73,78,84],[256,257,258,259],[9,10,11,12],[13,14,15,16]]

Server Tag Address	Format	Data Type	Notes
dintarraytag	Standard	Boolean	Invalid: Tag cannot be an array.
dintarraytag	Standard	Byte	Invalid: Tag cannot be an array.

dintarraytag	Standard	Word	Invalid: Tag cannot be an array.
dintarraytag	Standard	DWord	Invalid: Tag cannot be an array.
dintarraytag	Standard	Float	Invalid: Tag cannot be an array.
dintarraytag [3]	Array Element	DWord	Invalid: Server Tag missing dimension 2 address.
dintarraytag [1,3]	Array Element	Boolean	Invalid: Boolean not allowed for array elements.
dintarraytag [1,3]	Array Element	DWord	Value = 259
dintarraytag {10}	Array w/o Offset	Byte	Value = [68,73,78,84,255,255,255,255,9,10]
dintarraytag {2}{5}	Array w/o Offset	DWord	Value = [68,73,78,84,256] [257,258,259,9,10]
dintarraytag {1}	Array w/o Offset	DWord	Value = 68
dintarraytag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
dintarraytag [1,3]{4}	Array w/ Offset	DWord	Value = [259,9,10,11]
dintarraytag . 3	Bit	Boolean	Invalid: Tag must reference atomic location.
dintarraytag [1,3] . 3	Bit	Boolean	Value = 0
dintarraytag [1,3] .0 {32}	Array w/o Offset	Boolean	Value = [1,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0] Bit value for 259
dintarraytag / 1	String	String	Value = "D"
dintarraytag / 3	String	String	Value = "DINT"

Advanced Addressing: LINT

Format	Supported Data Types	Notes
Standard	Double * Date**	None.
Array Element	Double * Date**	The Controller Tag must be an array.
Array w/o Offset	Double Array*	If accessing more than a single element, the Controller Tag must be an array.
Array w/ Offset	Double Array*	The Controller Tag must be an array.
Bit	N/A	Not supported.
String	N/A	Not supported.

*Double value will equal face value of Controller Tag in Float form (non-IEEE Floating point number).
**Date values are in universal time (UTC), not localized time.

Examples

Examples highlighted in yellow signify common use cases.

LINT Controller Tag - linttag = 2007-01-01T16:46:40.000 (date) == 1.16767E+15 (decimal)

Server Tag Address	Format	Data Type	Notes
linttag	Standard	Boolean	Invalid: Boolean not supported.
linttag	Standard	Byte	Invalid: Byte not supported.
linttag	Standard	Word	Invalid: Word not supported.
linttag	Standard	Double	Value = 1.16767E+15
linttag	Standard	Date	Value = 2007-01-01T16:46:40.000*
linttag [3]	Array Element	Boolean	Invalid: Tag not an array. Also, Boolean is invalid.
linttag [3]	Array Element	Double	Invalid: Tag not an array.
linttag {3}	Array w/o Offset	Double	Invalid: Tag not an array.
linttag {1}	Array w/o Offset	Double	Value = [1.16767E+15]
linttag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
lintag [3] {1}	Array w/ Offset	Double	Invalid: Tag not an array.
linttag . 3	Bit	Boolean	Invalid: Syntax/data type not supported.
linttag / 1	String	String	Invalid: Syntax/data type not supported.

*Date values are in universal time (UTC), not localized time.

LINT Array Controller Tag -
dintarraytag [2,2] = [0, 1.16767E+15],[9.4666E+14, 9.46746E+14] where:

1.16767E+15 == 2007-01-01T16:46:40.000 (date)
9.4666E+14 == 1999-12-31T17:06:40.000
9.46746E+14 == 2000-01-1T17:00:00.000
0 == 1970-01-01T00:00:00.000

Server Tag Address	Format	Data Type	Notes
lintarraytag	Standard	Boolean	Invalid: Boolean not supported.
lintarraytag	Standard	Byte	Invalid: Byte not supported.
lintarraytag	Standard	Word	Invalid: Word not supported.
lintarraytag	Standard	Double	Invalid: Tag cannot be an array.
lintarraytag	Standard	Date	Invalid: Tag cannot be an array.
lintarraytag [1]	Array Element	Double	Invalid: Server Tag missing dimension 2 address.
lintarraytag [1,1]	Array Element	Boolean	Invalid: Boolean not allowed for array elements.
lintarraytag [1,1]	Array Element	Double	Value = 9.46746E+14
lintarraytag [1,1]	Array Element	Date	Value = 2000-01-01T17:00:00.000*
lintarraytag {4}	Array w/o Offset	Double	Value = [0, 1.16767E+15, 9.4666E+14, 9.46746E+14]
lintarraytag {2} {2}	Array w/o Offset	Double	Value = [0, 1.16767E+15][9.4666E+14, 9.46746E+14]
lintarraytag {4}	Array w/o Offset	Date	Invalid: Date array not supported.
lintarraytag {1}	Array w/o Offset	Double	Value = 0
lintarraytag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
lintarraytag [0,1] {2}	Array w/ Offset	Double	Value = [1.16767E+15, 9.4666E+14]
lintarraytag . 3	Bit	Boolean	Invalid: Syntax/data type not supported.
lintarraytag / 1	String	String	Invalid: Syntax/data type not supported.

*Date values are in universal time (UTC), not localized time.

Advanced Addressing: REAL

Format	Supported Data Types	Notes
Standard	Boolean* Byte, Char** Word, Short, BCD*** DWord, Long, LBCD Float****	None.
Array Element	Byte, Char** Word, Short, BCD*** DWord, Long, LBCD Float****	The Controller Tag must be an array.
Array w/o Offset	Boolean Array	1. Use this case to have the bits within an REAL in array form. **Note:** This is not an array of REALs in Boolean notation. 2. Applies to bit-within-REAL only. Example: tag_1.0{32}. 3. .bit + array size cannot exceed 32 bits. Example: tag_1.1{32} exceeds an REAL, tag_1.0{32} does not.
Array w/o Offset	Byte Array, Char Array** Word Array, Short Array, BCD Array*** DWord Array, Long Array, LBCD Array Float Array****	If accessing more than a single element, the Controller Tag must be an array.
Array w/ Offset	Byte Array, Char Array** Word Array, Short Array, BCD Array*** DWord Array, Long Array, LBCD Array Float Array****	The Controller Tag must be an array.
Bit	Boolean	1. The range is limited from 0 to 31. 2. If the Controller Tag is an array, the bit class reference must be prefixed by an array element class reference. Example: tag_1 [2,2,3].0.

		Note: Float is casted to a DWord to allow referencing of bits.
String	String	1. If accessing a single element, the Controller Tag need not be an array. **Note:** The value of the string will be the ASCII equivalent of the REAL value (clamped to 255). Example: SINT = 65dec = "A". 2. If accessing more than a single element, the Controller Tag must be an array. The value of the string will be the null-terminated ASCII equivalent of all the REALs (clamped to 255) in the string. 1 character in string = 1 REAL, clamped to 255 **Note:** REAL strings are not packed. For greater efficiency, use SINT strings or the STRING structure instead.

*non-zero values will be clamped to true.
**Values exceeding 255 will be clamped to 255.
***Values exceeding 65535 will be clamped to 65535.
****Float value will be a valid IEEE single precision Floating point number.

Examples

Examples highlighted in yellow signify common use cases.

REAL Controller Tag - realtag = 512.5 (decimal)

Server Tag Address	Format	Data Type	Notes
realtag	Standard	Boolean	Value = true
realtag	Standard	Byte	Value = 255
realtag	Standard	Word	Value = 512
realtag	Standard	DWord	Value = 512
realtag	Standard	Float	Value = 512.5
realtag [3]	Array Element	Boolean	Invalid: Tag not an array. Also, Boolean is invalid.
realtag [3]	Array Element	DWord	Invalid: Tag not an array.
realtag {3}	Array w/o Offset	DWord	Invalid: Tag not an array.
realtag {1}	Array w/o Offset	Float	Value = [512.5]
realtag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
realtag [3] {1}	Array w/ Offset	Float	Invalid: Tag not an array.
realtag . 3	Bit	Boolean	Value = true
realtag . 0 {32}	Array w/o Offset	Boolean	Value = [0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,...0] Bit value for 512
realtag / 1	String	String	Value = unprintable character = 255 decimal
realtag / 4	String	String	Invalid: Tag not an array.

REAL Array Controller Tag - realarraytag [4,4] = [[82.1,69.2,65.3,76.4],[256.5,257.6,258.7,259.8],[9.0,10.0,11.0,12.0],[13.0,14.0,15.0,16.0]]

Server Tag Address	Format	Data Type	Notes
realarraytag	Standard	Boolean	Invalid: Tag cannot be an array.
realarraytag	Standard	Byte	Invalid: Tag cannot be an array.
realarraytag	Standard	Word	Invalid: Tag cannot be an array.
realarraytag	Standard	DWord	Invalid: Tag cannot be an array.
realarraytag	Standard	Float	Invalid: Tag cannot be an array.
realarraytag [3]	Array Element	Float	Invalid: Server Tag missing dimension 2 address.
realarraytag [1,3]	Array Element	Boolean	Invalid: Boolean not allowed for array elements.
realarraytag [1,3]	Array Element	Float	Value = 259.8

realarraytag {10}	Array w/o Offset	Byte	Value = [82,69,65,76,255,255,255,255,9,10]
realarraytag {2} {5}	Array w/o Offset	Float	Value = [82.1,69.2,65.3,76.4,256.5] [257.6,258.7,259.8,9,10]
realarraytag {1}	Array w/o Offset	Float	Value = 82.1
realarraytag {1}	Array w/o Offset	Boolean	Invalid: Bad data type.
realarraytag [1,3] {4}	Array w/ Offset	Float	Value = [259.8,9.0,10.0,11.0]
realarraytag . 3	Bit	Boolean	Invalid: Tag must reference atomic location.
realarraytag [1,3] . 3	Bit	Boolean	Value = 0
realarraytag [1,3] . 0 {32}	Array w/o Offset	Boolean	Value = [1,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0] Bit value for 259
realarraytag / 1	String	String	Value = "R"
realarraytag / 3	String	String	Value = "REAL"

File Listing

Select a link from the list below for information on a specific file supported by various device models.

Function File Listing

Note: For more information on device models and their supported files, refer to **Address Descriptions**.

Output Files

The syntax for accessing data in the output file differs depending on the PLC model. Arrays are not supported for output files. The default data types are shown in **bold**.

PLC-5 Syntax

Syntax	Data Type	Access
O:<word>	Short, **Word**, BCD	Read/Write
O:<word>/<bit>	**Boolean**	Read/Write
O/bit	**Boolean**	Read/Write

Note: Word and bit address information is in octal for PLC-5 models. This follows the convention of the programming software.

Micrologix Syntax

Syntax	Data Type	Access
O:<word>	Short, **Word**, BCD	Read/Write
O:<word>/<bit>	**Boolean**	Read/Write
O/bit	**Boolean**	Read/Write

Micrologix models have two types of I/O: embedded I/O and expansion I/O (not applicable for Micrologix 1000). Embedded I/O resides with the CPU base unit while Expansion I/O plugs into the CPU base unit. The table below lists the I/O capabilities of each Micrologix model.

Micrologix Model	Embedded I/O	Expansion I/O
1000	Slot 0	N/A
1100	Slot 0	Slots 1-4
1200	Slot 0	Slots 1-6
1400	Slot 0	Slots 1-7
1500	Slot 0	Slots 1-16

The address syntax for Micrologix I/O references a zero-based word offset, not a slot. Users must determine the word offset to a particular slot. This requires knowledge of the modules and their respective size in words. The table below specifies the size of some available modules; however, it is recommended that users consult both the Micrologix documentation and the controller project to determine the module's true word size.

Micrologix Embedded I/O Word Sizes

Micrologix Model	# Input Words	# Output Words
1000	2	1
1100	6	4
1200	4	4
1400	8	6
1500	4	4

Micrologix Expansion I/O Word Sizes

Modules	# Input Words	# Output Words
1769-HSC	35	34
1769-IA8I	1	0
1769-IA16	1	0
1769-IF4	6	0
1769-IF4XOF2	8	2
1769-IF8	12	1
1769-IM12	1	0
1769-IQ16	1	0
1769-IQ6XOW4	1	1
1769-IQ16F	1	0
1769-IQ32	2	0
1769-IR6	8	0
1769-IT6	8	0
1769-OA8	0	1
1769-OA16	0	1
1769-OB8	0	1
1769-OB16	0	1
1769-OB16P	0	1
1769-OB32	0	2
1769-OF2	2	2
1769-OF8C	11	9
1769-OF8V	11	9
1769-OV16	0	1
1769-OW8	0	1
1769-OW16	0	1

1769-OW8I	0	1
1769-SDN	66	2
1769-SM1	12	12
1769-SM2	7	7
1769-ASCII	108	108
1762-IA8	1	0
1762-IF2OF2	6	2
1762-IF4	7	0
1762-IQ8	1	0
1762-IQ8OW6	1	1
1762-IQ16	1	0
1762-OA8	0	1
1762-OB8	0	1
1762-OB16	0	1
1762-OW8	0	1
1762-OW16	0	1
1762-IT4	6	0
1762-IR4	6	0
1762-OF4	2	4
1762-OX6I	0	1

Calculation
Output Word Offset for Slot x = # Output Words in Slot 0 through Slot (x-1).

