Siemens TCP/IP Ethernet Driver

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Siemens TCP/IP Ethernet Driver

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Tip: For S7 1200 and 1500 PLC support, consider the Siemens S7 Plus Ethernet Driver.

Version 1.131

Overview

The Siemens TCP/IP Ethernet Driver provides a reliable way to connect Siemens TCP/IP Ethernet devices to OPC client applications, including HMI, SCADA, Historian, MES, ERP, and countless custom applications. It is intended for use with Siemens S7-200, 300, 400, 1200, and 1500 PLCs. There are two options for communications:

- Industrial Ethernet TCP/IP interface communication processor (CP). The protocol used is S7 Messaging on Industrial Ethernet (ISO 8073 Class 0) over TCP/IP as defined in RFC1006.
- Hilscher's NetLink adapter. Only an MPI port is required. The NetLink adapter does not support the S7-200 model.

The driver requires no special libraries or hardware. A standard Ethernet card is all that is needed.

Setup

Supported Devices

S7-200 via CP243
S7-300 via CP343
S7-400 via CP443
S7-1200*
S7-1500*
S7-300 via NetLink
S7-400 via NetLink

*This device has a built-in Ethernet module.

Supported NetLink Cables and Gateways

NT 50-MPI
NL 50-MPI
NL-MPI

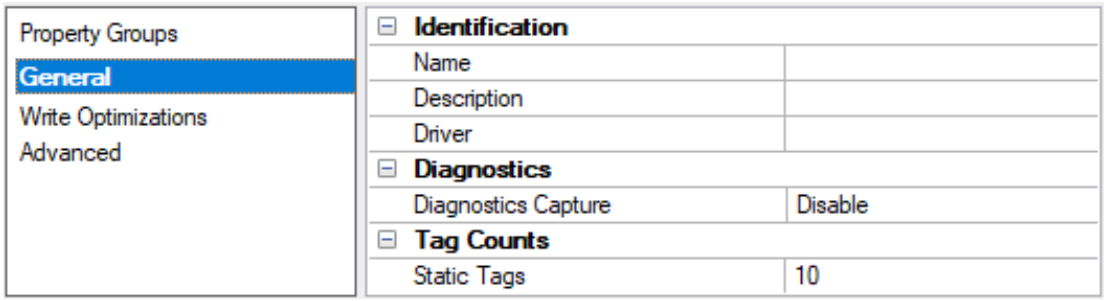
Note: For NetLink users, NetLink communication parameters (such as IP Address, Subnet Mask, and Baud Rate) can be configured using the NetLink Configuration utility. This application is located in the server's Utilities sub-directory and can be launched using the Start menu shortcut.

Channel and Device Limits

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

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.



Identification

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

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

Description: User-defined information about this channel.

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

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

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

Diagnostics

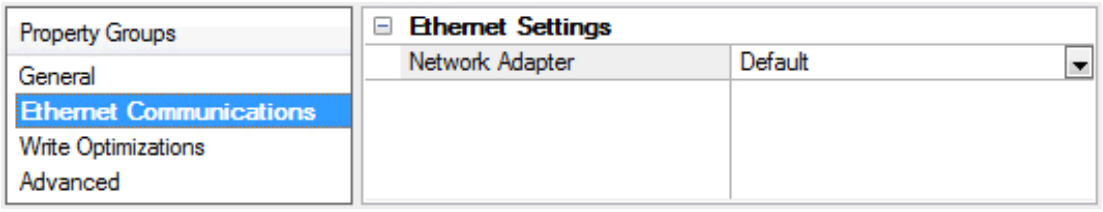
Diagnostics Capture: When enabled, this option makes the channel's diagnostic information available to OPC applications. Because the server's diagnostic features require a minimal amount of overhead processing, it is recommended that they be utilized when needed and disabled when not. The default is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

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

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

Channel Properties — Ethernet Communications

Ethernet Communication can be used to communicate with devices.

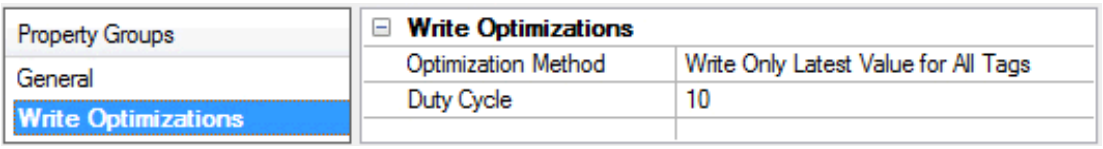


Ethernet Settings

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

Channel Properties — Write Optimizations

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



Write Optimizations

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

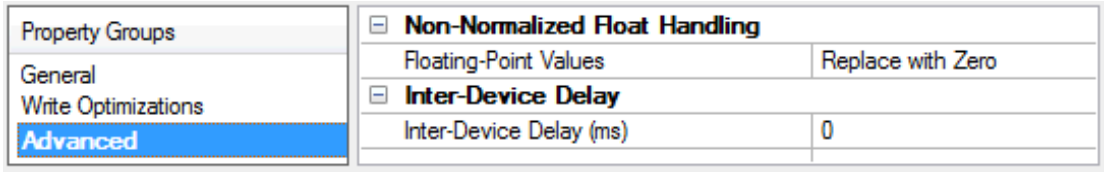
- **Write All Values for All Tags**: This option forces the server to attempt to write every value to the controller. In this mode, the server continues to gather write requests and add them to the server's internal write queue. The server processes the write queue and attempts to empty it by writing 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.



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

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

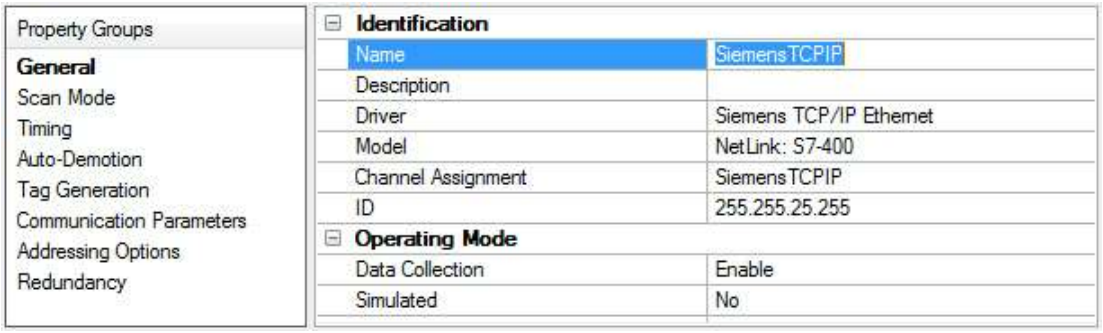
Note: This property is disabled if the driver does not support floating-point values or if it only supports the option that is displayed. According to the channel's float normalization setting, only real-time driver tags (such as values and arrays) are subject to float normalization. For example, EFM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

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

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

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

Device Properties — General



Identification

Name: User-defined identity of this device.

