



CODESYS Driver

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CODESYS Driver

Help version [1.017](#)

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Overview

The CODESYS Driver provides a reliable way to connect CODESYS-compliant controllers to client applications, including HMI, SCADA, Historian, MES, ERP, and countless custom applications.

Setup

Communication Protocol

CODESYS V2.3 Ethernet over ARTI

Maximum Channels and Devices

The maximum number of channels supported by this driver is 1024. The maximum number of devices per channel is 256.

Tag Database Creation

The Automatic Tag Database Generation feature of this driver has been designed to make setting up the OPC application less time consuming. This driver can be configured to automatically build a list of server tags within the server that correspond to device-specific data. The automatically generated OPC tags can then be browsed from the OPC client.

Device Timeouts

The driver does not support configurable timing parameters. These parameters are always set to the following values:

- **Connect Timeout:** 20 seconds
- **Request Timeout:** 10000 milliseconds
- **Retry Attempts:** 3 attempts

Channel Properties - General

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

Property Groups	<input checked="" type="checkbox"/> Identification	
General	Name	
Write Optimizations	Description	
Advanced	Driver	
	<input checked="" type="checkbox"/> Diagnostics	
	Diagnostics Capture	Disable

Identification

Name: User-defined identity of this channel. In each server project, each channel name must be unique. Although names can be up to 256 characters, some client applications have a limited display window when browsing the OPC server's tag space. The channel name is part of the OPC browser information.

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

Description: User-defined information about this channel.

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

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

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

Diagnostics

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

● **Note:** This property is disabled if the driver does not support diagnostics.

● For more information, refer to "Communication Diagnostics" in the server help.

Channel Properties - Ethernet Communications

Ethernet Communication can be used to communicate with devices.

Property Groups	Ethernet Settings	
General	Network Adapter	Default
Ethernet Communications		
Write Optimizations		
Advanced		

Ethernet Settings

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

Channel Properties - Write Optimizations

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

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

Write Optimizations

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

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

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

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

Channel Properties - Advanced

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

Property Groups	[-] Non-Normalized Float Handling	
General	Floating-Point Values	Replace with Zero
Write Optimizations	[-] Inter-Device Delay	
Advanced	Inter-Device Delay (ms)	0

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

- **Replace with Zero:** This option allows a driver to replace non-normalized IEEE-754 floating point values with zero before being transferred to clients.

- **Unmodified:** This option allows a driver to transfer IEEE-754 denormalized, normalized, non-number, and infinity values to clients without any conversion or changes.

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

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

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

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

Channel Properties - Communication Parameters

The Communication Parameters group is a collection of properties that configure communication parameters that apply to all devices within the channel.

Property Groups	[-] Communication Parameters	
General	Keep Alive (min)	1
Ethernet Communications		
Write Optimizations		
Advanced		
Communication Parameters		

Communication Parameters

Keep-Alive: Configure how many minutes the driver maintain an open connection with the device after all client references are removed. If no client references are added before the timeout expires, the connection is closed. If a client reference is added while the timer is active, the timeout is canceled, preventing the connection from being closed.

Device Properties - General

A device represents a single target on a communications channel. If the driver supports multiple controllers, users must enter a device ID for each controller.

Property Groups	General	
	Scan Mode	
	Timing	
	Auto-Demotion	
	Redundancy	
		Identification
	Name	
	Description	
	Channel Assignment	
	Driver	
	Model	
	ID Format	Decimal
	ID	2
	Operating Mode	
	Data Collection	Enable
	Simulated	No

Identification

Name: This property specifies the name of the device. It is a logical user-defined name that can be up to 256 characters long, and may be used on multiple channels.

Note: Although descriptive names are generally a good idea, some OPC client applications may have a limited display window when browsing the OPC server's tag space. The device name and channel name become part of the browse tree information as well. Within an OPC client, the combination of channel name and device name would appear as "ChannelName.DeviceName".

For more information, refer to "How To... Properly Name a Channel, Device, Tag, and Tag Group" in server help.

Description: User-defined information about this device.

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

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

Driver: Selected protocol driver for this device.

Model: This property specifies the specific type of device that is associated with this ID. The contents of the drop-down menu depends on the type of communications driver being used. Models that are not supported by a driver are disabled. If the communications driver supports multiple device models, the model selection can only be changed when there are no client applications connected to the device.

Note: If the communication driver supports multiple models, users should try to match the model selection to the physical device. If the device is not represented in the drop-down menu, select a model that conforms closest to the target device. Some drivers support a model selection called "Open," which allows users to communicate without knowing the specific details of the target device. For more information, refer to the driver help documentation.