Note 1: The Embedded I/O needs to be taken into account when offsetting to Expansion I/O.

Note 2: The number of Input words does not factor into the calculation for Output Word Offset.

I/O Example
Let
Slot 0 = Micrologix 1500 LRP Series C = 4 Output Words
Slot 1 = 1769-OF2 = 2 Output Words
Slot 2 = 1769-OW8 = 1 Output Word
Slot 3 = 1769-IA16 = 0 Output Word
Slot 4 = 1769-OF8V = 9 Output Word
Bit 5 of Slot 4 = 4 + 2 + 1 = 7 words = O:7/5

SLC 500 Syntax
The default data types are shown in **bold**.

Syntax	Data Type	Access
O:<slot>	Short, **Word**, BCD	Read Only
O:<slot>.<word>	Short, **Word**, BCD	Read Only
O:<slot>/<bit>	**Boolean**	Read Only
O:<slot>.<word>/<bit>	**Boolean**	Read Only

Ranges
PLC Model	Min Slot	Max Slot	Max Word
Micrologix	NA	NA	2047
SLC 500 Fixed I/O	NA	NA	1
SLC 500 Modular I/O	1	30	*
PLC-5 Series	NA	NA	277 (octal)

*The number of Input or Output words available for each I/O module can be found in the **SLC 500 Modular I/O Selection Guide**. For slot configuration help, refer to **Device Setup**.

Examples
Micrologix	Description
O:0	word 0

O/2	bit 2
O:0/5	bit 5

SLC 500 Fixed I/O	Description
O:0	word 0
O:1	word 1
O/16	bit 16
O:1/0	bit 0 word 1 (same as O/16)

PLC5*	Description
O:0	word 0
O:37	word 31 (37 octal = 31 decimal)
O/42	bit 34 (42 octal = 34 decimal)
O:2/2	bit 2 word 2 (same as O/42)

*Addresses are in Octal.

SLC 500 Modular I/O	Description
O:1	word 0 slot 1
O:1.0	word 0 slot 1 (same as O:1)
O:12	word 0 slot 12
O:12.2	word 2 slot 12
O:4.0/0	bit 0 word 0 slot 4
O:4/0	bit 0 slot 4 (same as O:4.0/0)
O:4.2/0	bit 0 word 2 slot 4
O:4/32	bit 32 slot 4 (same as O:4.2/0)

Input Files

The syntax for accessing data in the input file differs depending on the PLC model. Arrays are not supported for input files. The default data types are shown in **bold**.

PLC-5 Syntax

Syntax	Data Type	Access
I:<word>	Short, **Word**, BCD	Read/Write
I:<word>/<bit>	**Boolean**	Read/Write
I/bit	**Boolean**	Read/Write

Note: Word and bit address information is in octal for PLC-5 models. This follows the convention of the programming software.

Micrologix Syntax

Syntax	Data Type	Access
I:<word>	Short, **Word**, BCD	Read/Write
I:<word>/<bit>	**Boolean**	Read/Write
I/bit	**Boolean**	Read/Write

Micrologix models have two types of I/O: embedded I/O and expansion I/O (not applicable for Micrologix 1000). Embedded I/O resides with the CPU base unit while Expansion I/O plugs into the CPU base unit. The table below lists the I/O capabilities of each Micrologix model.

Micrologix Model	Embedded I/O	Expansion I/O
1000	Slot 0	N/A
1100	Slot 0	Slots 1-4
1200	Slot 0	Slots 1-6
1400	Slot 0	Slots 1-7
1500	Slot 0	Slots 1-16

The address syntax for Micrologix I/O references a zero-based word offset, not a slot. Users must determine the word offset to a particular slot. This requires knowledge of the modules and their respective size in words. The table below specifies the size of some available modules; however, it is recommended that the Micrologix documentation and controller project be consulted in order to determine a module's true word size.

Micrologix Embedded I/O Word Sizes

Micrologix Model	# Input Words	# Output Words
1000	2	1
1100	6	4
1200	4	4
1400	8	6
1500	4	4

Micrologix Expansion I/O Word Sizes

Modules	# Input Words	# Output Words
1769-HSC	35	34
1769-IA8I	1	0
1769-IA16	1	0
1769-IF4	6	0
1769-IF4XOF2	8	2
1769-IF8	12	1
1769-IM12	1	0
1769-IQ16	1	0
1769-IQ6XOW4	1	1
1769-IQ16F	1	0
1769-IQ32	2	0
1769-IR6	8	0
1769-IT6	8	0
1769-OA8	0	1
1769-OA16	0	1
1769-OB8	0	1
1769-OB16	0	1
1769-OB16P	0	1
1769-OB32	0	2
1769-OF2	2	2
1769-OF8C	11	9
1769-OF8V	11	9
1769-OV16	0	1
1769-OW8	0	1
1769-OW16	0	1
1769-OW8I	0	1
1769-SDN	66	2
1769-SM1	12	12
1769-SM2	7	7
1769-ASCII	108	108
1762-IA8	1	0
1762-IF2OF2	6	2
1762-IF4	7	0
1762-IQ8	1	0
1762-IQ8OW6	1	1
1762-IQ16	1	0
1762-OA8	0	1
1762-OB8	0	1
1762-OB16	0	1
1762-OW8	0	1
1762-OW16	0	1

1762-IT4	6	0
1762-IR4	6	0
1762-OF4	2	4
1762-OX6I	0	1

Calculation
Input Word Offset for Slot x = # Input Words in Slot 0 through Slot (x-1).

Note 1: The Embedded I/O needs to be taken into account when offsetting to Expansion I/O.

Note 2: The number of Output words does not factor into the calculation for Input Word Offset.

I/O Example
Let
Slot 0 = Micrologix 1500 LRP Series C = 4 Input Words
Slot 1 = 1769-OF2 = 2 Input Words
Slot 2 = 1769-OW8 = 0 Input Word
Slot 3 = 1769-IA16 = 1 Input Word
Slot 4 = 1769-OF8V = 11 Input Word
Bit 5 of Slot 3 = 4 + 2 = 6 words = I:6/5

SLC 500 Syntax
Syntax	Data Type	Access
I:<slot>	Short, **Word**, BCD	Read Only
I:<slot>.<word>	Short, **Word**, BCD	Read Only
I:<slot>/<bit>	**Boolean**	Read Only
I:<slot>.<word>/<bit>	**Boolean**	Read Only

Ranges
PLC Model	Min Slot	Max Slot	Max Word
Micrologix	NA	NA	2047
SLC 500 Fixed I/O	NA	NA	1
SLC 500 Modular I/O	1	30	*
PLC-5 Series	NA	NA	277 (octal)

*The number of Input or Output words available for each I/O module can be found in the **SLC 500 Modular I/O Selection Guide**. For slot configuration help, refer to **Device Setup**.

Examples
Micrologix	Description
I:0	Word 0
I/2	Bit 2
I:1/5	Bit 5 word 1

SLC 500 Fixed I/O	Description
I:0	Word 0
I:1	Word 1
I/16	bit 16
I:1/0	Bit 0 word 1 (same as I/16)

PLC5*	Description
I:0	Word 0
I:10	Word 8 (10 octal = 8 decimal)
I/20	Bit 16 (20 octal = 16 decimal)
I:1/0	Bit 0 word 1 (same as I/20)

*Addresses are in Octal.

SLC 500 Modular I/O	Description

I:1	Word 0 slot 1
I:1.0	Word 0 slot 1 (same as I:1)
I:12	Word 0 slot 12
I:12.2	Word 2 slot 12
I:4.0/0	Bit 0 word 0 slot 4
I:4/0	Bit 0 slot 4 (same as I:4.0/0)
I:4.2/0	Bit 0 word 2 slot 4
I:4/32	Bit 32 slot 4 (same as I:4.2/0)

Status Files

To access status files, specify a word and an optional bit in the word. The default data types are shown in **bold**.

Syntax	Data Type	Access
S:<word>	Short, **Word**, BCD, DWord, Long, LBCD	Read/Write
S:<word> [rows][cols]	Short, **Word**, BCD, DWord, Long, LBCD (array type)	Read/Write
S:<word> [cols]	Short, **Word**, BCD, DWord, Long, LBCD (array type)	Read/Write
S:<word>/<bit>	**Boolean**	Read/Write
S/bit	**Boolean**	Read/Write

The number of array elements (in bytes) cannot exceed the block request size specified. This means that the array size cannot exceed 16 words given a block request size of 32 bytes.

Ranges

PLC Model	Max Word
Micrologix	999
SLC 500 Fixed I/O	96
SLC 500 Modular I/O	999
PLC-5 Series	999

The maximum word location is one less when accessing as a 32 bit data type (such as Long, DWord, or Long BCD).

Examples

Example	Description
S:0	Word 0
S/26	Bit 26
S:4/15	Bit 15 word 4
S:10 [16]	16 element array starting at word 10
S:0 [4] [8]	4 by 8 element array starting at word 0

Binary Files

To access binary files, specify a file number, a word and optional bit in the word. The default data types are shown in **bold**.

Syntax	Data Type	Access
B<file>:<word>	Short, **Word**, BCD, DWord, Long, LBCD	Read/Write
B<file>:<word> [rows][cols]	Short, **Word**, BCD, DWord, Long, LBCD (array type)	Read/Write
B<file>:<word> [cols]	Short, **Word**, BCD, DWord, Long, LBCD (array type)	Read/Write
B<file>:<word>/<bit>	**Boolean**	Read/Write
B<file>/bit	**Boolean**	Read/Write

The number of array elements (in bytes) cannot exceed the block request size specified. This means that array size cannot exceed 16 words given a block request size of 32 bytes.

Ranges

PLC Model	File Number	Max Word

Micrologix	3, 9-999	999
SLC 500 Fixed I/O	3, 9-255	255
SLC 500 Modular I/O	3, 9-999	999
PLC-5 Series	3-999	1999

The maximum word location is one less when accessing as a 32 bit data type (such as Long, DWord, or Long BCD).

Examples

Example	Description
B3:0	Word 0
B3/26	Bit 26
B12:4/15	Bit 15 word 4
B3:10 [20]	20 element array starting at word 10
B15:0 [6] [6]	6 by 6 element array starting at word 0

Timer Files

Timer files are a structured type whose data is accessed by specifying a file number, an element and a field. The default data types are shown in **bold**.

Syntax	Data Type	Access
T<file>:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation.

Element Field	Data Type	Access
ACC	**Short**, Word	Read/Write
PRE	**Short**, Word	Read/Write
DN	**Boolean**	Read Only
TT	**Boolean**	Read Only
EN	**Boolean**	Read Only

Ranges

PLC Model	File Number	Max Element
Micrologix	4, 9-999	999
SLC 500 Fixed I/O	4, 9-255	255
SLC 500 Modular I/O	4, 9-999	999
PLC-5 Series	3-999	1999

Examples

Example	Description
T4:0.ACC	Accumulator of timer 0 file 4
T4:10.DN	Done bit of timer 10 file 4
T15:0.PRE	Preset of timer 0 file15

Counter Files

Counter files are a structured type whose data is accessed by specifying a file number, an element, and a field. The default data types are shown in **bold**.

Syntax	Data Type	Access
C<file>:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation.

Element Field	Data Type	Access
ACC	**Word**, Short	Read/Write

PRE	**Word**, Short	Read/Write
UA	**Boolean**	Read Only
UN	**Boolean**	Read Only
OV	**Boolean**	Read Only
DN	**Boolean**	Read Only
CD	**Boolean**	Read Only
CU	**Boolean**	Read Only

Ranges

PLC Model	File Number	Max Element
Micrologix	5, 9-999	999
SLC 500 Fixed I/O	5, 9-255	255
SLC 500 Modular I/O	5, 9-999	999
PLC-5 Series	3-999	1999

Examples

Example	Description
C5:0.ACC	Accumulator of counter 0 file 5
C5:10.DN	Done bit of counter 10 file 5
C15:0.PRE	Preset of counter 0 file 15

Control Files

Control files are a structured type whose data is accessed by specifying a file number, an element, and a field. The default data types are shown in **bold**.

Syntax	Data Type	Access
R<file>:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation.