Description: User-defined information about this device.

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

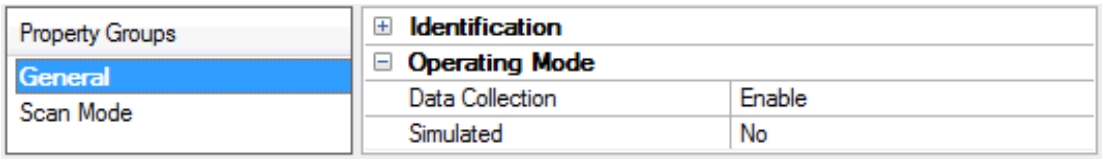
Driver: Selected protocol driver for this device.

Model: Select the specific version of the device.

ID: the unique identity of the device for communication with the driver. The device ID is formatted as *YYY.YYY.YYY.YYY*, where *YYY* designates the device's IP address. Each *YYY* byte should be in the range of 0 to 255. If the device supports host name resolution, the device ID may also be specified as a standard UNC/DNS name.

See Also: *Operating Mode*

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: Place the device into or out of 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.

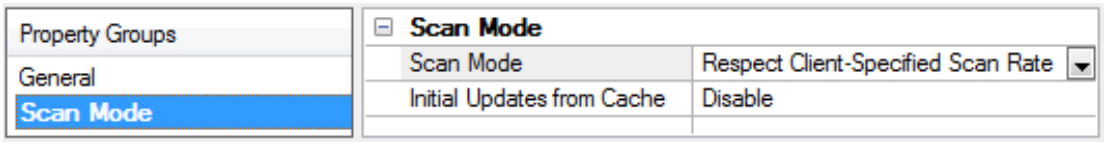
Notes:

1. Updates are not applied until clients disconnect and reconnect.
2. The 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.
3. 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.
4. When a device is simulated, updates may not appear faster than one (1) second in the client.

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

Device Properties — Scan Mode

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



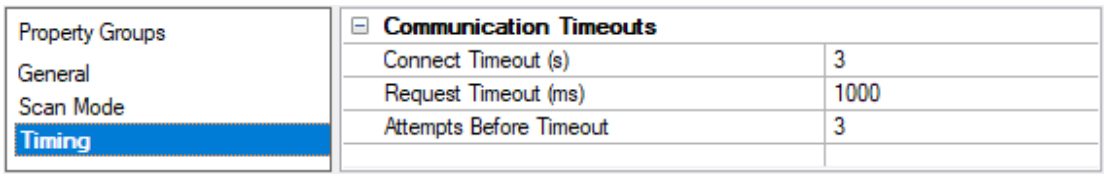
Scan Mode: Specify how tags in the device are scanned for updates sent to subscribing clients. Descriptions of the options are:

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

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

Device Properties — Timing

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



Communications Timeouts

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

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

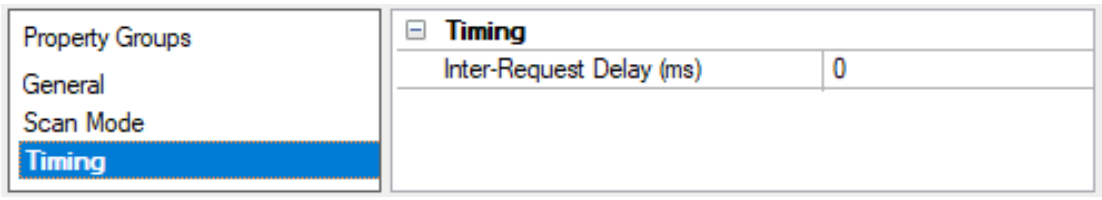
Request Timeout: Specify an interval used by all drivers to determine how long the driver waits for a response from the target device to complete. The valid range is 50 to 9999999 milliseconds (167 minutes). The default is usually 1000 milliseconds, but can vary depending on the driver. The default timeout for most serial drivers is based on a baud rate of 9600 baud or better. When using a driver at lower baud rates, increase the timeout to compensate for the increased time required to acquire data.

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

Timing

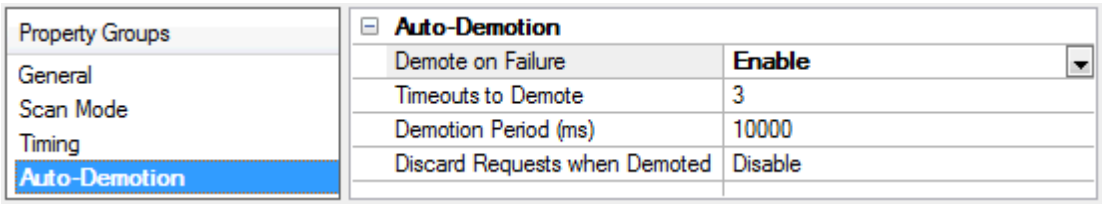
Inter-Request Delay: Specify how long the driver waits before sending the next request to the target device. It overrides the normal polling frequency of tags associated with the device, as well as one-time reads and writes. This delay can be useful when dealing with devices with slow turnaround times and in cases where network load is a concern. Configuring a delay for a device affects communications with all other devices on the channel. It is recommended that users separate any device that requires an inter-request delay to a separate channel if possible. Other communications properties (such as communication serialization) can extend this delay. The valid range is 0 to 300,000 milliseconds; however, some drivers may limit the maximum value due to a function of their particular design. The default is 0, which indicates no delay between requests with the target device.

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



Device Properties — Auto-Demotion

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



Demote on Failure: When enabled, the device is automatically taken off-scan until it is responding again.
Tip: Determine when a device is off-scan by monitoring its demoted state using the _AutoDemoted system tag.

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

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

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

Device Properties — Tag Generation

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

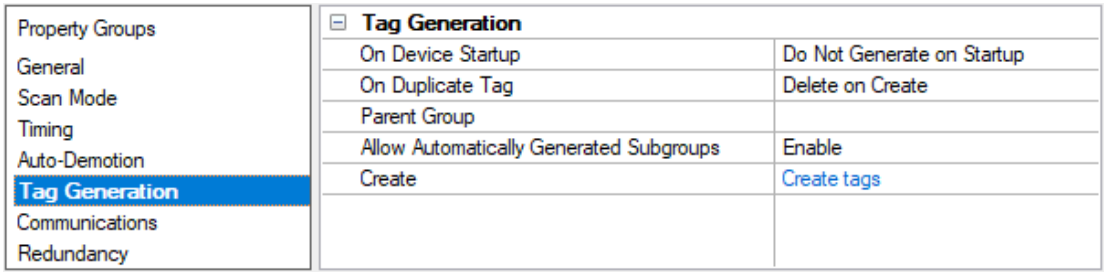
Not all devices and drivers support full automatic tag database generation and not all support the same data types. Consult the data types descriptions or the supported data type lists for each driver for specifics.