ID: This property specifies the device's driver-specific station or node. The type of ID entered depends on the communications driver being used. For many communication drivers, the ID is a numeric value. Drivers that support a Numeric ID provide users with the option to enter a numeric value whose format can be changed to suit the needs of the application or the characteristics of the selected communications driver. The ID format can be Decimal, Octal, and Hexadecimal.

Note: If the driver is Ethernet-based or supports an unconventional station or node name, the device's TCP/IP address may be used as the device ID. TCP/IP addresses consist of four values that are separated by periods, with each value in the range of 0 to 255. Some device IDs are string based. There may be additional

properties to configure within the ID field, depending on the driver. For more information, refer to the driver's help documentation.

Operating Mode

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

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

Notes:

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

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

Device Properties - Scan Mode

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

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

Scan Mode: specifies how tags in the device are scanned for updates sent to subscribed clients. Descriptions of the options are:

- **Respect Client-Specified Scan Rate:** This mode uses the scan rate requested by the client.
- **Request Data No Faster than Scan Rate:** This mode specifies the maximum scan rate to be used. The valid range is 10 to 99999990 milliseconds. The default is 1000 milliseconds.
 - **Note:** When the server has an active client and items for the device and the scan rate value is increased, the changes take effect immediately. When the scan rate value is decreased, the changes do not take effect until all client applications have been disconnected.
- **Request All Data at Scan Rate:** This mode forces tags to be scanned at the specified rate for subscribed clients. The valid range is 10 to 99999990 milliseconds. The default is 1000 milliseconds.

- **Do Not Scan, Demand Poll Only:** This mode does not periodically poll tags that belong to the device nor perform a read to get an item's initial value once it becomes active. It is the client's responsibility to poll for updates, either by writing to the `_DemandPoll` tag or by issuing explicit device reads for individual items. *For more information, refer to "Device Demand Poll" in server help.*
- **Respect Tag-Specified Scan Rate:** This mode forces static tags to be scanned at the rate specified in their static configuration tag properties. Dynamic tags are scanned at the client-specified scan rate.

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

Device Properties - Auto-Demotion

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

Property Groups	Auto-Demotion	
General	Demote on Failure	Enable
Scan Mode	Timeouts to Demote	3
Timing	Demotion Period (ms)	10000
Auto-Demotion	Discard Requests when Demoted	Disable

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

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

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

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

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

Device Properties - Tag Generation

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

If the target device supports its own local tag database, the driver reads the device's tag information and uses the data to generate tags within the server. If the device does not natively support named tags, the driver creates a list of tags based on driver-specific information. An example of these two conditions is as follows:

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

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

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

On Device Startup

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

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

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

On Duplicate Tag

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

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

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

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

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

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

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

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

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


Automatic Tag Database Generation

- When tags are automatically generated, they are created with Client Access privileges matching the access privileges provided by the PLC wherever possible.
- Tags with Write Only privileges are generated with Read/Write Client Access privileges because there is no Write Only Client Access setting in the server.
- Tags that do not have Read or Write permissions are not generated as there is no corresponding access privilege in the server.
- According to the CODESYS Protocol, addresses must be defined in a PLC Program variable list or a Global variable list. The first group is always the location of the variable (Global or the name of PLC Program where the tag is defined).
- Arrays are always expanded during tag generation, meaning that a tag is created for each element in the array. No tag is generated for the array itself.

- When **Allow Automatically Generated Subgroups** is enabled, subgroups are created for each segment of a tag address, with a maximum depth of eight groups. The tag name is the part of the address left over after subgroups have been created.
- When array elements are generated, provided the nested group limit has not been reached, the tags are placed in a group named after the array to which they belong.



Examples

Tag Address	Groups	Tag Name
.myTag	Global	myTag
PLC_PRG.myTag	PLC_PRG	myTag
.myStruct.myArray[0]	Global.myStruct.myArray[x]	myArray[0]
PLC_PRG.myStruct.myArray[0]	PLC_PRG.myStruct.myArray[x]	myArray[0]
.group1...group8	Global.group1...group7	group8_myTag

 **Tip:** To make it easier to read, Groups have been concatenated together using periods (similar to how a user would access the tag via an OPC DA/UA client).

Device Properties - Communication Parameters

Communication parameters are properties used for establishing a connection to the device.