Element Field	Data Type	Access
LEN	**Word**, Short	Read/Write
POS	**Word**, Short	Read/Write
FD	**Boolean**	Read Only
IN	**Boolean**	Read Only
UL	**Boolean**	Read Only
ER	**Boolean**	Read Only
EM	**Boolean**	Read Only
DN	**Boolean**	Read Only
EU	**Boolean**	Read Only
EN	**Boolean**	Read Only

Ranges

PLC Model	File Number	Max Element
Micrologix	6, 9-999	999
SLC 500 Fixed I/O	6, 9-255	255
SLC 500 Modular I/O	6, 9-999	999
PLC-5 Series	3-999	1999

Examples

Example	Description
R6:0.LEN	Length field of control 0 file 6
R6:10.DN	Done bit of control 10 file 6
R15:18.POS	Position field of control 18 file 15

Integer Files

To access integer files, specify a file number, a word, and an optional bit in the word. The default data types are shown in **bold**.

Syntax	Data Type	Access
N<file>:<word>	Short, **Word**, BCD, DWord, Long, LBCD	Read/Write
N<file>:<word> [rows][cols]	Short, **Word**, BCD, DWord, Long, LBCD (array type)	Read/Write
N<file>:<word> [cols]	Short, **Word**, BCD, DWord, Long, LBCD (array type)	Read/Write
N<file>:<word>/<bit>	**Boolean**	Read/Write
N<file>/bit	**Boolean**	Read/Write

The number of array elements (in bytes) cannot exceed the block request size specified. This means that array size cannot exceed 16 words given a block request size of 32 bytes.

Ranges

PLC Model	File Number	Max Word
Micrologix	7, 9-999	999
SLC 500 Fixed I/O	7, 9-255	255
SLC 500 Modular I/O	7, 9-999	999
PLC-5 Series	3-999	1999

The maximum word location is one less when accessing as a 32 bit data type (such as Long, DWord, or Long BCD).

Examples

Example	Description
N7:0	Word 0
N7/26	Bit 26
N12:4/15	Bit 15 word 4
N7:10 [8]	8 element array starting at word 10
N15:0 [4] [5]	4 by 5 element array starting at word 0

Float Files

To access float files, specify a file number and an element. The default data types are shown in **bold**.

Syntax	Data Type	Access
F<file>:<element>	**Float**	Read/Write
F<file>:<element> [rows][cols]	**Float** (array type)	Read/Write
F<file>:<element> [cols]	**Float** (array type)	Read/Write

The number of array elements (in bytes) cannot exceed the block request size specified. This means that array size cannot exceed 8 Floats given a block request size of 32 bytes.

Ranges

PLC Model	File Number	Max Word
Micrologix	8-999	999
SLC 500 Fixed I/O	NA	NA
SLC 500 Modular I/O	8-999	999
PLC-5 Series	3-999	1999

Examples

Example	Description
F8:0	Float 0
F8:10 [16]	16 element array starting at word 10
F15:0 [4] [4]	16 element array starting at word 0

ASCII Files

To access ASCII file data, specify a file number and a character location. The default data types are shown in **bold**.

Syntax	Data Type	Access
A<file>:<char>	**Char**, Byte*	Read/Write
A<file>:<char> [rows][cols]	**Char**, Byte*	Read/Write
A<file>:<char> [cols]	**Char**, Byte*	Read/Write
A<file>:<word offset>/length	String**	Read/Write

*The number of array elements cannot exceed the block request size specified. Internally, the PLC packs two characters per word in the file, with the high byte containing the first character and the low byte containing the second character. The PLC programming software allows access at the word level or two-character level. The Allen-Bradley ControlLogix Ethernet Driver allows accessing to the character level.

Using the programming software, "A10:0 = AB," would result in 'A' being stored in the high byte of A10:0 and 'B' being stored in the low byte. Using the Allen-Bradley ControlLogix Ethernet Driver, two assignments would be made: "A10:0 = A" and "A10:1 = B." This would result in the same data being stored in the PLC memory.

**Referencing this file as string data allows access to data at word boundaries like the programming software. The length can be up to 232 characters. If a string that is sent to the device is smaller in length than the length specified by the address, the driver null terminates the string before sending it down to the controller.

Ranges

PLC Model	File Number	Max Character
Micrologix	3-255	511
SLC 500 Fixed I/O	NA	NA
SLC 500 Modular I/O	9-999	1999
PLC-5 Series	3-999	1999

Note: Not all Micrologix and SLC 500 PLC devices support ASCII file types. For more information, refer to the PLC's documentation.

Examples

Example	Description
A9:0	character 0 (high byte of word 0)
A27:10 [80]	80 character array starting at character 10
A15:0 [4] [16]	4 by 16 character array starting at character 0
A62:0/32	32 character string starting at word offset 0

String Files

To access string files, specify a file number and an element. Strings are 82 character null terminated arrays. The driver places the null terminator based on the string length returned by the PLC. The default data types are shown in **bold**.

Note: Arrays are not supported for String files.

Syntax	Data Type	Access
ST<file>:<element>.<field>	**String**	Read/Write

Ranges

PLC Model	File Number	Max Word
Micrologix	9-999	999
SLC 500 Fixed I/O	NA	NA
SLC 500 Modular I/O	9-999	999
PLC-5 Series	3-999	999

Examples

Example	Description
ST9:0	String 0
ST18:10	String 10

BCD Files

To access BCD files, specify a file number and a word. The default data types are shown in **bold**.

PLC-5 Syntax

Syntax	Data Type	Access
D<file>:<word>	**BCD**, LBCD	Read/Write
D<file>:<word> [rows][cols]	**BCD**, LBCD (array type)	Read/Write
D<file>:<word> [cols]	**BCD**, LBCD (array type)	Read/Write

The number of array elements (in bytes) cannot exceed the block request size specified. This means that array size cannot exceed 16 BCD, given a block request size of 32 bytes.

Ranges

PLC Model	File Number	Max Word
Micrologix	NA	NA
SLC 500 Fixed I/O	NA	NA
SLC 500 Modular I/O	NA	NA
PLC-5 Series	3-999	999

Examples

Example	Description
D9:0	word 0
D27:10 [16]	16 element array starting at word 10
D15:0 [4][8]	32 element array starting at word 0

Long Files

To access long integer files, specify a file number and an element. The default data types are shown in **bold**.

Syntax	Data Type	Access
L<file>:<DWord>	Long, **DWord**, LBCD	Read/Write
L<file>:<DWord> [rows][cols]	Long, **DWord**, LBCD (array type)	Read/Write
L<file>:<DWord> [cols]	Long, **DWord**, LBCD (array type)	Read/Write

The number of array elements (in bytes) cannot exceed the block request size specified. This means that array size cannot exceed 8 longs given a block request size of 32 bytes.

Ranges

PLC Model	File Number	Max Word
Micrologix	9-999	999
SLC 500 Fixed I/O	NA	NA
SLC 500 Modular I/O	NA	NA
PLC-5 Series	NA	NA

Examples

Example	Description
L9:0	word 0
L9:10 [8]	8 element array starting at word 10
L15:0 [4] [5]	4 by 5 element array starting at word 0

MicroLogix PID Files

PID files are a structured type whose data is accessed by specifying a file number, an element, and a field. The default data types are shown in **bold**.

Syntax	Data Type	Access
PD<file>:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation for the meaning of each field.

Element Field	Data Type	Access
SPS	**Word**, Short	Read/Write
KC	**Word**, Short	Read/Write
TI	**Word**, Short	Read/Write
TD	**Word**, Short	Read/Write
MAXS	**Word**, Short	Read/Write
MINS	**Word**, Short	Read/Write
ZCD	**Word**, Short	Read/Write
CVH	**Word**, Short	Read/Write
CVL	**Word**, Short	Read/Write
LUT	**Word**, Short	Read/Write
SPV	**Word**, Short	Read/Write
CVP	**Word**, Short	Read/Write
TM	**Boolean**	Read/Write
AM	**Boolean**	Read/Write
CM	**Boolean**	Read/Write
OL	**Boolean**	Read/Write
RG	**Boolean**	Read/Write
SC	**Boolean**	Read/Write
TF	**Boolean**	Read/Write
DA	**Boolean**	Read/Write
DB	**Boolean**	Read/Write
UL	**Boolean**	Read/Write
LL	**Boolean**	Read/Write
SP	**Boolean**	Read/Write
PV	**Boolean**	Read/Write
DN	**Boolean**	Read/Write
EN	**Boolean**	Read/Write

Ranges

PLC Model	File Number	Max Element
Micrologix	3-255	255
All SLC	NA	NA
PLC-5	**PID Files**	**PID Files**

Examples

Example	Description
PD14:0.KC	Proportional gain of PD 0 file 14
PD18:6.EN	PID enable bit of PD 6 file 18

PID Files

PID files are a structured type whose data is accessed by specifying a file number, an element, and a field. The default data types are shown in **bold**.

PLC-5 Syntax

Syntax	Data Type	Access
PD<file>:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation.

Element Field	Data Type	Access
SP	**Real**	Read/Write
KP	**Real**	Read/Write
KI	**Real**	Read/Write
KD	**Real**	Read/Write
BIAS	**Real**	Read/Write
MAXS	**Real**	Read/Write
MINS	**Real**	Read/Write
DB	**Real**	Read/Write
SO	**Real**	Read/Write
MAXO	**Real**	Read/Write
MINO	**Real**	Read/Write
UPD	**Real**	Read/Write
PV	**Real**	Read/Write
ERR	**Real**	Read/Write
OUT	**Real**	Read/Write
PVH	**Real**	Read/Write
PVL	**Real**	Read/Write
DVP	**Real**	Read/Write
DVN	**Real**	Read/Write
PVDB	**Real**	Read/Write
DVDB	**Real**	Read/Write
MAXI	**Real**	Read/Write
MINI	**Real**	Read/Write
TIE	**Real**	Read/Write
FILE	**Word**, Short	Read/Write
ELEM	**Word**, Short	Read/Write
EN	**Boolean**	Read/Write
CT	**Boolean**	Read/Write
CL	**Boolean**	Read/Write
PVT	**Boolean**	Read/Write
DO	**Boolean**	Read/Write
SWM	**Boolean**	Read/Write
CA	**Boolean**	Read/Write
MO	**Boolean**	Read/Write
PE,	**Boolean**	Read/Write
INI	**Boolean**	Read/Write
SPOR	**Boolean**	Read/Write
OLL	**Boolean**	Read/Write
OLH	**Boolean**	Read/Write
EWD	**Boolean**	Read/Write
DVNA	**Boolean**	Read/Write
DVHA	**Boolean**	Read/Write
PVLA	**Boolean**	Read/Write
PVHA	**Boolean**	Read/Write

Ranges

PLC Model	File Number	Max Element
Micrologix	NA	NA
SLC 500 Fixed I/O	NA	NA
SLC 500 Modular I/O	NA	NA
PLC-5 Series	3-999	999

Examples

Example	Description

PD14:0.SP	Set point field of PD 0 file 14
PD18:6.EN	Status enable bit of PD 6 file 18

MicroLogix Message Files

Message files are a structured type whose data is accessed by specifying a file number, an element, and a field. The default data types are shown in **bold**.

Syntax	Data Type	Access
MG<file>:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation for the meaning of each field.

Element Field	Data Type	Access
IA	**Word**, Short	Read/Write
RBL	**Word**, Short	Read/Write
LBN	**Word**, Short	Read/Write
RBN	**Word**, Short	Read/Write
CHN	**Word**, Short	Read/Write
NOD	**Word**, Short	Read/Write
MTO	**Word**, Short	Read/Write
NB	**Word**, Short	Read/Write
TFT	**Word**, Short	Read/Write
TFN	**Word**, Short	Read/Write
ELE	**Word**, Short	Read/Write
SEL	**Word**, Short	Read/Write
TO	**Boolean**	Read/Write
CO	**Boolean**	Read/Write
EN	**Boolean**	Read/Write
RN	**Boolean**	Read/Write
EW	**Boolean**	Read/Write
ER	**Boolean**	Read/Write
DN	**Boolean**	Read/Write
ST	**Boolean**	Read/Write
BK	**Boolean**	Read/Write

Ranges

PLC Model	File Number	Max Element
Micrologix	3-255	255
All SLC	NA	NA
PLC5	**Message Files**	**Message Files**

Examples

Example	Description
MG14:0.TO	Ignore if timed out bit of MG 0 file 14
MG18:6.CO	Continue bit of MG 6 file 18

Message Files

Message files are a structured type whose data is accessed by specifying a file number, an element, and a field. The default data types are shown in **bold**.

PLC-5 Syntax

Syntax	Data Type	Access
MG<file>:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation.