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

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

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

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



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

On Device Startup: Specify when OPC tags are automatically generated. Descriptions of the options are as follows:

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

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

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

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

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

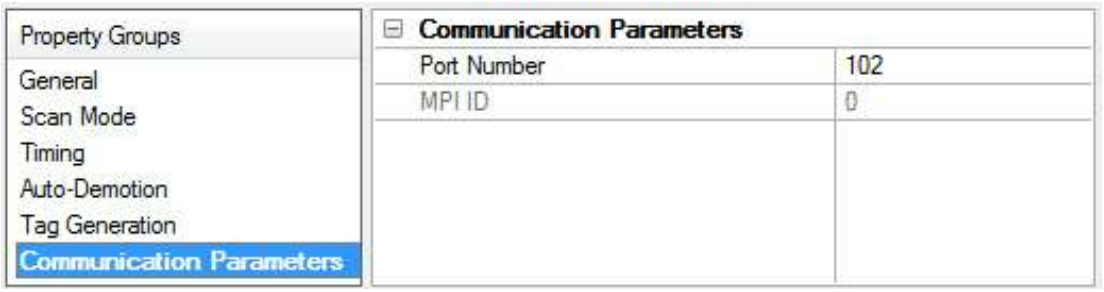
Note: Removing OPC tags affects tags that have been automatically generated by the communications driver as well as any tags that have been added using names that match generated tags. Users should avoid adding tags to the server using names that may match tags that are automatically generated by the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

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

Allow Automatically Generated Subgroups: This property controls whether the server automatically creates subgroups for the automatically generated tags. This is the default setting. If disabled, the server generates the device's tags in a flat list without any grouping. In the server project, the resulting tags are named with the address value. For example, the tag names are not retained during the generation process.
Note: If, as the server is generating tags, a tag is assigned the same name as an existing tag, the system automatically increments to the next highest number so that the tag name is not duplicated. For example, if the generation process creates a tag named "AI22" that already exists, it creates the tag as "AI23" instead.

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

Device Properties — Communications Parameters



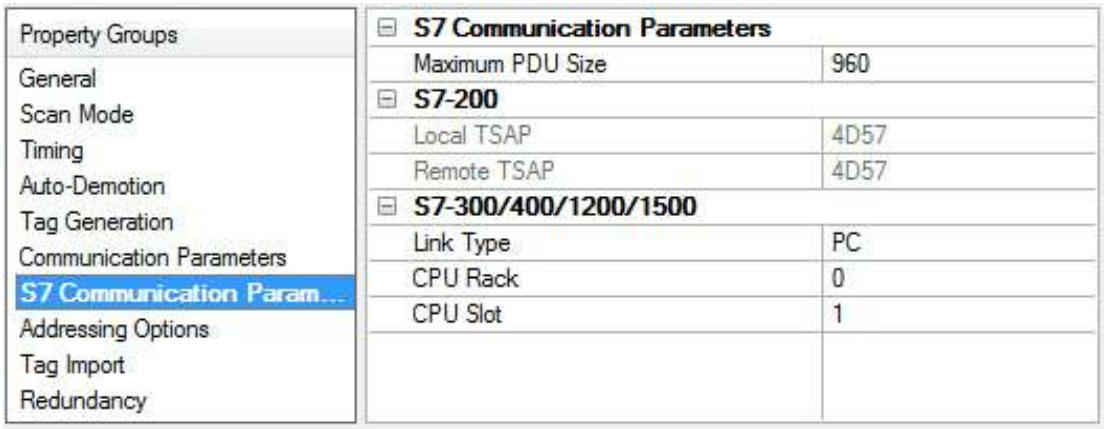
Port Number: This parameter specifies the port number that the remote CP is configured to use. The default setting for TCP/IP is 102 (TSAP). The default setting for NetLink is 1099.
Note: It is recommended that the default port be used for most applications, where the server and the PLC exist on the same network. For an application using the Internet through firewalls and advanced

routers, the port number can be changed to allow these operations to occur. In most cases, however, the PLC only accepts a connection on port 102/1099 and may require router forwarding.

MPI ID: This parameter is for NetLink only, and is configured for the port in which the NetLink adapter is connected. It does not apply to models utilizing the TCP/IP CPs (such as S7-300 and S7-400). A maximum of two connections or devices via TCP are possible when using the NetLink adapter.

Device Properties — S7 Communication Parameters

The S7 family includes specific parameters, which are broken out into the following groups: **S7 Communication Parameters**, **S7-200**, and **S7-300/400/1200/1500**.



S7 Communication Parameters

Maximum PDU Size: This parameter establishes the maximum Protocol Data Unit (PDU) size that will be requested from the device. The actual PDU used for communication depends on what the device supports. Typically, the driver and device negotiate the highest supported PDU size. However, this parameter can force a lower PDU size than would normally be negotiated.
Note: To observe the PDU value negotiated with the device, use the _CurrentPDUSize internal tag *(See **Internal Tags**)*.

S7-200

S7-200 enables communication with S7-200 devices on an Ethernet network. There are two options:

- PG connection (such as, a connection utilized by Micro/WIN). One connection is available.
- Configured connection (such as, a connection configured in Micro/WIN via the Ethernet wizard). Eight connections are available.

Note: Configured connections are recommended because they free the PG port for Micro/WIN and also provide flexibility to make multiple concurrent connections.

Local TSAP

Link Type	TSAP Value (hex)
PG	4B57 ('KW')
Configured	A remote (client) TSAP configured in Micro/WIN's Ethernet wizard. If Micro/WIN remote TSAP=xx.yy*, set local TSAP to xxyy.

Remote TSAP

Link Type	TSAP Value (hex)
PG	4B57 ('KW')
Configured	A local (server) TSAP configured in Micro/WIN's Ethernet wizard. If Micro/WIN remote TSAP=xx.yy*, set local TSAP to xxyy.

*TSAP as displayed in Micro/WIN's Ethernet wizard. When accessed from V memory, the value may be in decimal form. For example, if TSAP is 10.00, the V memory value is 1000 hex or 4096 decimal. The values entered for Local TSAP must be in hexadecimal notation; in this example, the value 1000 would be entered.