Property Groups	 Communication Parameters	
General	IP Address	255.255.25.255
Scan Mode	Port	1200
Auto-Demotion	Protocol	TCP/IP (Level 2)
Tag Generation	Layer 7 Motorola Byte Order	Disable
Communication Parameters	Device Motorola Byte Order	Disable
Advanced Logging	PLC Login	Enable
Redundancy	Target ID	0
	ELAU-Max4 Version	Disable
	 Performance	
	Tags per Request	5

Communication Parameters

IP Address: Specify the IP address for the target device.

Port: Specify the Ethernet / IP port number on the target device.

Protocol: Specify the protocol in use in this device.

Layer 7 Motorola Byte Order: Specify if Layer 7 uses the Motorola byte order (Big Endian).

Device Motorola Byte Order: Specify if the target device uses the Motorola byte order (Big Endian). In most cases, this is set to the same value as Layer 7 Motorola Byte Order.

PLC Login: Specify if the driver should stay logged into the PLC after connecting. This setting should be disabled if the PLC only supports a single client connection, otherwise it should be enabled.

Target ID: Specify the identity if this is a sub-PLC device. PLCs that require communications to be routed through another PLC are called sub-PLCs. The target ID provides additional address information required to communicate with sub-PLCs. When not communicating with a sub-PLC, this setting should be 0.

ELAU-Max4 Version: Specify the hardware revision of the target PLC. This value should be disabled except when the device is an ELAU Max 4 1100 or 1200.

Performance

Tags per Request: Maximum number of tags to include in a single request. For each single request, there is some service overhead. In general, it is better to handle several items in one request instead of request each item separately. However, requesting many items in one request causes the round-trip time (answer time) to rise. Depending on the application, it may be better to split up huge lists in several small requests.

● **Note:** The number of writes per request is limited based on the [Duty Cycle](#) specified in the channel settings.

Device Properties - Redundancy

Property Groups	[-] Redundancy	
General	Secondary Path	...
Scan Mode	Operating Mode	Switch On Failure
Timing	Monitor Item	
Redundancy	Monitor Interval (s)	300
	Return to Primary ASAP	Yes

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

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

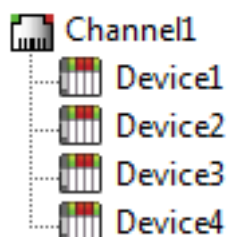
Performance Optimization

Optimizing Communications

With any programmable controller, there are unique ways for optimizing system throughput, and the CODESYS Driver is no different. The CODESYS Driver is designed to optimize reads and writes. For tags of all data types, requests are grouped into a single transaction. This provides drastic improvement in performance over single-tag transactions. The only limitation is on the number of tags that can fit in a single transaction.

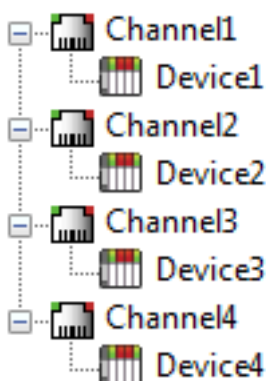
Optimizing the Application

While the driver is fast, there are a couple of guidelines to optimizing the application for maximum performance. Communications protocols like CODESYS are referred to as channels. 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 may then be defined under that channel. Each of these devices represents a single CODESYS controller from which data can be collected. This approach to defining the application provides a high level of performance, it doesn't take full advantage of the driver or the network. An example of how the application may appear when configured using a single channel is shown below.



In this example, each device appears under a single channel. In this configuration, the driver must move from one device to the next as quickly as possible 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 CODESYS Driver could only define a single channel, the example above would be the only option. However, the driver can define up to 1024 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 is defined under its own channel. In this configuration, a single path of execution is dedicated to the task of gathering data from each device. If the application has 1024 or fewer devices, it can be optimized exactly as shown here.

The performance improves even if the application has more than 1024 devices. While 1024 or fewer devices may be ideal, the application still benefits from additional channels. Spreading the device load across all channels causes the server to move from device to device again with far fewer devices to process on a single channel.

Data Types Description

Data Type	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
Float	32-bit IEEE floating point value
Double	64-bit IEEE floating point value
Date	64-bit IEEE date and time value
String	Null-terminated character array

For a description of CODESYS-platform specific data types, refer to CODESYS data types.

Unsupported Data Types

Unsupported data types include LBCD and BCD.

Symbolic Tag-Based Addressing

The CODESYS Driver uses a symbolic addressing structure for tags. These tags (commonly referred to as Native Tags) differ from conventional PLC data items in that the tag name itself is the address, not a physical or logical address.