Element Field	Data Type	Access
ERR	**Short**, Word	Read/Write
RLEN	**Short**, Word	Read/Write
DLEN	**Short**, Word	Read/Write
EN	**Boolean**	Read/Write
ST	**Boolean**	Read/Write
DN	**Boolean**	Read/Write
ER	**Boolean**	Read/Write
CO	**Boolean**	Read/Write
EW	**Boolean**	Read/Write
NR	**Boolean**	Read/Write
TO	**Boolean**	Read/Write

Ranges

PLC Model	File Number	Max Element
Micrologix	NA	NA
SLC 500 Fixed I/O	NA	NA
SLC 500 Modular I/O	NA	NA
PLC-5 Series	3-999	999

Examples

Example	Description
MG14:0.RLEN	Requested length field of MG 0 file 14
MG18:6.CO	Continue bit of MG 6 file 18

Block Transfer Files

Block transfer files are a structured type whose data is accessed by specifying a file number, an element, and a field. The default data types are shown in **bold**.

PLC-5 Syntax

Syntax	Data Type	Access
BT<file>:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For more information on the meaning of each field, refer to the PLC's documentation.

Element Field	Data Type	Access
RLEN	**Word**, Short	Read/Write
DLEN	**Word**, Short	Read/Write
FILE	**Word**, Short	Read/Write
ELEM	**Word**, Short	Read/Write
RW	**Boolean**	Read/Write
ST	**Boolean**	Read/Write
DN	**Boolean**	Read/Write
ER	**Boolean**	Read/Write
CO	**Boolean**	Read/Write
EW	**Boolean**	Read/Write
NR	**Boolean**	Read/Write
TO	**Boolean**	Read/Write

Ranges

PLC Model	File Number	Max Element
Micrologix	NA	NA
SLC 500 Fixed I/O	NA	NA
SLC 500 Modular I/O	NA	NA
PLC-5 Series	3-999	1999

Examples

Example	Description
BT14:0.RLEN	Requested length field of BT 0 file 14
BT18:6.CO	Continue bit of BT 6 file 18

Function File Listing

For information on the files supported by the ENI MicroLogix and MicroLogix 1100 device models, select a link from the list below.

High Speed Counter File (HSC)
Real-Time Clock File (RTC)
Channel 0 Communication Status File (CS0)
Channel 1 Communication Status File (CS1)
I/O Module Status File (IOS)

Note: For more information on device models and their supported files, refer to **Address Descriptions**.

High Speed Counter File (HSC)

The HSC files are a structured type whose data is accessed by specifying an element and a field. The default data types are shown in **bold**.

See Also: **ENI DF1/ DH+/ControlNet Gateway Communications Parameters**

Syntax	Data Type	Access
HSC:<element>.<field>	Depends on field.	Depends on field.

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation.

Element Field	Default Type	Access
ACC	**DWord**, Long	Read Only
HIP	**DWord**, Long	Read/Write
LOP	**DWord**, Long	Read/Write
OVF	**DWord**, Long	Read/Write
UNF	**DWord**, Long	Read/Write
PFN	**Word**, Short	Read Only
ER	**Word**, Short	Read Only
MOD	**Word**, Short	Read Only
OMB	**Word**, Short	Read Only
HPO	**Word**, Short	Read/Write
LPO	**Word**, Short	Read/Write
UIX	**Boolean**	Read Only
UIP	**Boolean**	Read Only
AS	**Boolean**	Read Only
ED	**Boolean**	Read Only
SP	**Boolean**	Read Only
LPR	**Boolean**	Read Only
HPR	**Boolean**	Read Only
DIR	**Boolean**	Read Only
CD	**Boolean**	Read Only
CU	**Boolean**	Read Only
UIE	**Boolean**	Read/Write
UIL	**Boolean**	Read/Write
FE	**Boolean**	Read/Write
CE	**Boolean**	Read/Write
LPM	**Boolean**	Read/Write
HPM	**Boolean**	Read/Write

UFM	**Boolean**	Read/Write
OFM	**Boolean**	Read/Write
LPI	**Boolean**	Read/Write
HPI	**Boolean**	Read/Write
UFI	**Boolean**	Read/Write
OFI	**Boolean**	Read/Write
UF	**Boolean**	Read/Write
OF	**Boolean**	Read/Write
MD	**Boolean**	Read/Write

Ranges

PLC Model	File Number	Max Element
Micrologix	N/A	254
All SLC	N/A	N/A
PLC5	N/A	N/A

Examples

Example	Description
HSC:0.OMB	Output mask setting for high speed counter 0.
HSC:1.ED	Error detected indicator for high speed counter 1.

Real-Time Clock File (RTC)

The RTC files are a structured type whose data is accessed by specifying an element and a field. The default data types are shown in **bold**.

See Also: **ENI DF1/ DH+/ControlNet Gateway Communications Parameters**

Syntax	Data Type	Access
RTC:<element>.<field>	Depends on field	Depends on field

The following fields are allowed for each element. For the meaning of each field, refer to the PLC's documentation.

Element Field	Data Type	Access
YR	**Word**, Short	Read/Write
MON	**Word**, Short	Read/Write
DAY	**Word**, Short	Read/Write
HR	**Word**, Short	Read/Write
MIN	**Word**, Short	Read/Write
SEC	**Word**, Short	Read/Write
DOW	**Word**, Short	Read/Write
DS	**Boolean**	Read Only
BL	**Boolean**	Read Only
_SET (for block writes)	**Boolean**	Read/Write

Ranges

PLC Model	File Number	Max Element
Micrologix	N/A	254
All SLC	N/A	N/A
PLC5	N/A	N/A

Examples

Example	Description
RTC:0.YR	Year setting for real-time clock 0.
RTC:0.BL	Battery low indicator for real-time clock 0.

Channel 0 Communication Status File (CS0)

To access the communication status file for channel 0, specify a word (and optionally a bit in the word). The default data types are shown in **bold**.

See Also: ENI DF1/ DH+/ControlNet Gateway Communications Parameters

Syntax	Data Type	Access
CS0:<word>	Short, **Word**, BCD, DWord, Long, LBCD	Depends on <word> and <bit>
CS0:<word>/<bit>	**Boolean**	Depends on <word> and <bit>
CS0/bit	**Boolean**	Depends on <word> and <bit>

Ranges

PLC Model	File Number	Max Element
Micrologix	N/A	254
All SLC	N/A	N/A
PLC5	N/A	N/A

Examples

Example	Description
CS0:0	Word 0.
CS0:4/2	Bit 2 word 4 = MCP.

Note: For more information on CS0 words/bit meanings, refer to the Rockwell documentation.

Channel 1 Communication Status File (CS1)

To access the communication status file for channel 1, specify a word (and optionally a bit in the word). The default data types are shown in **bold**.

See Also: ENI DF1/ DH+/ControlNet Gateway Communications Parameters

Syntax	Data Type	Access
CS1:<word>	Short, **Word**, BCD, DWord, Long, LBCD	Depends on <word> and <bit>
CS1:<word>/<bit>	**Boolean**	Depends on <word> and <bit>
CS1/bit	**Boolean**	Depends on <word> and <bit>

Ranges

PLC Model	File Number	Max Element
Micrologix	N/A	254
All SLC	N/A	N/A
PLC5	N/A	N/A

Examples

Example	Description
CS1:0	Word 0.
CS1:4/2	Bit 2 word 4 = MCP.

Note: For more information on CS1 words/bit meanings, refer to the Rockwell documentation.

I/O Module Status File (IOS)

To access an I/O module status file, specify a word and optionally a bit. The default data types are shown in **bold**.

See Also: ENI DF1/ DH+/ControlNet Gateway Communications Parameters

Syntax	Data Type	Access
IOS:<word>	Short, **Word**, BCD, DWord, Long, LBCD	Depends on <word> and <bit>
IOS:<word>/<bit>	**Boolean**	Depends on <word> and <bit>
IOS/bit	**Boolean**	Depends on <word> and <bit>

Ranges

PLC Model	File Number	Max Element
Micrologix	N/A	254
All SLC	N/A	N/A
PLC5	N/A	N/A

Examples

Example	Description
IOS:0	Word 0.
IOS:4/2	Bit 2 word 4.

Note: For a listing of 1769 expansion I/O status codes, refer to the instruction manual.

Automatic Tag Database Generation

The Allen-Bradley ControlLogix Ethernet Driver can be configured to automatically generate a list of server tags within the server that correspond to device-specific data. The automatically generated tags are based on the Logix Tags defined in the Logix device, and can be browsed from the OPC client. Logix Tags can be atomic or structured. Structure and array tags can quickly increase the number of tags imported (and therefore the number of tags available in the server).

Note: ENI/DH+, ControlNet Gateway, and MicroLogix 1100 models do not support automatic tag database generation: only ENI ControlLogix, CompactLogix, and FlexLogix models do.

Atomic Tag -> **one-to-one**-> Server Tag
Structure Tag -> **one-to-many** -> Server Tags
Array Tag -> **one-to-many**> -> Server Tags

Note: For more information on the Database Creation settings, refer to the server help file.

Tag Hierarchy

The server tags created by automatic tag generation can follow one of two hierarchies: Expanded or Condensed. To enable this functionality, make sure "Allow Automatically Generated Subgroups" is enabled in Device Properties. The default setting is Expanded Mode.

Expanded Mode

In Expanded Mode, the server tags created by automatic tag generation follow a group/tag hierarchy consistent with the tag hierarchy in RSLogix 5000. Groups are created for every segment preceding the period as in Condensed Mode, but are also created in logical groupings. Groups created include the following:

- Global (controller) scope
- Program scope
- Structures and substructures
- Arrays

Note: Groups are not created for .bit addresses.

The root level groups (or subgroup levels of the group specified in "Add generated tags to the following group") are "Prgm_<program name>" and "Global". Each program in the controller will have its own "Prgm_<program name>" group. The driver recognizes this as the first group level.

Basic Global Tags (or non-structure, non-array tags) are placed under the Global group; basic Program Tags are placed under their respective program group. Each structure and Array Tag is provided in its own subgroup of the parent group. By organizing the data in this fashion, the server's tag view mimics RSLogix5000.

The name of the structure/array subgroup also provides a description of the structure/array. For instance, an array tag1[1,6] defined in the controller would have a subgroup name "tag1_x_y"; x signifies dimension 1 exists, and y signifies dimension 2 exists. The tags within an array subgroup are all the elements of that array (unless explicitly limited). The tags within a structure subgroup are the structure members themselves. If a structure contains an array, an array subgroup of the structure group will be created as well.

With a complex project, the tag hierarchy could require a number of group levels. The maximum number of group levels created by automatic tag generation is seven. This does not include the group specified in "Add generated tags to the following group". When more than seven levels are required, the tags will be placed in the seventh group (causing the hierarchy to plateau).

Array Tags

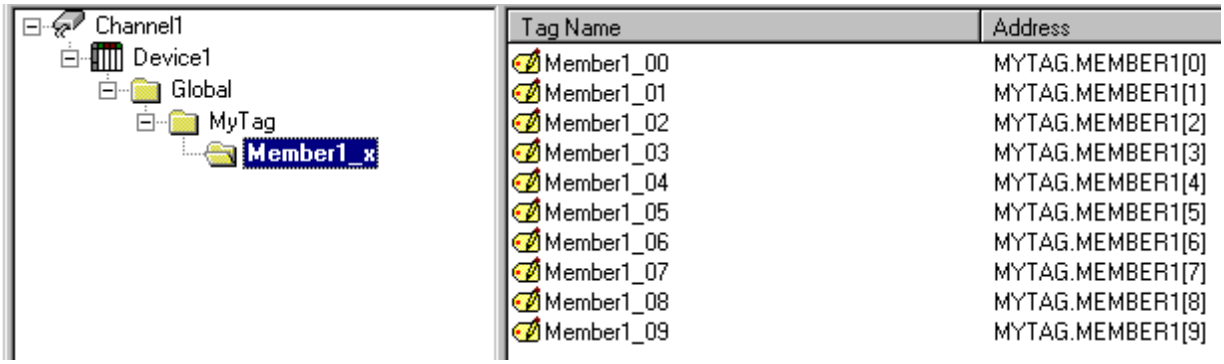
A group is created for each array that contains the array's elements. Group names will have the notation: <*array name*>*_x_y_z* where:

x_y_z = 3 dimensional array
x_y = 2 dimensional array
x = 1 dimensional array

Array Tags will have the notation: <*tag element*>*_XXXXX_YYYYY_ZZZZZ*. For example, element tag1[12,2,987] would have the tag name "tag1_12_2_987".

Simple Example

Name	Value	Force Mask	Style	Data Type
MyTag	{...}	{...}		MyDataType
MyTag.Member1	{...}	{...}	Decimal	DINT[10]
MyTag.Member1[0]	0		Decimal	DINT
MyTag.Member1[1]	0		Decimal	DINT
MyTag.Member1[2]	0		Decimal	DINT
MyTag.Member1[3]	0		Decimal	DINT



Complex Example
A Logix Tag is defined with the address "Local:1:O.Slot[9].Data". This would be represented in the groups "Global" - "Local_1_O" - "Slot_x" - "Slot_09". Within the last group would be the tag "Data".

The static reference to "Data" would be "Channel1.Device1.Global.Local_1_O.Slot_x.Slot_09.Data". The dynamic reference to "Data" would be "Channel1.Device1.Local:1:O.Slot[9].Data".