Tip: Local TSAP==Micro/WIN remote TSAP, Remote TSAP==Micro/WIN local TSAP.

*For information on using the CP243-1 module, refer to **How to Configure S7-200 Connections in Micro/WIN**.*

S7-300/400/1200/1500

Link Type: Defines the communication connection between the driver and the CP. The type of link chosen determines the number of simultaneous requests allowed. The greater the number of simultaneous requests, the greater the data throughput. Each device connection is allowed one outstanding request. To achieve multiple simultaneous requests, multiple connections must be configured. This is achieved by defining the device multiple times in the server (identical device properties). The devices can be defined within the same channel or under separate channels.
*For more information, refer to **Optimizing Communication**.*

Channel.Device=1 CP connection

There are three types of links: PC (applications), OP (operator panel), and PG (programming device). OP and PG are usually reserved, but can be used if all PC connections are taken.

Type	S7-300 CPU 314, 315	S7-400 CPU 412, 413	S7-400 CPU 414	S7-400 CPU 416
PC	2	14	30	62
OP	1	1	1	1
PG	1	1	1	1

Example
Given an S7-400 CPU 412 device, 14 simultaneous requests can be achieved by defining 14 identical devices in the server with all configured for Link Type PC. In addition to the PC connections, two more devices can be configured for Link Type OP and PG. This provides 16 connections overall.

Connection resources are shared amongst applications communicating with the CP. If another application such as STEP 7 is configured to use Industrial Ethernet over TCP/IP, at least one PG/PC connection must be left open for that application.

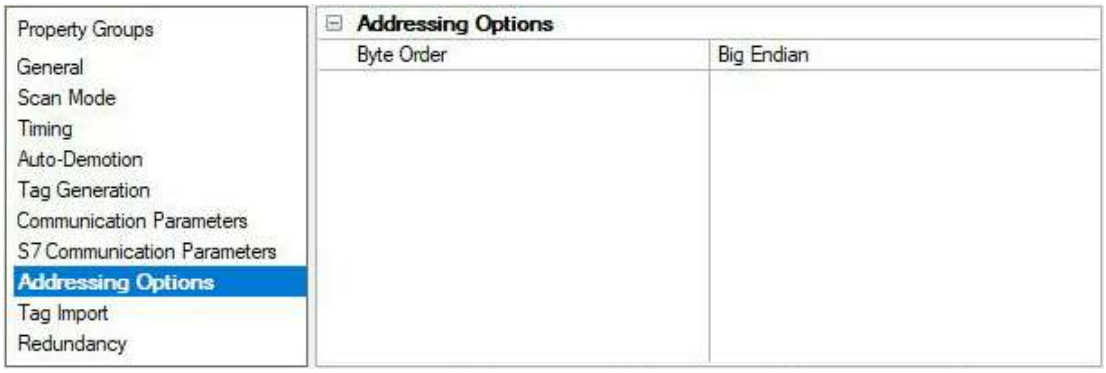
*For information on increasing the number of PG, OP, and PC type connections, refer to **How to Configure S7-300/400 Connections in STEP 7**.*

CPU Rack: The number of the rack in which the CPU of interest resides.

CPU Slot: The number of the slot in the rack in which the CPU of interest resides.

*For information on how to read or write the rack number or slot number using an internal tag, refer to **Internal Tags**.*

Device Properties — Addressing Options



Byte Order : establishes the order for 16-bit and 32-bit values. Options include Big Endian (S7 Default) or Little Endian, explained below.

Big Endian

DWord 1																															
-7	-6	-5	-4	-3	-2	-1	-0	1-5	1-4	1-3	1-2	1-1	1-0	-9	-8	2-3	2-2	2-1	2-0	1-9	1-8	1-7	1-6	3-1	3-0	2-9	2-8	2-7	2-6	2-5	2-4
Word 1																Word 3															
-7	-6	-5	-4	-3	-2	-1	-0	1-5	1-4	1-3	1-2	1-1	1-0	-9	-8	7	6	5	4	3	2	1	0	1-5	1-4	1-3	1-2	1-1	1-0	9	8
Byte 1								Byte 2								Byte 3								Byte 4							
-7	-6	-5	-4	-3	-2	-1	-0	7	6	5	4	3	2	-1	-0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Bits

- The bit range for DWord 1 is 31-0.
- The bit range for Word 1 and Word 3 is 15-0.
- The bit range for Byte 1, Byte 2, Byte 3, and Byte 4 is 7-0.

Note: Big Endian uses bytes ordered from highest to lowest. The bit order is never changed.

Little Endian

DWord 1																															
3-1	3-0	2-9	2-8	2-7	2-6	2-5	2-4	2-3	2-2	2-1	2-0	1-9	1-8	1-7	1-6	1-5	1-4	1-3	1-2	1-1	1-0	-9	-8	-7	-6	-5	-4	-3	-2	-1	-0
Word 3																Word 1															
1-5	1-4	1-3	1-2	1-1	1-0	9	8	7	6	5	4	3	2	1	0	1-5	1-4	1-3	1-2	1-1	1-0	-9	-8	-7	-6	-5	-4	-3	-2	-1	-0
Byte 4								Byte 3								Byte 2								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	-1	-0	-7	-6	-5	-4	-3	-2	-1	-0

Bits

- The bit range for DWord 1 is 31-0.
- The bit range for Word 3 and Word 1 is 15-0.
- The bit range for Byte 4, Byte 3, Byte 2, and Byte 1 is 7-0.

Note: Little Endian uses bytes ordered from lowest to highest. The bit order is never changed.

Device Properties — Tag Import

The Tag Import parameters allow automatic tag database generation from projects defined in Siemens STEP 7 orin Siemens TIA Portal that were exported via the TIA Portal Exporter.

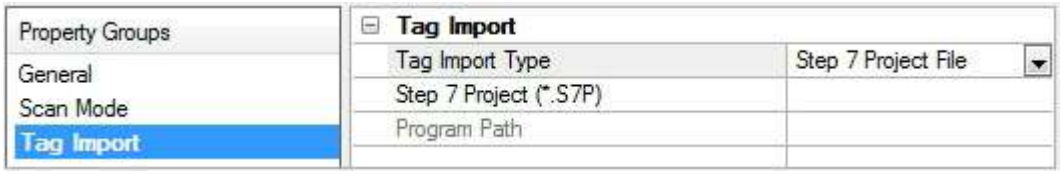
Supported Models via Siemens STEP 7

S7-300
S7-400

Supported Models via Siemens TIA Portal

S7-300
S7-400
S7-1200
S7-1500

STEP 7 Tag Import



Tag Import Type: Select "Step 7 Project File" from the drop-down menu.