Client / Server Tag Address Rules

CODESYS variable names correspond to client / server tag addresses. CODESYS variable names (entered via CODESYS PLC) follow the IEC 61131-3 identifier rules. Client / server tag addresses follow these same rules and are listed below:

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

Client / Server Tag Name Rules

The rules for tag name assignment in the server differs from address assignment because tag names cannot begin with an underscore.

Tag Scope

Global Tags

Global tags are CODESYS variables that have global scope in the controller. Any program or task can access the global tags, which use the following notation:

`.<tag name>`

`.<struct name>.<tag name>`

● **Note:** Structures can be nested within other structures, so a tag name may be prefixed by multiple structure entries (<outer struct>.<inner struct>.<my tag>).

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 have the same addressing rules and limitations as global tags. The only difference is that program tags are prefixed with the program name:

<program name>.<tag name>

OR

<program name>.<outer struct>.<inner struct>.<tag name>

Example:

"prog_1.tag_1": Program "prog_1" containing a tag called "tag_1"

Tag Addressing

There are two categories of variables supported by CODESYS: global and private. Each of these categories has a slightly different format. The following tables provides examples of the different CODESYS variables and their corresponding server addressing syntax.

Address Type	Address Syntax
Global variable	.MyTag
Global variable within a struct*	.MyStruct.MyTag
Private variable	Program.MyTag
Private variable within a struct*	Program.MyStruct.MyTag

* Multiple levels of structs are supported (up to eight levels deep).

Nested Structures

Symbolic tags have the potential to be nested deep within any number of structures (i.e. .Struct1.Struct2.Struct3.Struct4.Struct5.Struct6.Struct7.Struct8.Struct9.tag). To keep the tag hierarchy from becoming overly complex due to nested structures, Automatic Tag Generation prevents the server from generating tags more than eight groups deep. If the tag's hierarchy on the device exceeds eight groups, the remaining groups are placed in the tag name. For automatically generated tags, the first group is either GLOBAL or the Program Organization Unit (POU) name.

Notes:

1. This only applies when the Allow Automatically Generated Subgroups property is set to Enabled.
2. The symbol file contains data points for structures as a whole represented as a byte array. The server does not support these tags.

Arrays

CODESYS Drivers supports arrays for all basic types, as well as user-defined structures. This driver has partial support for the arrays that can be defined in a PLC. Both one- and two-dimensional arrays are supported for all types, except Strings and Structures. Strings and Structures must be accessed using the [array element](#) syntax. Neither three-dimensional arrays nor nested arrays can be read as arrays. They must be accessed element by element using the array element syntax.

It is necessary to provide the size of each of the array dimensions. The array size in the server must match the array size in the PLC to read or write the array. *See the table below for several examples.*

Address Type	Address Syntax
Global 1D Array (10 elements)	.myArray{10}
Private 1D Array (100 elements)	PLC_PRG.myArray {100}
Global 2D Array (9 elements)	.myArray{3}{3}
Private 2D Array (25 elements)	PLC_PRG.myArray {5}{5}

● **Note:** The maximum number of elements supported by an array is 65535.

Array Elements

If reading an entire array is not necessary or supported, it is possible directly access a particular array element. Element access is available for one, two, and three-dimensional arrays as well as nested arrays. See the table below for example address syntax. It is important to note that while Structures must be accessed as array elements, they must be accessed using each of their member variables because reading an entire structure as a single tag is not supported by OPC.

Address Type	Address Syntax
One-Dimensional Array Element	.myArray[0]
Two-Dimensional Array Element	.myArray[1,7]
Three-Dimensional Array Element	.myArray[2,4,5]
Nested Array Element (5 Levels)	.myNestedArray[1][0][4][5][9]
Nested 3D Array (2 Levels)	.my3DNestedArray[4,8,1][3,2,0]

● **Note:** Non-zero indexed arrays, arrays with a first element not beginning at zero, are supported. Example: To have the first element of a 1-indexed 1D array, use .myArray[1] as the address.

Access Privileges

Each tag described by a program's symbol file has specific access privileges: None, Read, Write, or Both (Read + Write). These privileges tell the server how the PLC program intends for each tag with which a client interacts, but these privileges can be overridden by the server. This is supported through the Client Access property on each tag. If a tag in the server is configured as Read Only, regardless of the Access Privileges reported by the device, the server only allows clients to perform Read operations. If the tag is configured as Read/Write, regardless of the access privileges reported by the device, clients can Read and Write to the tag.