Condensed Mode

In Condensed Mode, the server tags created by automatic tag generation follow a group/tag hierarchy consistent with the tag's address. Groups are created for every segment preceding the period. Groups created include the following:

- Program scope
- Structures and substructures

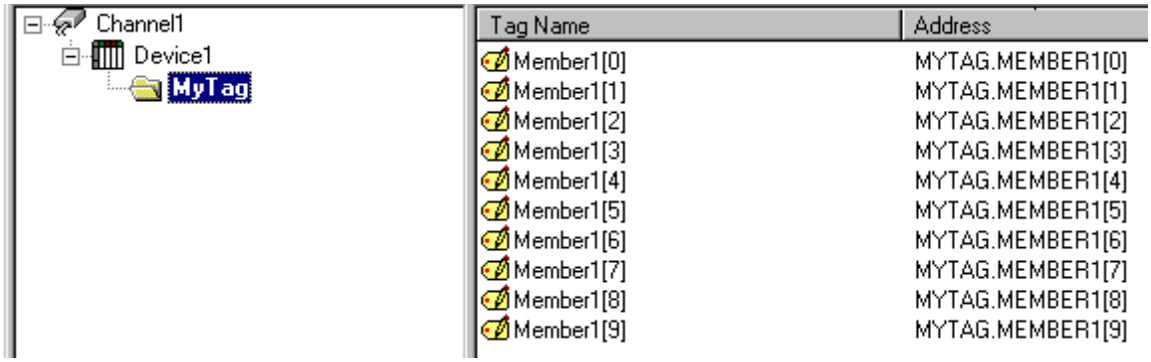
Note: Groups are not created for arrays or .bit addresses.

With a complex project, it is easy to how the tag hierarchy could require a number of group levels. The maximum number of group levels created by automatic tag generation is seven. This does not include the group specified in "Add generated tags to the following group". When more than seven levels are required, the tags will be placed in the seventh group (causing the hierarchy to plateau).

Note: Tag or structure member names leading off with an underscore will be converted to "U_". This is required because the server does not support leading underscores. For more information, refer to **Controller-to-Server Name Conversion**.

Simple Example

Name	Value	Force Mask	Style	Data Type
MyTag	{...}	{...}		MyDataType
MyTag.Member1	{...}	{...}	Decimal	DINT[10]
MyTag.Member1[0]	0		Decimal	DINT
MyTag.Member1[1]	0		Decimal	DINT
MyTag.Member1[2]	0		Decimal	DINT
MyTag.Member1[3]	0		Decimal	DINT



Complex Example
Logix Tag is defined with address "Local:1:O.Slot[9].Data". This would be represented in the groups "Local:1:O" -> "Slot[9]". Within the last group would be the tag "Data".

The static reference to "Data" would be "Channel1.Device1.Local:1:O.Slot[9].Data". The dynamic reference would be "Channel1.Device1.Local:1:O.Slot[9].Data".

Note: I/O module tags cannot be directly imported in Offline mode. Since aliases can be imported, it is recommended that they be created for I/O module tags of interest in RSLogix5000.

Controller-to-Server Name Conversions

Leading Underscores

Leading underscores "_" in tag or program names will be replaced with "U_". This is required because the server does not accept tag or group names beginning with an underscore.

Long Names (OPC Server Version 4.64 and below)

Under older OPC server versions, the Allen-Bradley ControlLogix Ethernet Driver was limited to 31 characters in group and tag names. Therefore, if a controller program or tag name exceeded 31 characters, it had to be clipped. OPC server Version 4.70 and above has a 256 character limit, so the rules do not apply. Names will be clipped as follows:

Non-Array

1. Determine a 5-digit Unique ID for this tag.
2. Given a tag name: ThisIsALongTagNameAndProbablyExceeds31
3. Clip tag at 31: ThisIsALongTagNameAndProbablyEx
4. Room is made for the Unique ID: ThisIsALongTagNameAndProba#####
5. Insert this ID: ThisIsALongTagNameAndProba00000

Array

1. Determine a 5-digit Unique ID for this array.
2. Given an Array Tag name: ThisIsALongTagNameAndProbablyExceeds31_23_45_8
3. Clip tag at 31 while holding on to the element values: ThisIsALongTagNameAndPr_23_45_8
4. Room is made for the Unique ID: ThisIsALongTagName#####_23_45_8
5. Insert this ID: ThisIsALongTagName00001_23_45_8

Long program names are clipped in the same manner as long non-Array Tag names. For every tag or program name that is clipped, the Unique ID will be incremented. Array Tag names (elements) of a clipped array name will have the same Unique ID. This provides for 100000 unique tag/program names.

Note: If the "Limit Tag/Group Names to 31 Characters" setting is enabled, the following rules apply even if the 256 character names are supported. For more information, refer to **Logix Database Options**.

Preparing for Automatic Tag Database Generation

For information on using Automatic Tag Database Generation, follow the instructions below.

Online
It is recommended that all communications to the Logix CPU of interest cease during the database creation process.

In RSLogix5000
Set the project OFFLINE.

In the OPC Server

1. Open the Device Properties of the device for which tags will be generated.
2. Click **Database Settings** | **Create tag database from device**.
3. Select the **Options** tab and make any desired changes.
4. Select the **Filtering** tab and make any desired changes.
5. Select the **Database Creation** tab and utilize as instructed in the server help file.

Offline
The Allen-Bradley ControlLogix Ethernet Driver uses a file generated from RSLogix5000 called an L5K/L5X import/export file to generate the tag database.

In RSLogix5000

1. Open the project containing the tags that will be ported over to the OPC server.
2. Click **File** | **Save As**.
3. Select **L5K/L5X Import/Export File** and then specify a name. RSLogix will export the project's contents into this L5K/L5X file.

In the OPC Server

1. Open the Device Properties of the device for which tags will be generated.
2. Select **Database Settings** | **Create tag database from import file**.
3. Enter or browse for the location of the L5K/L5X file previously created.
4. Select the **Options** tab and make any desired changes.
5. Select the **Filtering** tab and make any desired changes.
6. Select the **Database Creation** tab and utilize as instructed in the server help file.

Note: Imported pre-defined tag types will be based on the latest version supported by the Allen-Bradley ControlLogix Ethernet Driver. For more information, refer to **Firmware Versions**.

Error Codes

The following sections define error codes that may be encountered in the server's Event Log. For more information on a specific error code type, select a link from the list below.

Encapsulation Error Codes
CIP Error Codes

Encapsulation Error Codes

The following error codes are in hexadecimal.

Error Code	Description
0001	Command not handled.
0002	Memory not available for command.
0003	Poorly formed or incomplete data.
0064	Invalid Session ID.
0065	Invalid length in header.
0069	Requested protocol version not supported.
0070	Invalid Target ID.

CIP Error Codes

The following error codes are in hexadecimal.

Error Code	Description
0001	Connection Failure.*
0002	Insufficient resources.
0003	Value invalid.
0004	IOI could not be deciphered or tag does not exist.
0005	Unknown destination.
0006	Data requested would not fit in response packet.
0007	Loss of connection.
0008	Unsupported service.
0009	Error in data segment or invalid attribute value.
000A	Attribute list error.
000B	State already exists.
000C	Object model conflict.
000D	Object already exists.
000E	Attribute not settable.
000F	Permission denied.
0010	Device state conflict.
0011	Reply will not fit.
0012	Fragment primitive.
0013	Insufficient command data / parameters specified to execute service.
0014	Attribute not supported.
0015	Too much data specified.
001A	Bridge request too large.
001B	Bridge response too large.
001C	Attribute list shortage.
001D	Invalid attribute list.
001E	Embedded service error.
001F	Failure during connection.**
0022	Invalid reply received.
0025	Key segment error.
0026	Number of IOI words specified does not match IOI word count.
0027	Unexpected attribute in list.

*See Also: 0x0001 Extended Error Codes
**See Also: 0x001F Extended Error Codes

Logix5000-Specific (1756-L1) Error Codes

The following error codes are in hexadecimal.

Error Code	Description
00FF	General Error.*

*See Also: 0x00FF Extended Error Codes

Note: For unlisted error codes, refer to the Rockwell documentation.

0x0001 Extended Error Codes

The following error codes are in hexadecimal.

Error Code	Description
0100	Connection in use.
0103	Transport not supported.
0106	Ownership conflict.
0107	Connection not found.
0108	Invalid connection type.
0109	Invalid connection size.
0110	Module not configured.
0111	EPR not supported.
0114	Wrong module.
0115	Wrong device type.
0116	Wrong revision.
0118	Invalid configuration format.
011A	Application out of connections.
0203	Connection timeout.
0204	Unconnected message timeout.
0205	Unconnected send parameter error.
0206	Message too large.
0301	No buffer memory.
0302	Bandwidth not available.
0303	No screeners available.
0305	Signature match.
0311	Port not available.
0312	Link address not available.
0315	Invalid segment type.
0317	Connection not scheduled.
0318	Link address to self is invalid.

Note: For unlisted error codes, refer to the Rockwell documentation.

0x001F Extended Error Codes

The following error codes are in hexadecimal.

Error Code	Description
0203	Connection timed out.

Note: For unlisted error codes, refer to the Rockwell documentation.

0x00FF Extended Error Codes

The following error codes are in hexadecimal.

Error Code	Description
2104	Address out of range.
2105	Attempt to access beyond end of data object.
2106	Data in use.
2107	Data type is invalid or not supported.

Note: For unlisted error codes, refer to the Rockwell documentation.

Error Descriptions

Error messages are classified according to error sub types. For more information, select a link from the list below.

Address Validation Errors

The following is a list of sub type error topics. Click on a link for more information about that specific error message.

Address Validation

Address '<address>' is out of range for the specified device or register

Error Type:
Warning

Possible Cause:
A tag address that has been specified statically references a location that is beyond the range of the device's supported locations.

Solution:
Verify that the address is correct; if it is not, re-enter it in the client application.

Note:
For valid bit and array element ranges, refer to **Address Formats**.

Array size is out of range for address '<address>'

Error Type:
Warning

Possible Cause:
A tag address that has been specified statically is requesting an array size that is too large.

Solution:
1. Specify a smaller value for the array.
2. Specify a different starting point by re-entering the address in the client application.

Note:
For valid array size ranges, refer to **Address Formats**.

Array support is not available for the specified address: '<address>'

Error Type:
Warning

Possible Cause:

A tag address that has been specified statically contains an array reference for an address type that doesn't support arrays.

Solution:
1. Re-enter the address in the client application to remove the array reference.
2. Correct the address type.

Data Type '<type>' is not valid for device address '<address>'

Error Type:
Warning

Possible Cause:
A tag address that has been specified statically has been assigned an invalid data type.

Solution:
Modify the requested data type in the client application.

Device address '<address>' contains a syntax error

Error Type:
Warning

Possible Cause:
A tag address that has been specified statically contains one or more of the following errors.

1. Address doesn't conform to the tag address naming conventions.
2. Address is invalid according to the address format and underlying Controller Tag data type.
3. A Program Tag was specified incorrectly.
4. An invalid address format was used.

Solution:
Re-enter the address in the client application.

See Also:
Addressing Atomic Data Types
Address Formats

Device address '<address>' is not supported by model '<model name>'

Error Type:
Warning

Possible Cause:
A tag address that has been specified statically references a location that is valid for the communications protocol but not supported by the target device.

Solution:
Verify the address is correct; if it is not, re-enter it in the client application. Also verify that the selected model name for the device is correct.

Device address '<address>' is Read Only

Error Type:
Warning

Possible Cause:
A tag address that has been specified statically has a requested access mode that is not compatible with what the device supports for that address.

Solution:
Change the access mode in the client application.

Memory could not be allocated for tag with address '<address>' on device '<device name>'

Error Type:
Warning

Possible Cause:
Resources needed to build a tag could not be allocated. Tag will not be added to the project.

Solution:
Close any unused applications and/or increase the amount of virtual memory. Then, try again.

Missing address

Error Type:
Warning

Possible Cause:
A tag address that has been specified statically has no length.

Solution:
Re-enter the address in the client application.

Communication Errors

The following is a list of sub type error topics. Click on a link for more information about that specific error message.

Communication Errors
Unable to bind to adapter: '<adapter>'. Connect failed
Winsock initialization failed (OS Error = n)
Winsock V1.1 or higher must be installed to use the Allen-Bradley ControlLogix Ethernet device driver

Unable to bind to adapter: '<adapter>'. Connect failed

Error Type:
Fatal

Possible Cause:
The driver was unable to bind to the specified network adapter, which is necessary for communications with the device.

Reasons:
1. Adapter is disabled or no longer exists.
2. Network system failure, such as Winsock or network adapter failure.
3. No more available ports.