STEP 7 Project (*.S7P): Locate and select the desired STEP 7 project file (*.S7P) from which to import tags.
Note: The desired STEP 7 project file (*.S7P) must be located in the Step 7 project directory to import tags.

Program Path: Specify the PLC program within the project for which tags should be generated. The program path format is "Station Name\CPU Name\Program Name" and the program path selection drop-down list can be populated with stations that have single or multiple CPUs. When a station with multiple CPUs is found, each CPU associated with the station has a CPU ID designator formatted as " @ ID x" appended to the CPU name portion of program path.
For example: A SIMATIC 400 controller with two 400 CPUs would have two entries:

- "=K51 S7-400\K34 CPU @ ID 3\K34"
- "=K51 S7-400\CPU 416-3 DP @ ID 2\K51"

Note: Tag import for the Siemens S7-300 and S7-400 devices have been qualified for use with projects created from Siemens Simatic STEP 7 versions 5.3, 5.4, and 5.5.

Important: Tag import for the Siemens TCP/IP Ethernet Driver supports tag names and comments in the native character set as specified by the Windows code page in the Siemens STEP 7 project's language file. A missing, altered, corrupt, or incorrect Siemens STEP 7 language file may cause tag names and comments to

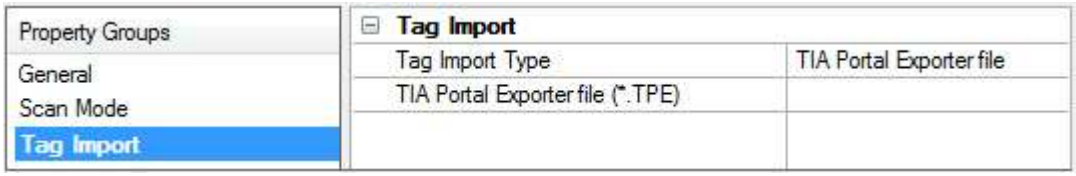
import incorrectly. Utilizing the STEP 7 language-neutral option (which allows text to be entered in a different character set than what is used in the STEP 7 language file) may also cause tag names and comments to import incorrectly. The STEP 7 language file can be located in the Global sub-directory of the STEP 7 project root. Automatic tag generation may result in the display of incorrect characters if the necessary language packs are not installed on the system.

***See Also**: Appendix: Configuring Siemens Connections*

TIA Portal Tag Import

The TIA Portal Exporter can export tags from a Siemens TIA Portal project into the server. This utility opens a project, and allows the selection of program blocks, tag tables, or individual tags for export. Tags are exported into a format which can be consumed by the Siemens TCP/IP Ethernet Driver Automatic Tag Generation process.

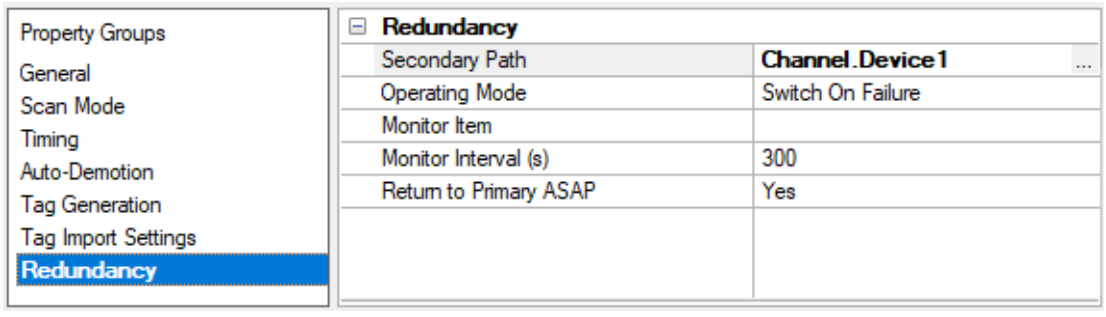
When Siemens TCP/IP Ethernet Driver is installed, the application installer for TIA Portal Exporter is saved in the Server's "Utilities" folder. Copy the installer to a computer that has Siemens TIA Portal and the Openness API installed. Run the installer and refer to the instructions in the Help documentation to create a *.TPE export file.



Tag Import Type: Select "TIA Portal Exporter file" from the drop-down menu.

TIA Portal Exporter file (*.TPE): Locate and select the desired TIA Portal Exporter file (*.TPE) from which to import tags.

Device Properties — Redundancy



Redundancy is available with the Media-Level Redundancy Plug-In.
Consult the website, a sales representative, or the user manual for more information.

Configuration API — Siemens TCP/IP Ethernet Example

For a list of channel and device definitions and enumerations, access the following endpoints with the REST client or refer to the appendices.

Channel Definitions

Endpoint (GET):

```
https://<hostname_or_ip>:<-
port>/config/v1/doc/drivers/Siemens%20TCP%2FIP%20Ethernet/channels
```

Device Definitions

Endpoint (GET):

```
https://<hostname_or_ip>:<-
port>/config/v1/doc/drivers/Siemens%20TCP%2FIP%20Ethernet/devices
```

Create Siemens TCP/IP Ethernet Channel

Endpoint (POST):

```
https://<hostname_or_ip>:<port>/config/v1/project/channels
```

Body:

```
{
"common.ALLTYPES_NAME": "MyChannel",
"servermain.MULTIPLE_TYPES_DEVICE_DRIVER": "Siemens TCP/IP Ethernet"
}
```

***See Also**: Appendix for a list of channel properties.*

Create Siemens TCP/IP Ethernet Device

Endpoint (POST):

```
https://<hostname_or_ip>:<port>/config/v1/project/channels/MyChannel/devices
```

Body:

```
{
"common.ALLTYPES_NAME": "MyDevice",
"servermain.DEVICE_ID_STRING": "<IP Address>",
"servermain.MULTIPLE_TYPES_DEVICE_DRIVER": "Siemens TCP/IP Ethernet",
"servermain.DEVICE_MODEL": <model enumeration>
}
```

where <IP Address> is the device's address.

Tip: The above minimum required properties are adequate to define a NetLink device as well.
***See Also**: Device Properties and Device Model Enumerations.*

Create Siemens TCP/IP Ethernet Tags

Endpoint (POST):

```
https://<hostname_or_ip>:<port>/config/v1/project/channels/MyChannel/devices/MyDevice/tags
```

Body:

```
[
{
"common.ALLTYPES_NAME": "MyTag1",
"servermain.TAG_ADDRESS": "DB1,INT00"
}
{
"common.ALLTYPES_NAME": "MyTag2",
"servermain.TAG_ADDRESS": "DB1,INT01"
}
]
```

***See Also**: Appendix for a list of tag properties.*

See server and driver-specific help for more information on configuring projects over the Configuration API.