When a user performs automatic tag generation, the tags are configured with the correct client access based on the access privileges reported by the device. There are two cases where this does not occur.

Write Only: Tags that report as being Write Only are generated as Read/Write tags with both Read and Write permissions as there is no Write Only setting for client access.

None: Tags that report as having permissions None are not supported either through automatic tag generation or through manual tag creation because there is no client access setting that can correctly represent this access privilege.

Addressing Atomic Data Types

The table below shows the available CODESYS data types and the OPC equivalents.

Atomic Data Type (CODESYS Type)	OPC Data Type
BOOL	Boolean
USINT	Byte, Char
SINT	Byte, Char
BYTE	Byte, Char
UINT	Short, Word
INT	Short, Word
DWORD	DWord, Long
UDINT	DWord, Long
DINT	DWord, Long
REAL	Float
LREAL	Double
TIME	DWord
TIME_OF_DAY	DWord
DATE	DWord, Date
DATE_AND_TIME	DWord, Date
STRING	String
ENUM	Short, Word

Unsupported CODESYS Data Types

The only unsupported data type is pointer.

• **See Also:** [Address Descriptions](#)

Event Log Messages

The following information concerns messages posted to the Event Log pane in the main user interface. Consult the server help on filtering and sorting the Event Log detail view. Server help contains many common messages, so should also be searched. Generally, the type of message (informational, warning) and troubleshooting information is provided whenever possible.

Tag generation failed because the device symbols could not be loaded. | Device = '<ChannelName.DeviceName>'.

Error Type:

Error

Possible Cause:

The automatic tag generation operation failed because the server could not access the symbol information on the device.

Possible Solution:

1. Verify that the device is capable of storing its own symbol information. Some devices do not have this capability, requiring symbol information to be manually exported and accessed by the server.
2. Ensure that the device communication parameters are correctly configured in the server.

Tag generation failed because communications could not be established with the device. | Device = '<ChannelName.DeviceName>'.

Error Type:

Error

Possible Cause:

The automatic tag generation operation failed because the server was unable to connect to the device.

Possible Solution:

1. Ensure that the device communication parameters are correctly configured in the server.
2. Check the physical connection between the server and the device.

Tag generation failed because an unexpected failure occurred. | Device = '<ChannelName.DeviceName>'.

Error Type:

Error

Possible Cause:

The automatic tag generation operation failed due to an unknown reason.

Possible Solution:

1. Ensure that the device communication parameters are correctly configured in the server.
2. Check the physical connection between the server and the device.
3. Ensure the device is functioning properly.
4. Contact technical support.

Internal Error. An unexpected error occurred. Resetting the PLC connection. | Transaction info = '<Transaction Type and Details>'.

Error Type:

Error

Possible Cause:

An unknown error occurred.

Possible Solution:

Attempt the operation again or contact technical support.

Error occurred while attempting to write tag. Unable to connect to the device. | Tag address = '<.mystruct.innerstruct.tag>'.

Error Type:

Error

Possible Cause:

The server failed to connect to the device.

Possible Solution:

1. Ensure that the device communication parameters are correctly configured in the server.
2. Check the physical connection between the server and the device.

Error occurred while attempting to connect to device. Failed to retrieve symbol list from device.

Error Type:

Error

Possible Cause:

The server could not access the symbol information on the device.

Possible Solution:

1. Verify that the device is capable of storing its own symbol information. Some devices do not have this capability, those devices are not currently supported.
2. Ensure that the device communication parameters are correctly configured in the server.

Internal error occurred while attempting to read tag. | Tag address = '<.mystruct.innerstruct.tag>'.

Error Type:

Error

Possible Cause:

The read failed due to an unknown reason.

Possible Solution:

Contact technical support.

Internal error occurred while attempting to write tag. | Tag address = '<.mystruct.innerstruct.tag>'.

Error Type:

Error

Possible Cause:

1. Non-ASCII characters were written to the string tag.
2. The write failed due to an unknown reason.

Possible Solution:

1. Only write ASCII characters to the string tag.
2. Contact technical support.

Error occurred while attempting to read tag. Unsupported data type or invalid address specified. | Tag address = '<.mystruct.innerstruct.tag>', data type = '<type>'.

Error Type:

Error

Possible Cause:

1. The specified data type is not supported.
2. The specified address is not valid.

Possible Solution:

Ensure that the correct data type and address are specified.

Error occurred while attempting to read tag. The specified tag address was not found on the device. | Tag address = '<.mystruct.innerstruct.tag>'.

Error Type:

Error

Possible Cause:

The tag address was not found on the device.