Solution:
1. For network adapters available on the system, check the Channel Properties | Network Interface | Network Adapter list in the communications server application. If '<adapter>' is not in this list, steps should be taken to make it available to the system. This includes verifying that the network connection is enabled and connected in the PC's Network Connections.

2. Determine how many channels are using the same '<adapter>' in the communications server application. Reduce this number so that only one channel is referencing '<adapter>'. If the error still occurs, check to see if other applications are using that adapter and shut down those applications.

Winsock initialization failed (OS Error = n)

Error Type:
Fatal

OS Error:	Indication	Possible Solution
10091	The underlying network subsystem is not	Wait a few seconds and restart

	ready for network communication.	the driver.
10067	The limit on the number of tasks supported by the Windows Sockets implementation has been reached.	Close one or more applications that may be using Winsock and restart the driver.

Winsock V1.1 or higher must be installed to use the Allen-Bradley ControlLogix Ethernet device driver

Error Type:
Fatal

Possible Cause:
The version number of the Winsock DLL found on the system is less than 1.1.

Solution:
Upgrade Winsock to version 1.1 or higher.

Device Specific Error Messages

The following is a list of device specific error topics. Click on a link for more information about that specific error message.

Device Specific Error Messages
Device '<device name>' is not responding
Encapsulation error occurred during a request to device '<device name>'. [Encap. Error=<code>]
Error occurred during a request to device '<device name>'. [CIP Error=<code>, Ext. Error=<code>]
Frame received from device '<device name>' contains errors

Device '<device name>' is not responding

Error Type:
Warning

Possible Cause:
1. The Ethernet connection between the device and the Host PC is broken.
2. The communications parameters for the Ethernet connection are incorrect.
3. The named device may have been assigned an incorrect IP address.
4. When using the Serial Gateway device model, one or more devices has an incorrect serial port configuration.
5. The response from the device took longer to receive than the amount of time specified in the "Request Timeout" device setting.

Solution:
1. Verify the cabling between the PC and the device.
2. Verify that the correct port is specified for the named device.
3. Verify that the IP address given to the named device matches that of the actual device.
4. Verify that all devices have the correct serial port and system protocol configuration.
5. Increase the Request Timeout setting so that the entire response can be handled.

Encapsulation error occurred during a request to device '<device name>'. [Encap. Error=<code>]

Error Type:
Warning

Possible Cause:
Device '<device name>' returned an error within the Encapsulation portion of the Ethernet/IP packet during a request. All reads and writes within the request failed.

Solution:
The driver will attempt to recover from such an error. If the problem persists, contact Technical Support. This excludes error 0x02, which is device-related, not driver-related.

See Also:
Encapsulation Error Codes

Error occurred during a request to device '<device name>'. [CIP Error=<code>, Ext. Error=<code>]

Error Type:
Warning

Possible Cause:
Device '<device name>' returned an error within the CIP portion of the Ethernet/IP packet during a request. All reads and writes within the request failed.

Solution:
The solution depends on the error code(s) returned.

See Also:
CIP Error Codes

Frame received from device '<device name>' contains errors

Error Type:
Warning

Possible Cause:
1. Misalignment of packets due to connection/disconnection between PC and device.
2. There is bad cabling connecting the device that is causing noise.

Solution:
1. Place device on less noisy network if that is the case.
2. Increase the request timeout and/or attempts

ControlLogix Specific Error Messages

The following sections pertain to messaging from the ControlLogix driver level source.

ControlLogix Specific Error Messages
Read Errors (Non-Blocking)
Read Errors (Blocking)
Write Errors
Project Upload Errors

Read Errors (Non-Blocking)

The following error/warning messages may be generated. Click on the link for a description of the message.

Read Errors (Non-Blocking) Error Messages
Read request for tag '<tag address>' on device '<device name>' failed due to a framing error. Tag deactivated
Unable to read '<tag address>' on device '<device name>'. Tag deactivated
Unable to read tag '<tag address>' on device '<device name>'. [CIP Error=<code>, Ext. Error=<code>]
Unable to read tag '<tag address>' on device '<device name>'. Controller Tag data type '<type>' unknown. Tag deactivated
Unable to read tag '<tag address>' on device '<device name>'. Data type '<type>' is illegal for this tag. Tag deactivated
Unable to read tag '<tag address>' on device '<device name>'. Data type '<type>' not supported. Tag deactivated
Unable to read tag '<tag address>' on device '<device name>'. Tag does not support multi-element arrays. Tag deactivated

Read request for tag '<tag address>' on device '<device name>' failed due to a framing error. Tag deactivated

Error Type:
Warning

Possible Cause:
A read request for the specified tag failed due to one of the following reasons:

1. Incorrect request service code.
2. Received more or less bytes than expected.

Solution:
If this error occurs frequently, there may be an issue with the cabling or the device itself. If the error occurs frequently for a specific tag, contact Technical Support. Increasing the request attempts will also give the driver more opportunities to recover from this error. In response to this error, the tag will be deactivated; thus, it will not be processed again.

Unable to read '<tag address>' on device '<device name>'. Tag deactivated

Error Type:
Warning

Possible Cause:
1. The Ethernet connection between the device and the Host PC is broken.
2. The communication parameters for the Ethernet connection are incorrect.
3. The named device may have been assigned an incorrect IP address.

Solution:
1. Verify the cabling between the PC and the device.
2. Verify that the correct port has been specified for the named device.
3. Verify that the IP address given to the named device matches that of the actual device.

Note:
In response to this error, the tag will be deactivated and will not be processed again.

Unable to read tag '<tag address>' on device '<device name>'. [CIP Error=<code>, Ext. Error=<code>]

Error Type:
Warning

Possible Cause:
Device '<device name>' returned an error within the CIP portion of the Ethernet/IP packet during a read request for tag '<tag address>'.

Solution:
The solution depends on the error code(s) returned.

See Also:
CIP Error Codes

Unable to read tag '<tag address>' on device '<device name>'. Controller Tag data type '<type>' unknown. Tag deactivated

Error Type:
Warning

Possible Cause:
A read request for the specified tag failed because the Controller Tag's data type is not currently supported.

Solution:
Contact Technical Support so that support may be added for this type. In response to this error, the tag will be deactivated; thus, it will not be processed again.

Unable to read tag '<tag address>' on device '<device name>'. Data type '<type>' is illegal for this tag. Tag deactivated

Error Type:
Warning

Possible Cause:
A read request for the specified tag failed because the client's tag data type is illegal for the given Controller Tag.

Solution:
Change the tag's data type to one that is supported. For example, data type Short is illegal for a BOOL array Controller Tag. Changing the data type to Boolean would remedy this problem. In response to this error, the tag will be deactivated; thus, it will not be processed again.

See Also:
Addressing Atomic Data Types

Unable to read tag '<tag address>' on device '<device name>'. Data type '<type>' not supported. Tag deactivated

Error Type:
Warning

Possible Cause:
A read request for the specified tag failed because the client's tag data type is not supported.

Solution:
Change the tag's data type to one that is supported. In response to this error, the tag will be deactivated; thus, it will not be processed again.

See Also:
Addressing Atomic Data Types

Unable to read tag '<tag address>' on device '<device name>'. Tag does not support multi-element arrays. Tag deactivated

Error Type:
Warning

Possible Cause:
A read request for the specified tag failed because the driver does not support multi-element array access to the given Controller Tag.

Solution:
Change the tag's data type or address to one that is supported. In response to this error, the tag will be deactivated; thus, it will not be processed again.

See Also:
Addressing Atomic Data Types

Read Errors (Blocking)

The following error/warning messages may be generated. Click on the link for a description of the message.

Read Errors (Blocking) Error Messages
Read request for '<count>' element(s) starting at '<tag address>' on device '<device name>' failed due to a framing error. Block Deactivated
Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. Block Deactivated
Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. [CIP Error=<code>, Ext. Error=<code>]
Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. Controller Tag data type '<type>' unknown. Block Deactivated
Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. Data type '<type>' is illegal for this block. Block Deactivated
Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. Data type '<type>' not supported. Block Deactivated
Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. Block does not support multi-element arrays. Block Deactivated

Read request for '<count>' element(s) starting at '<tag address>' on device '<device name>' failed due to a framing error. Block Deactivated

Error Type:
Warning

Possible Cause:
A read request for tags <tag address> to <tag address>+<count> failed due to one of the following reasons:

1. Incorrect request service code.
2. Received more or less bytes than expected.

Solution:
If this error occurs frequently, there may be an issue with the cabling or the device itself. If the error occurs frequently for a specific tag, contact Technical Support. Increasing the request attempts will also give the driver more opportunities to recover from this error. In response to this error, <count> elements of the block will be deactivated; thus, it will not be processed again.

Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. Block Deactivated

Error Type:
Warning

Possible Cause:
1. The Ethernet connection between the device and the Host PC is broken.
2. The communication parameters for the Ethernet connection are incorrect.
3. The named device may have been assigned an incorrect IP address.

Solution:
1. Verify the cabling between the PC and the device.
2. Verify that the correct port has been specified for the named device.
3. Verify that the IP address given to the named device matches that of the actual device.

Note:
In response to this error, <count> elements of the block will be deactivated; thus, it will not be processed again.

Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. [CIP Error=<code>, Ext. Error=<code>]

Error Type:
Warning

Possible Cause:
Device '<device name>' returned an error within the CIP portion of the Ethernet/IP packet during a read request for tag '<tag address>'.

Solution:
The solution depends on the error code(s) returned.

See Also:
CIP Error Codes

Unable to read '<count>' element(s) starting at '<address>' on device '<device>'. Controller Tag data type '<type>' unknown. Block deactivated

Error Type:
Warning

Possible Cause:
A read request for tags <tag address> to <tag address>+<count> failed because the Controller Tag's data type is not currently supported.

Solution:

Contact Technical Support so that support may be added for this type. In response to this error, <count> elements of the block will be deactivated; thus, it will not be processed again.

Unable to read '<count>' element(s) starting at '<address>' on device '<device>'. Data type '<type>' is illegal for this block

Error Type:
Warning

Possible Cause:
A read request for tags <tag address> to <tag address>+<count> failed because the client's tag data type is illegal for the given Controller Tag.

Solution:
Change the data type for tags within this block to one that is supported. For example, data type Short is illegal for a BOOL array Controller Tag. Changing the data type to Boolean would remedy this problem. In response to this error, <count> elements of the block will be deactivated; thus, it will not be processed again.

See Also:
Addressing Atomic Data Types

Unable to read '<count>' element(s) starting at '<address>' on device '<device>'. Data type '<type>' not supported

Error Type:
Warning

Possible Cause:
A read request for tags <tag address> to <tag address>+<count> failed because the client's tag data type is not supported.

Solution:
Change the data type for tags within this block to one that is supported. In response to this error, <count> elements of the block will be deactivated; thus, it will not be processed again.

See Also:
Addressing Atomic Data Types

Unable to read '<count>' element(s) starting at '<tag address>' on device '<device name>'. Block does not support multi-element arrays. Block Deactivated

Error Type:
Warning

Possible Cause:
A read request for tags <tag address> to <tag address>+<count> failed because the driver does not support multi-element array access to the given Controller Tag.

Solution:
Change the data type or address for tags within this block to one that is supported. In response to this error, <count> elements of the block will be deactivated; thus, it will not be processed again.

See Also:
Addressing Atomic Data Types

Write Errors

The following error/warning messages may be generated. Click on the link for a description of the message.

Write Errors
Unable to write to '<tag address>' on device '<device name>'
Unable to write to tag '<tag address>' on device '<device name>'. [CIP Error=<code>, Ext. Status=<code>]

Unable to write to '<tag address>' on device '<device name>'

Error Type:
Warning

Possible Cause:
1. The Ethernet connection between the device and the Host PC is broken.
2. The communication parameters for the Ethernet connection are incorrect.
3. The named device may have been assigned an incorrect IP address.

Solution:
1. Verify the cabling between the PC and the device.
2. Verify that the correct port has been specified for the named device.
3. Verify that the IP address given to the named device matches that of the actual device.

Unable to write to tag '<tag address>' on device '<device name>'. [CIP Error=<code>, Ext. Status=<code>]

Error Type:
Warning

Possible Cause:
Device '<device name>' returned an error within the CIP portion of the Ethernet/IP packet during a write request for tag '<tag address>'.

Solution:
The solution depends on the error code(s) returned.

See Also:
CIP Error Codes

Unable to write to tag '<tag address>' on device '<device name>'. Controller Tag data type '<type>' unknown

Error Type:
Warning

Possible Cause:
A write request for the specified tag failed because the Controller Tag's data type is not currently supported.

Solution:
Contact Technical Support so that support may be added for this type.

Unable to write to tag '<tag address>' on device '<device name>'. Data type '<type>' is illegal for this tag

Error Type:
Warning

Possible Cause:
A write request for the specified tag failed because the client's tag data type is illegal for the given Controller Tag.

Solution:

Change the tag's data type to one that is supported. For example, data type Short is illegal for a BOOL array Controller Tag. Changing the data type to Boolean would remedy this problem.