Enumerations

Some properties, such as Device Model, have values that are mapped to an enumeration. A valid list of enumerations and their values can be found by querying the device endpoint with 'content=property_definitions 'or the documentation definitions endpoints.

For example, to view the property definitions for a device named "MyDevice" under a channel named "MyChannel", the GET request would be sent to:

```
https://<hostname_or_ip>:<-
port>/config/v1/project/channels/MyChannel/devices/MyDevice/?content=property definitions
```

Property definitions are also available for other objects such as channels or tags.

Alternatively, if enabled in the settings for the Configuration API, the channel and device property definitions for the driver can be viewed at:

```
https://<hostname_or_ip>:<port>/config/v1/doc/drivers/<drivername>/Channels
```

```
https://<hostname_or_ip>:<port>/config/v1/doc/drivers/<drivername>/Devices
```

Example Data Type Enumerations

Querying the documentation endpoint for tag data types provides the following enumerations:

```
{
   "Default": -1,
   "String": 0,
   "Boolean": 1,
   "Char": 2,
   "Byte": 3,
   "Short": 4,
   "Word": 5,
   "Long": 6,
   "DWord": 7,
   "Float": 8,
   "Double": 9,
   "BCD": 10,
```

```
  "LBCD": 11,
  "Date": 12,
  "LLong": 13,
  "QWord": 14,
  "String Array": 20,
  "Boolean Array": 21,
  "Char Array": 22,
  "Byte Array": 23,
  "Short Array": 24,
  "Word Array": 25,
  "Long Array": 26,
  "DWord Array": 27,
  "Float Array": 28,
  "Double Array": 29,
  "BCD Array": 30,
  "LBCD Array": 31,
  "Date Array": 32,
  "LLong Array": 33,
  " QWord Array": 34
}
```

Note: Supported data types vary by protocol and driver.

Device Model Enumerations

The Device Model property has values mapped to the following enumerations. The below table is for reference only; the information at the device endpoint is the complete and current source of information:

```
https://<hostname_or_ip>:<-
port>/config/v1/doc/drivers/Siemens%20TCP%2FIP%20Ethernet/Channels
```

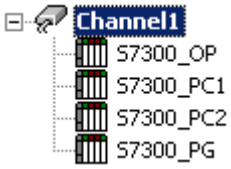
```
https://<hostname_or_ip>:<-
port>/config/v1/doc/drivers/Siemens%20TCP%2FIP%20Ethernet/Devices
```

Enumeration	Device Model
0	S7-200
1	S7-300
2	S7-400
3	S7-1200
4	S7-1500
5	NetLink: S7-300
6	NetLink: S7-400

Optimizing Communications

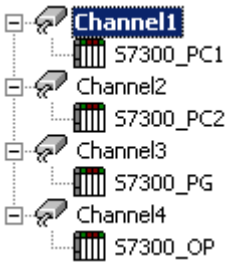
The Siemens TCP/IP Ethernet Driver was designed to provide the best performance with the least amount of impact on the system's overall performance. While the Siemens TCP/IP Ethernet Driver is fast, there are a couple of guidelines that can be used to optimize the application and gain maximum performance.

This server refers to communications protocols like Siemens TCP/IP 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 can then be defined under that channel. Each of these devices represents a single Siemens TCP/IP Ethernet controller from which data will be collected. Although this approach to defining the application provides a high level of performance, it does not take full advantage of the Siemens TCP/IP Ethernet Driver or the network. An example of how the application may appear when configured using a single channel is shown below.



Each device is defined 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 Siemens TCP/IP Ethernet Driver could only define one channel, the example above would be the only option available; 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 is shown below.



Each device can be defined under its own channel. In this configuration, a single path of execution is dedicated to the task of gathering data from each device.

The performance will improve even if the application has more than 1024 devices. While 1024 or fewer devices may be ideal, the application will still benefit from additional channels. Although 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.

Although the maximum number of channels is 1024, the device ultimately determines the number of allowed connections. This constraint comes from the fact that some devices cannot support so many connections. For these devices, the maximum number of channels defined should equal the maximum number of connections allowed. For devices that support more connections, the maximum of 1024 channels should be defined, with devices spread evenly over these channels.

For more information on device connections, refer to ***Device Properties****.*

Data Types Description

Data Type	Description
Boolean	Single bit
Byte	Unsigned 8-bit value
Char	Signed 8-bit value
Word	Unsigned 16-bit value bit 0 is the low bit bit 15 is the high bit
Short	Signed 16-bit value bit 0 is the low bit bit 14 is the high bit bit 15 is the sign bit
BCD	Two-byte packed BCD Value range is 0-9999. Behavior is undefined for values beyond this range.
DWord	Unsigned 32-bit value bit 0 is the low bit bit 31 is the high bit
Long	Signed 32-bit value bit 0 is the low bit bit 30 is the high bit bit 31 is the sign bit
LBCD	Four-byte packed BCD Value range is 0-99999999. Behavior is undefined for values beyond this range.
Float	32-bit floating-point value The driver interprets two consecutive registers as a floating-point value by making the second register the high word and the first register the low word.
Date	64-bit floating-point value
QWord	Unsigned 64-bit value bit 0 is the low bit bit 63 is the high bit
LLong	Signed 64-bit value bit 0 is the low bit bit 62 is the high bit bit 63 is the sign bit
Double	64-bit floating point value
String	Null-terminated ASCII string*

*The Data Block subtype, String, is a NULL padded ASCII string.

Address Descriptions

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

S7-200 Address Descriptions

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

Address Type	Range	Type	Access
Discrete Inputs (IEC)	I0.b-I65535.b .b is Bit Number 0-7 IB0-IB65535 IW0-IW65534 ID0-ID65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write
Discrete Inputs (SIMATIC)	E0.b-E65535.b .b is Bit Number 0-7 EB0-EB65535** EW0-EW65534 ED0-ED65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write
Note: I and E access the same memory area.			
Discrete Outputs (IEC)	Q0.b-Q65535.b .b is Bit Number 0-7 QB0-QB65535 QW0-QW65534 QD0-QD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read /