Possible Solution:

1. Verify that the correct address is specified.
2. Verify that the address exists on the device.

Error occurred while attempting to write tag. The specified tag address was not found on the device. | Tag address = '<.mystruct.innerstruct.tag>'.

Error Type:

Error

Possible Cause:

The tag address was not found on the device.

Possible Solution:

1. Verify that the correct address is specified.
2. Verify that the address exists on the device.

Error occurred while attempting to read tag. The specified server data type is not compatible with the device data type. | Tag address = '<.mystruct.innerstruct.tag>', server data type = '<type>', device data type = '<type>'.

Error Type:

Error

Possible Cause:

The specified server data type is not compatible with the device data type.

Possible Solution:

Change the server data type to one that is compatible with the device data type for this address.

Error occurred while attempting to write tag. The specified server data type is not compatible with the device data type. | Tag address = '<.mystruct.innerstruct.tag>', server data type = '<type>', device data type = '<type>'.

Error Type:

Error

Possible Cause:

The specified server data type is not compatible with the device data type.

Possible Solution:

Change the server data type to one that is compatible with the device data type for this address.

Internal error occurred while attempting to connect to device. The configuration provided is not valid.

Error Type:

Error

Possible Cause:

The configuration provided is not valid.

Possible Solution:

Contact technical support.

Error occurred while attempting to read tag. The array size must match between the server and device. | Tag address = '<.mystruct.innerstruct.tag>', server array size = '<length>', device array size = '<length>'.

Error Type:

Error

Possible Cause:

The array size does not match between the server and device.

Possible Solution:

Specify the same array size for both the server and device.

Error occurred while attempting to write tag. The array size must match between the server and device. | Tag address = '<.mystruct.innerstruct.tag>', server array size = '<length>', device array size = '<length>'.

Error Type:

Error

Possible Cause:

The array size does not match between the server and device.

Possible Solution:

Specify the same array size for both the server and device.

Error occurred while attempting to read tag. The specified tag address has a string length that is larger than the maximum supported by the server. | Tag address = '<.mystruct.innerstruct.tag>', Max length = '<number>' characters.

Error Type:

Error

Possible Cause:

The corresponding tag on the device has a string length larger than the maximum supported by the server.

Possible Solution:

Shorten the string length of the tag on the device to a value that is supported by the server.

Error occurred while attempting to write tag. The specified tag address has a string length that is larger than the maximum supported by the server. | Tag address = '<.mystruct.innerstruct.tag>', Max length = '<number>' characters.

Error Type:

Error

Possible Cause:

The corresponding tag on the device has a string length larger than the maximum supported by the server.

Possible Solution:

Shorten the string length of the tag on the device to a value that is supported by the server.

Data type for the given address is not supported. A tag is not generated for this data point. | Tag address = '<.mystruct.innerstruct.tag>'.

Error Type:

Warning

Possible Cause:

This is caused by having an unsupported data type in the PLC program.

Possible Solution:

Verify that the tag is the correct data type in the programming software. Correct or use a different data type (supported by the server) or data the unsupported type contains is not accessible.

The tag could not be added to the server because the address exceeds the maximum length. | Tag address = '<.mystruct.innerstruct.tag>', Max length = '<1024>' characters.

Error Type:

Warning

Possible Cause:

This is caused by having a tag address in the PLC program that exceeds the maximum length supported by the server.

Possible Solution:

Restructure the PLC program so that the tag address is shorter than the maximum length.

The tag could not be added to the server because it failed address validation. | Tag address = '<.mystruct.innerstruct.tag>'.

Error Type:

Warning

Possible Cause:

The tag address is malformed or is not supported by the server.

Possible Solution:

1. Verify the integrity of the symbol file or make a correction before trying again.
2. Verify or correct the tag address before trying again.

The value read from the string tag was truncated. | Tag address = '<.mystruct.innerstruct.tag>', maximum length = '<number>' characters.

Error Type:

Warning

Possible Cause:

The value read from the string tag was longer than the buffer size reported by the device.

Possible Solution:

Restart the server runtime.

The value written to the string tag was truncated. | Tag address = '<.mystruct.innerstruct.tag>', maximum length = '<number>' characters.

Error Type:

Warning

Possible Cause:

The value written to the string tag was longer than the buffer on the device.

Possible Solution:

1. Write a value that has a length less than or equal to the buffer on the device.
2. Make the buffer on the device large enough to fit the value being written.

Tags generated. | Tag count = <count>.

Error Type:

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