See Also:
Addressing Atomic Data Types

Unable to write to tag '<tag address>' on device '<device name>'. Data type '<type>' not supported

Error Type:
Warning

Possible Cause:
A write request for the specified tag failed because the client's tag data type is not supported.

Solution:
Change the tag's data type to one that is supported.

See Also:
Addressing Atomic Data Types

Unable to write to tag '<tag address>' on device '<device name>'. Tag does not support multi-element arrays

Error Type:
Warning

Possible Cause:
A write request for the specified tag failed because the driver does not support multi-element array access to the given Controller Tag.

Solution:
Change the tag's data type or address to one that is supported.

See Also:
Addressing Atomic Data Types

Write request for tag '<tag address>' on device '<device name>' failed due to a framing error

Error Type:
Warning

Possible Cause:
A write request for the specified tag failed after so many retries due to one of the following reasons:

1. Incorrect request service code.
2. Received more or less bytes than expected.

Solution:
If this error occurs frequently, there may be an issue with the cabling or device. Increasing the Retry Attempts will also give the driver more opportunities to recover from this error.

Project Upload Errors

A project upload is required for the Logical Protocol Modes. Without it, the driver does not have the information necessary to perform Logical reads/writes. Each error below is preceded with the following:

"The following error(s) occurred uploading controller project from device '<device name>'. Resorting to symbolic addressing."

Project Upload Errors
Encapsulation error occurred while uploading project information. [Encap. Error=<code>]
Error occurred while uploading project information. [CIP Error=<code>, Ext. Error=<code>]

Encapsulation error occurred while uploading project information. [Encap. Error=<code>]

Error Type:
Warning

Possible Cause:
Device '<device name>' returned an error within the Encapsulation portion of the Ethernet/IP packet while uploading the controller project.

Solution:
The solution depends on the error code that is returned. If the problem persists, contact Technical Support.

Note:
A project upload is required for the Logical Addressing Modes.

See Also:
Encapsulation Error Codes

Error occurred while uploading project information. [CIP Error=<code>, Ext. Error=<code>]

Error Type:
Warning

Possible Cause:
Device '<device name>' returned an error within the CIP portion of the Ethernet/IP packet while uploading the controller project.

Solution:
The solution depends on the error code that is returned. If the problem persists, contact Technical Support.

Note:
A project upload is required for the Logical Addressing Modes.

See Also:
CIP Error Codes

Framing error occurred while uploading project information

Error Type:
Warning

Possible Cause:
1. The packets are misaligned (due to connection/disconnection between the PC and device).
2. There is bad cabling connecting the device that is causing noise.

Solution:
1. Place the device on a less noisy network.
2. Increase the request timeout and/or attempts.
3. Restart the server and try again.

Note:
A project upload is required for the Logical Addressing Modes.

Invalid or corrupt controller project

Error Type:
Warning

Possible Cause:
The controller project was considered invalid or corrupt at the time of the upload.

Solution:
Re-download the project to the controller. Then, restart the server and try again.

Note:
A project upload is required for the Logical Addressing Modes.

Low memory resources

Error Type:
Warning

Possible Cause:
Memory required for controller project upload could not be allocated.

Solution:
Close any unused applications and/or increase the amount of virtual memory. Then, restart the server and try again.

Note:
A project upload is required for the Logical Addressing Modes.

Unable to read '<element>' element(s) starting at '<address>' on device '<device name>'. Native Tag size mismatch

Error Type:
Warning

Possible Cause:
The Native Tag's size (footprint) does not match the expected size that was determined from the project upload.

Solution:
Contact Technical Support to report the issue. Then, change the Protocol Mode to Symbolic as a workaround.

Unable to read tag '<tag name>' on device '<device name>'. Native Tag size mismatch

Error Type:
Warning

Possible Cause:
The Native Tag's size (footprint) does not match the expected size that was determined from the project upload.

Solution:
Contact Technical Support to report the issue. Then, change the Protocol Mode to Symbolic as a workaround.

Unable to write to tag '<tag name>' on device '<device name>'. Native Tag size mismatch

Error Type:
Warning

Possible Cause:
The Native Tag's size (footprint) does not match the expected size that was determined from the project upload.

Solution:
Contact Technical Support to report the issue. Then, change the Protocol Mode to Symbolic as a workaround.

ENI/DH+/ControlNet Gateway Specific Error Messages

The following is a list of sub type error topics. Click on a link for more information about that specific error message.

ENI/DH+/ControlNet Gateway Specific Error Messages

Device '<device name>' is not responding. Local node responded with error '[DF1 STS=<value>]'

Error Type:
Warning

Possible Cause:
This error means that the PLC did not respond to the read request from the local node. A local node could be an intermediate node like 1756-DHRIO, 1756-CNB, 1761-NET-ENI, and so forth.

Solution:
Refer to A-B documentation for STS error code definitions. For example, if STS code '0x02'(hex) is returned, verify the cabling between the remote node (PLC) and the local node.

Unable to read '<block size>' element(s) starting at '<address>' on device '<device name>'. [DF1 STS=<value>, EXT STS=<value>]. Tag(s) deactivated

Error Type:
Warning

Possible Cause:
The address requested in the block does not exist in the PLC.

Solution:
Check the status and extended status codes that are being returned by the PLC. An extended status code may not always be returned; therefore, the error information is contained within the status code. The codes are displayed in hexadecimal.

Status code errors in the low nibble of the status code indicate errors found by the local node. The driver will continue to retry reading these blocks of data periodically. Errors found by the local node occur when the KF module cannot see the destination PLC on the network.

Status code errors in the high nibble of the status code indicate errors found by the PLC. These errors are generated when either the block of data the driver is asking for is not available in the PLC or the address does not exist in the PLC. The driver will not ask for these blocks again after receiving this kind of error.

Note:
The block starting at address <address> may be deactivated in the process depending on the severity of the error.

See Also:
A-B documentation for STS and Ext. STS error code definitions.

Unable to read '<block size>' element(s) starting at '<address>' on device '<device name>'. Frame received contains errors

Error Type:
Warning

The Error Could Be:
1. Incorrect frame size received.
2. TNS mismatch.
3. Invalid response command returned from device.

Possible Cause:
1. Misalignment of packets due to connection/disconnection between PC and device.
2. There is bad cabling connecting the devices that is causing noise.

Solution:
The driver will recover from this error without intervention. If this error occurs frequently, there may be an issue with the cabling or the device itself.

Unable to write to address <address> on device '<device name>'. '[DF1 STS=<value>, EXT STS=<value>]'

Error Type:
Warning

Possible Cause:
The address written to does not exist in the PLC.

Solution:
Check the status and extended status codes that are being returned by the PLC. Note that an extended status code may not always be returned and thus the error information is contained within the status code. The codes are displayed in hexadecimal.

Status code errors in the low nibble of the status code indicate errors found by the local node. Errors found by the local node occur when the KF module cannot see the destination PLC on the network for some reason.

Status code errors in the high nibble of the status code indicate errors found by the PLC. These errors are generated when the data location is not available in the PLC or not write able.

See Also:
A-B documentation for STS and Ext. STS error code definitions.

Unable to write to address <address> on device '<device name>'. Frame received contains errors

Error Type:
Warning

Possible Cause:
1. Misalignment of packets due to connection/disconnection between PC and device.
2. There is bad cabling connecting the devices that is causing noise.
3. Incorrect frame size received.
4. TNS mismatch.
5. Invalid response command returned from device.

Solution:
The driver will recover from this error without intervention. If this error occurs frequently, there may be an issue with the cabling or the device itself.

Unable to write to address <address> on device '<device name>'. Local node responded with error '[DF1 STS=<value>]'

Error Type:
Warning

Possible Cause:
This error means that the PLC did not respond to the write request from the local node. A local node could be an intermediate node like 1756-DHRIO, 1756-CNB, 1761-NET-ENI, and so forth.

Solution:
Refer to A-B documentation for STS error code definitions. For example, if the STS code '0x02'(hex) is returned, verify the cabling between the remote node (PLC) and the local node.

Unable to write to function file <address> on device '<device name>'. Local node responded with error '[DF1 STS=<value>]'

Error Type:
Warning

Possible Cause:
This error means that the PLC did not respond to the write request from the local node. A local node could be an intermediate node like 1756-DHRIO, 1756-CNB, 1761-NET-ENI, and so forth.

Solution:
Refer to A-B documentation for STS error code definitions. For example, if the STS code '0x02'(hex) is returned, verify the cabling between the remote node (PLC) and the local node.

Automatic Tag Database Generation Errors

The following is a list of sub type error topics. Click on a link for more information about that specific error message.

Automatic Tag Database Generation Errors
Database Error: Array tags '<orig. tag name><dimensions>' exceed 31 characters. Tags renamed to '<new tag name><dimensions>'
Database Error: Data type '<type>' for tag '<tag name>' not found in Tag Import file. Tag not added
Database Error: Data type for Ref. Tag '<tag name>' unknown. Setting Alias Tag '<tag name>' data type to Default ('<type>')
Database Error: Error occurred processing Alias Tag '<tag name>'. Tag not added
Database Error: Member data type '<type>' for UDT '<UDT name>' not found in Tag Import file. Setting to Default Type '<type>'
Database Error: Program group '<orig. program name>' exceeds 31 characters. Program group renamed to '<new program name>'
Database Error: Tag '<orig. tag name>' exceeds 31 characters. Tag renamed to '<new tag name>'
Database Error: Unable to resolve CIP data type '<hex value>' for tag '<tag name>'. Setting to Default Type '<logix data type>'
Unable to generate a tag database for device <device name>. Reason: Import file not found
Unable to generate a tag database for device <device name>. Reason: L5K File is invalid or corrupt
Unable to generate a tag database for device <device name>. Reason: Low memory resources

Database Error: Array tags '<orig. tag name><dimensions>' exceed 31 characters. Tags renamed to '<new tag name><dimensions>'

Error Type:
Warning

Possible Cause:
The name assigned to an Array Tag originates from the tag name in the controller. This name exceeds the 31 character limitation and will be renamed to one that is valid. <Dimensions> define the number of dimensions for the given Array Tag . XXX for 1 dimension, XXX_YYY for 2, XXX_YYY_ZZZ for 3. The number of X's, Y's and Z's approximates the number of elements for the respective dimensions. Since such an error will occur for each element, generalizing with XXX, YYY and ZZZ implies all array elements will be affected.

Solution:
None.

See Also:
Controller-to-Server Name Conversions

Database Error: Data type '<type>' for tag '<tag name>' not found in Tag Import file. Tag not added

Error Type:
Warning

Possible Cause:
The definition of data type '<type>', for tag <tag name>, could not be found in the Tag Import file. Tag will not be added to the database.

Solution:
Contact Technical Support.

Database Error: Data type for Ref. Tag '<tag name>' unknown. Setting Alias Tag '<tag name>' data type to Default ('<type>')

Error Type:
Warning

Possible Cause:
The data type of the "Alias For" *tag referenced in the Alias Tag's declaration could not found in the Tag Import file. This data type is necessary to generate the alias tag correctly.

Solution:
The Alias Tag will take on the default type specified in the Default Type tab in Device Properties.

Note:
In RSLogix5000, "Alias For" is a column in the tag view under the Edit Tags tab. This is where the reference to the tag, structure tag member, or bit that the alias tag will represent is entered.

See Also:
Logix Options

Database Error: Error occurred processing Alias Tag '<tag name>'. Tag not added

Error Type:
Warning

Possible Cause:
An internal error occurred processing alias tag <tag name>. Alias tag could not be generated.

Solution:
None.

Database Error: Member data type '<type>' for UDT '<UDT name>' not found in Tag Import file. Setting to Default Type '<type>'

Error Type:
Warning

Possible Cause:
The definition of data type '<type>', for a member in the user-defined type <UDT name>, could not be found in the Tag Import file.

Solution:
This member will take on the default type specified in the Default Type tab of Device Properties.

See Also:
Logix Options

Database Error: Program group '<orig. program name>' exceeds 31 characters. Program group renamed to '<new program name>'

Error Type:
Warning

Possible Cause:
The program name assigned to this group exceeds the 31 character limitation and will be renamed to one that is valid.

Solution:
None.

See Also:
Controller-to-Server Name Conversions

Database Error: Tag '<orig. tag name>' exceeds 31 characters. Tag renamed to '<new tag name>'

Error Type:
Warning

Possible Cause:
The name assigned to a tag originates from the tag name in the controller. This name exceeds the 31 character limitation and will be renamed to one that is valid.

Solution:
None.

See Also:
Controller-to-Server Name Conversions

Database Error: Unable to resolve CIP data type '<hex value>' for tag '<tag name>'. Setting to Default Type '<logix data type>'

Error Type:
Warning

Possible Cause:
1. The CIP data type in the import file is unknown.
2. The import file may contain an error.