Address Type	Range	Type	Access
			Write
Discrete Outputs (SIMATIC)	A0.b-A65535.b .b is Bit Number 0-7 AB0-AB65535 AW0-AW65534 AD0-AD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write
Note: Q and A access the same memory area.			
Analog Inputs (IEC)	AI0-AI65534*** AIW0-AIW65534	**Word**, Short	Read Only
Analog Inputs (SIMATIC)	AE0-AE65534*** AEW0-AEW65534	**Word**, Short	Read Only
Note: AI and AE access the same memory area.			
Analog Outputs (IEC)	AQ0-AQ65534*** AQW0-AQW65534	**Word**, Short	Read / Write
Analog Outputs (SIMATIC)	AA0-AA65534*** AAW0-AAW65534	**Word**, Short	Read / Write
Note: AQ and AA access the same memory area.			
Internal Memory	M0.b-M65535.b .b is Bit Number 0-7 MB0-MB65535 MW0-MW65534 MD0-MD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write
Special Memory (Bytes 0-29 are Read Only)	SM0.b-SM65535.b .b is Bit Number 0-7 SMB0-SMB65535 SMW0-SMW65534 SMD0-SMD65532	Boolean **Byte**, Char, String** **Word**, Short, BCD **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write
Sequence Control Relay (SCR)	S0.b-S65535.b .b is Bit Number 0-7	Boolean	Read / Write

Address Type	Range	Type	Access
	SB0-SB65535 SW0-SW65534 SD0-SD65532	**Byte**, Char, String** **Word**, Short, BCD **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write
Variable Memory	V0.b-V65535.b .b is Bit Number 0-7 VB0-VB65535 VW0-VW65535 VD0-VD65535	Boolean **Byte**, Char, String** **Word**, Short, BCD **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write
Timer Current Values	T0-T65535*	DWord, **Long**	Read / Write
Timer Status Bit	T0-T65535*	Boolean	Read Only
Counter Current Values (IEC)	C0-C65535*	**Word**, Short	Read / Write
Counter Status Bit (IEC)	C0-C65535*	Boolean	Read Only
Counter Current Values (SIMATIC)	Z0-Z65535*	**Word**, Short	Read / Write
Counter Status Bit (SIMATIC)	Z0-Z65535*	Boolean	Read Only
Note: C and Z access the same memory area.			
High-Speed Counter	HC0-HC65535*	DWord, **Long**	Read Only

*These memory types/subtypes do not support arrays.
**Byte memory types (MB) support strings. The syntax for strings is <*address*>.<*length*> where 0 < *length* <= 932 (see notes below).
***For Analog Inputs and Outputs, the address must be even (AI0, AI2, AI4, and so forth).

Notes:

1. All offsets for memory types I, Q, M, S, and SM represent a byte starting location within the specified memory type.
2. Use caution when modifying Word, Short, DWord, and Long types. For I, Q, and F, each address starts at a byte offset within the device. Therefore, Words MW0 and MW1 overlap at byte 1. Writing to MW0 will also modify the value held in MW1. Similarly, DWord, and Long types can also overlap. It is recommended that these memory types be used so that overlapping does not occur. For example, DWord MD0, MD4, MD8, and so on can be used to prevent overlapping bytes.
3. The total number of bytes being requested cannot exceed the data portion of the negotiated PDU size. For example, for a 960-byte PDU size, the largest single array that may be read or written is 932 bytes. If arrays exceed the negotiated PDU size, they may fail to be read or written.

Arrays

All memory types/subtypes with the exception of those marked with an asterisk support arrays. The valid syntax for declaring an array is as follows:

<address>[rows][cols]
<address>.rows.cols
<address>,rows,cols
<address>_rows_cols

Notes:

1. If no rows are specified, a row count of 1 is assumed.
2. For Word, Short, and BCD arrays, the base address + (*rows* * *cols* * 2) cannot exceed 65536. Keep in mind that the elements of the array are words, located on a word boundary. For example, IW0[4] would return IW0, IW2, IW4, and IW6.
3. For Float, DWord, Long, and Long BCD arrays, the base address + (*rows* * *cols* * 4) cannot exceed 65536. Keep in mind that the elements of the array are DWord, located on a DWord boundary. For example, ID0[4] will return ID0, ID4, ID8, and ID12.
4. For all arrays, the total number of bytes requested cannot exceed the data portion of the negotiated PDU size. For example, for a 960-byte PDU size, the largest single array that may be read or written is 932 bytes. If arrays exceed the negotiated PDU size, they may fail to be read or written.

Note: The offset for an atomic type tag in a data block is denoted by the column "Address" in Step 7, as shown above. This offset is denoted by the column "Offset" in the Siemens TIA Portal programming environment.

S7-300 Address Descriptions

Standard Support
S7-300/400/1200/1500 Item Syntax
Internal Tags

Third-Party Support
For users familiar with third-party applications, limited addressing support is available.

Legacy Support
Legacy S7-300/400 Item Syntax

S7-400 Address Descriptions

Standard Support
S7-300/400/1200/1500 Item Syntax
Internal Tags

Third-Party Support
For users familiar with third-party applications, limited addressing support is available.

Legacy Support
Legacy S7-300/400 Item Syntax

S7-1200 Address Descriptions

Standard Support
S7-300/400/1200/1500 Item Syntax
Internal Tags

Third-Party Support
For users familiar with third-party applications, limited addressing support is available.

Legacy Support
Legacy S7-300/400 Item Syntax

S7-1500 Address Descriptions

Standard Support
S7-300/400/1200/1500 Item Syntax
Internal Tags

Third-Party Support
For users familiar with third-party applications, limited addressing support is available.

Legacy Support
Legacy S7-300/400 Item Syntax

ep - NetLink: S7-300 Address Descriptions

Standard Support
S7-300/400/1200/1500 Item Syntax

Third-Party Support
For users familiar with third-party applications, limited addressing support is available.

Legacy Support
Legacy S7-300/400 Item Syntax

NetLink: S7-400 Address Descriptions

Standard Support
S7-300/400/1200/1500 Item Syntax

Third-Party Support
For users familiar with third-party applications, limited addressing support is available.

Legacy Support
Legacy S7-300/400 Item Syntax

Internal Tags

Although the following internal tags are not visible in the server configuration, they can be browsed by the OPC client. They can be found under the <*Channel Name*>.<*Device Name*>._*InternalTags* group. If the OPC client does not support browsing, or if a non-OPC client is being used, the tags can be created dynamically and statically by using the addresses given below.

Note: The tags listed in the following table are valid for the S7-300, S7-400, S7-1200, and S7-1500 device models. The default data types are shown in **bold**.