Solution:
Resolve any errors in RSLogix. Then, retry the tag export process in order to produce a new tag import file.

See Also:
Preparing for Automatic Tag Database Generation

Unable to generate a tag database for device <device name>. Reason: Import file not found

Error Type:
Warning

Possible Cause:
The file specified as the Tag Import File in the Database Settings tab of Device Properties cannot be found.

Solution:
Select a valid Tag Import file or retry the tag export process in RSLogix to produce a new Tag Import file.

See Also:
Preparing for Automatic Tag Database Generation
Logix Database Settings

Unable to generate a tag database for device <device name>. Reason: L5K File is invalid or corrupt

Error Type:
Warning

Possible Cause:
The file specified as the Tag Import File in the Database Settings tab of Device Properties is not an L5K file (or it is a corrupt L5K file).

Solution:
Select a valid L5K file or retry the tag export process in RSLogix to produce a new L5K file.

See Also:
Preparing for Automatic Tag Database Generation
Logix Database Settings

Unable to generate a tag database for device <device name>. Reason: Low memory resources

Error Type:
Warning

Possible Cause:
Memory required for database generation could not be allocated. The process is aborted.

Solution:
Close any unused applications and/or increase the amount of virtual memory. Then, try again.

Reference Material

Select a link from the list below for more information on a specific topic.

Choosing a Protocol Mode

Symbolic Mode

Symbolic Mode represents each Client/Server Tag address in the packet by its ASCII character name.

Benefits	Detriments
1. All the information needed to make a data request lies in the Client/Server Tag's address. 2. Only the data that is being accessed in the Client/Server Tags will be requested from the PLC. 3. Backward compatible.	1. High device turnaround time when processing the symbolic addresses. 2. Less requests per Multi Request Packet because the size of each request varies.

Note: To take advantage of the Multi-Request Packet optimization, as many tags should be represented in a single packet as possible. Since tag addresses are represented by their ASCII character name in the packet, the tag addresses should be as short as possible. For example, "MyTag" is preferred over "MyVeryLongTagNameThatContains36Chars."

Logical Modes

Logical Non-Blocking and Logical Blocking encapsulate two read protocols. The protocol used is automatically determined by the driver and is based on the controller revision. The table below summarizes the modes and the protocols to which they map.

Protocol Mode	Read Protocol Used		Write Protocol Used
	FRN V21 and Higher	FRN V20 and Lower	All FRN
Symbolic	Symbolic (Non-Blocking)	Symbolic (Non-Blocking)	Symbolic
Logical Non-Blocking	Symbol Instance Non-Blocking	Physical Non-Blocking*	Symbol Instance
Logical Blocking	Symbol Instance Blocking	Physical Blocking*	Symbol Instance

*Deprecated in V21.

The information necessary to perform Logical reads is retrieved in a controller project upload sequence performed automatically by the driver. For the sake of brevity, the term "Logical Address" will be used to represent the Symbol Instance ID or Physical Address, depending on the protocol used. The Logical Modes avoid the time-consuming address parsing and lookups that are required for every symbolic request.

Note: These Logical Modes are not available to Serial Gateway models.

Logical Non-Blocking Mode

Logical Non-Blocking Mode requests all Client/Server Tags individually and at a fixed size.

Benefits	Detriments
1. Contains the maximum request per Multi-Request Packet because each request is a fixed size. 2. Low device turnaround time because the Client/Server Tags are specified in the packet with their logical address. 3. Only the data that is being accessed in the Client/Server Tags will be requested from the PLC.	Initialization overhead when uploading the project to determine the logical addresses.

Note: This mode is preferred when the minority of Structure Tag members are referenced by a client/server.

Logical Blocking Mode

Logical Blocking retrieves all data for a Logix Tag in a single request that may be initiated by only one Client/Server Tag. When the data block is received, it is placed in a cache in the driver and then time stamped. Successive Client/Server Tags that belong to the given Logix Tag then get their data from this cache. When all tags are updated, a new request is initiated provided that the cache is not old. The cache is old when the current time > cache timestamp + tag scan rate. If this case holds, another block request is made to the device, the cache is refreshed, and the cycle repeats.

Benefits	Detriments

1. Contents will be retrieved on every read. 2. Low device turnaround time because the Client/Server Tags are specified in the packet with their logical address. 3. Contains the maximum request per Multi-Request Packet because each request is a fixed size.	1. Initialization overhead when uploading the project to determine the logical addresses. 2. If the minority of Logix Tags are referenced, it is slower than Logical Non-Blocking Mode (because more data is being accessed from the PLC than referenced in the Client/Server Tags).

Note: This mode is preferred when the majority of Structure Tag members are referenced by a client/server.

See Also: Performance Statistics and Tuning

Symbol Instance vs. Physical Protocol

Symbol Instance reads are CIP requests wherein the CIP Instance ID is used to specify a Native Tag in a read request. In Non-Blocking Mode, the CIP Member ID may be required to fully qualify the path to structure members and array elements. For example, the CIP Instance ID would represent the structure whereas the CIP Member ID represents the member within the structure. Because of the addition of CIP Member IDs required to fully qualify a Client/Server Tag, requests can vary in size. The deeper the nesting of structures, the more CIP Member IDS that are required to specify it, and the less requests that will fit in a single packet. Symbol Instance reads were introduced in FRN V21.

Physical reads are CIP requests wherein the DMA address is used to specify a Native Tag in a read request. In Non-Blocking Mode, the byte offset may be required to fully qualify the path to structure members and array element. For example, the starting DMA address would represent the structure whereas the byte offset represents the member within the structure. Ultimately the start + offset is the DMA address specified in the request: all requests are fixed in size (unlike Symbol Instance reads). No matter how deep structures are nested, the request will be the same size in the packet. Physical reads have been deprecated as of FRN V21.

RSLogix 5000 Project Edit Warning

There are three primary concerns with the controller project: making online edits, downloading a project while clients are connected, and accessing active tags.

Online Edits

There is no mechanism for detecting and handling project correlation errors resulting from online edits made to a project.

Caution: If online edits are made while clients are accessing active tags, the Allen-Bradley ControlLogix Ethernet Driver will access incorrect data for modified tags that will not be flagged as invalid. This only applies to Logical Protocol Modes.

Project Download

The Allen-Bradley ControlLogix Ethernet Driver has been designed to monitor for project correlation errors resulting from downloads; however, there must be data access occurring during the download. When a download is detected, the following mode-specific actions will take place.

Symbolic Mode

1. The download occurs and is detected.
2. The tags in progress are invalidated.
3. During download process, device is polled on a 2 second interval to detect if the download is complete.
4. Upon download completion, normal tag transactions resume.

Logical Modes

1. The download occurs and is detected.
2. The tags in progress are invalidated.
3. During download process, device is polled on a 2 second interval to detect if the download is complete.
4. On download completion, processed tags are demoted to Symbolic Mode.

5. 60 seconds after the project download, tags are promoted back to Logical Mode.
6. Normal tag transactions resume.

Caution: If data access is not occurring on a device during a download, the download operation will not be detected. This will result in invalid access to the controller's memory. To prevent this, have at least 1 tag accessing the controller every 500-1000ms so that downloads can be detected and handled properly.

Example
Only 1 tag is being accessed on a given device whose scan rate is 10 seconds.
Scan x @ time t
Download starts @ time t + 3 seconds
Download finishes @ time t + 8 seconds
Scan x+1 @ time t + 10

Note: In this example, the download operation is not caught.

SoftLogix 5800 Connection Notes

For proper operation, no Ethernet-based drivers (such as ethernet devices, remote devices via Gateway, and so forth) should be installed in RSLinx on the SoftLogix PC. With one or more Ethernet-based drivers installed, requests will return with CIP Error 0x5 Ext. Error 0x1 and CIP Error 0x8.

Connecting to a SoftLogix Soft PLC on the Same PC as the OPC Server

To connect the Allen-Bradley ControlLogix Ethernet Driver to a SoftLogix Soft PLC running on the same PC as the server, follow the instructions below.

1. Ensure that there are no Ethernet-based drivers currently running in RSLinx on the PC.
2. Verify that the **Ethernet/IP Message Module** is installed in the SoftLogix virtual chassis.
3. Open the server's **Device Propeties**. In the **General** tab, locate the Device ID value. It should not be "127.0.0.1, 1, <PLC_CPU_slot>". The Device ID should be set to "<specific_IP_address_of_PC>, 1, <PLC_CPU_slot>".

   For example, if the PC's IP address is 192.168.3.4 and the SoftLogix CPU is in slot 2 of the virtual chassis, then the correct Device ID would be "192.168.3.4, 1, 2".

Glossary

Term	Definition
Protocol Mode	The means by which Controller Tag addresses are specified in data access communication packets.
Default Type	Due to the symbolic nature of Logix Tag-Based Addressing, tags can be of any data type. This is in contrast to DF1 where file access (such as N7:0) is always a given set of data types (Word, Short). Because of this flexibility, there needs to be a data type that tags default to when no data type is explicitly set. This is the case when a tag is created in a client and assigned the data type "Native" or created in the server and assigned the data type "Default". In these cases, the tag in question will be assigned the data type set as the Default Type. There are also cases in Automatic Tag Database Generation where the Default Type is used to set a server tag's data type.
Gateway	Utilizing an EtherNet/IP communication module to obtain access to a DH+ or ControlNet network from the same backplane. Rack must contain an EtherNet/IP communication module and a DHRIO or CNB module.
Link Address	Unique identifier for an interface module (such as Node ID, IP address and so forth).
Packet	Stream of data bytes on the wire representing the request(s) being made. Packets are limited in size.
Logical Mode	A Protocol Mode in which Controller Tag addresses are specified by their logical address in the controller. This provides a performance increase over Symbolic Mode but requires a project upload to gather the logical addresses. There are two logical addresses that can be used. If the controller revision is V20 or lower, the logical address is the Physical (DMA) address. If the controller revision is V21 or higher, the logical address is the Symbol Instance ID. Non-Blocking: Each Client/Server Tag is requested individually from the device. Similar to Symbolic in nature but much faster in performance. Blocking: Each Controller Tag is requested as a single block of data. Each Client/Server Tag is updated via cache storage of this data in the server. Much faster performance over Symbolic Mode.
Port ID	Specifies a way out of the interface module in question (such as channel).
Project Upload	Initialization sequence required for the Logical Protocol modes. All tags, programs, and data types are uploaded from the controller in the process.
Routing	Utilizing one or more Logix racks to hop to another Logix rack.
Symbolic Mode	A Protocol Mode in which Controller Tag addresses are specified by their ASCII character equivalent. Each Client/Server Tag is requested individually. This provides immediate access to controller data without a project upload but is overall slower in performance when compared to any of the Logical Modes.
Tag Division	Special assignment of tags to devices whose Protocol Mode is set for Logical Blocking or Logical Non-Blocking Mode. Assignment is based on rules that maximize the performance of access to these tags.*

*For more information on tag division, refer to **Performance Statistics and Tuning** and **Optimizing Your Communications**.

Logix Tag-Based Addressing

Term	Definition
Array Element	Element within a Logix Array. For client/server access, the element must be an atomic. For example, ARRAYTAG [0].
Array with Offset	Client/Server Array Tag whose address has an Array Element specified. For example, ARRAYTAG [0] {5}.
Array w/o Offset	Client/Server Array Tag whose address has no Array Element specified. For example, ARRAYTAG {5}.
Atomic Data Type	A Logix, pre-defined, non-structured data type. Example: SINT, DINT.
Atomic Tag	A Logix Tag defined with an Atomic Data Type.
Client	An HMI/SCADA or data bridging software package utilizing OPC,DDE, or proprietary client/server protocol to interface with the server.
Client/Server Data Type	Data type for tags defined statically in the server or dynamically in a client. Supported data types in the server are listed in Data Type Descriptions. Supported data types in the client depends on the client in use.
Client/Server Tag	Tag defined statically in the server or dynamically in a client. These tags are different entities

	than Logix Tags. A Logix Tag name becomes a Client/Server Tag address when referencing such Logix Tag.
Client/Server Array	Row x column data presentation format supported by the server and by some clients. Not all clients support arrays.
Logix Data Type	A data type defined in RSLogix 5000 for Logix-platform controllers.
Logix Tag	Tag defined in RSLogix 5000 for Logix-platform controllers.
Logix Array	Multi-dimensional array (1, 2 or 3 dimensions possible) support within RSLogix 5000 for Logix-platform controllers. All Logix atomic data types support Logix Arrays. Not all Logix structure data types support Logix Arrays.
Logix Pre-Defined Data Type	Logix Data Type pre-defined for use in RSLogix 5000.*
Server	The OPC/DDE/proprietary server utilizing this Allen-Bradley ControlLogix Ethernet Driver.
Structure Data Type	A Logix data type (pre-defined or user-defined) that consists of members whose data types are atomic or structure in nature.
Structure Tag	A Logix Tag defined with a Structure Data Type.

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