Device Address	Description	Range	Data Type	Access
_RACK	Number of the rack in which the CPU of interest resides. On changing this device property, the connection with the CPU is re-established.	0-7	**Byte**, Short	Read / Write
_SLOT	Number of the slot in which the CPU of interest resides. On changing this device property, the connection with the CPU is re-established.	2-31	**Byte**, Short	Read / Write
_CurrentPDUSize	Subsequent to connection, this tag shows the size of the Protocol Data Unit which has been negotiated with the device. Prior to connection it shows the maximum configured PDU value.	240, 480, 960	**Word**	Read

Standard S7-300/400/1200/1500 Item Syntax

Address Syntax

Input, Output, Peripheral, Flag Memory Types
<*memory type*><*S7 data type*><*address*>
<*memory type*><*S7 data type*><*address*><.*bit*>
<*memory type*><*S7 data type*><*address*><.*string length*>*
<*memory type*><*S7 data type*><*address*><[*row*][*col*]>

Timer and Counter Memory Types
<*memory type*><*address*>

DB Memory Type

DB<*num*>,<*S7 data type*><*address*>
DB<*num*>,<*S7 data type*><*address*><.*bit*>
DB<*num*>,<*S7 data type*><*address*><.*string length*>*
DB<*num*>,<*S7 data type*><*address*><[*row*][*col*]>

where <num> ranges from 1 to 65535.

*Applies to S7 data types that support string. String length can vary from 0<n<= 932, with the exception of S7 data type string (which can vary from 0<n<= 254 for a PDU size of 480 and above, 0<n<= 210 for a PDU size below 480).

See Also: *Examples*, *String Support*

Memory Types

Memory Type	Description	Address Range	Data Type	Access
I E	Inputs	Dependent on S7 Data Type		Read / Write
Q A	Outputs			Read / Write
PI PE	Peripheral Inputs			Read Only
PQ PA	Peripheral Outputs			Read / Write
M F	Flag Memory			Read / Write
DB	Data Blocks			Read / Write
T	Timers	T0-T65535	DWord, **Long**	Read / Write
C Z	Counters	C0-C65535 Z0-Z65535	**Word**, Short	Read / Write

See Also: *Examples*

S7 Data Types

The S7 data type is used to coerce the data type for a tag. It does not apply to Timers and Counters. The default data types are shown in **bold**.

S7 Data Type	Description	Address Range	Data Type
B Byte	Unsigned Byte	B0-B65535 BYTE0-BYTE65535 B0.b-B65535.b BYTE0.b-BYTE65535.b .b is Bit Number 0-7 B0.n-B65535.n BYTE0.n-BYTE65535.n .n is string length. 0 < n <= 932.	**Byte**, Char Boolean String*
C Char	Signed Byte	C0-C65535 CHAR0-	Byte, **Char**

S7 Data Type	Description	Address Range	Data Type
		CHAR65535 C0.b-C65535.b CHAR0.b-CHAR65535.b .b is Bit Number 0-7 C0.n-C65535.n CHAR0.n-CHAR65535.n .n is string length. 0<n<= 932.	Boolean String*
D DWORD	Unsigned Double Word	D0-D65532 DWORD0-DWORD65532 D0.b-D65532.b DWORD0.b-DWORD65532.b .b is Bit Number 0-31	**DWord**, Long, LBCD, Float Boolean
DATE	S7 Date Stored as WORD in steps of 1 day since January 1, 1990. Displayed as string format "yyyy-mm-dd" with range "1990-01-01" to "2168-12-31". Read / Write	DATE0-DATE65534	**String**
DI DINT	Signed Double Word	DI0-DI65532 DINT0-DINT65532 DI0.b-DI65532.b DINT0.b-DINT65532.b .b is Bit Number 0-31	DWord, **Long**, LBCD, Float Boolean
DT	S7 Date_And_Time Complex data type stored with 8 bytes as follows: 0 year, 1 month, 2 days, 3 hours, 4 minutes, 5 seconds, 6 two most significant digits of MSEC, 7 (4MSB) two least significant digits of MSEC, 7 (4LSB) day of week (1=Sunday). Displayed as string format "m/d/y h:mm:ss <AM/PM>" with range "1/1/1990 0:00:00 AM" to "12/31/2089 23:59:59 PM". Displayed as date format	DT0-DT65528	**String**, Date

S7 Data Type	Description	Address Range	Data Type
	"yyyy-mm-ddThh:mm:ss.hhh" with range "1990-01-01T00:00:00.000" to "2089-12-31T23:59:59.998" Read Only		
I INT	Signed Word	I0-I65534 INT0-INT65534 I0.b-I65534.b INT0.b-INT65534.b .b is Bit Number 0-15	Word, **Short**, BCD Boolean
LINT	Signed Long Word (64-bit)	LINT0-LINT65528 LINT0.b-LINT65528.b .b is Bit Number 0-63	QWord, **LLong**, Boolean
LREAL	IEEE Double (64-bit)	LREAL0-LREAL65528	**Double**
LWORD	Unsigned Long Word (64-bit)	LWORD0-LWORD65528 LWORD0.b-LWORD65528.b .b is Bit Number 0-63	**QWord** LLong Boolean
REAL	IEEE Float	REAL0-REAL65532	**Float**
String	S7 String	STRING0.n-STRING65532.n .n is string length 0<n< 254 (PDU size of 480 and above) 0<n< 210 (PDU size below 480) 0<n< 245 (Netlink S7300 and Netlink S7400 Models)	**String**
T TIME	S7 TIME Stored as DWORD in steps of milliseconds. Displayed as string format "+/-ddD_hhH_mmM_ssS_hhhMS" with range "-24D_20H_31M_23S_648MS" to "24D_20H_31M_23S_647MS. Read / Write.	T0-T65532 TIME0-TIME65532	**String**

S7 Data Type	Description	Address Range	Data Type
TOD	S7 Time_Of_Day Stored as DWORD, representing milliseconds since midnight. Displayed as string format "h:m:s.mmm" with range "0:0:0.0" to "23:59:59.999". Read / Write	TOD0-TOD65532	**String**
W Word	Unsigned Word	W0-W65534 WORD0-WORD65534 W0.b-W65534.b WORD0.b-WORD65534.b .b is Bit Number 0-15	**Word**, Short, BCD Boolean
X	Bit	X0.b-X65534.b .b is Bit Number 0-15	**Boolean**

*These are raw strings that differ in structure and usage from the STEP 7 string data type.

Use caution when modifying Word, Short, DWord, and Long type as each address starts at a byte offset within the device. Therefore, Words MW0 and MW1 overlap at byte 1. Writing to MW0 will also modify the value held in MW1. Similarly, DWord, and Long types can also overlap. It is recommended that these memory types be used so that overlapping does not occur. For example, DWord MD0, MD4, MD8, and so on can be used to prevent overlapping bytes.

***See Also**: Examples*

String Support

Raw Strings

For an address DBx,By.n @ string, string values read and written are stored at byte offset y.

y	y+1	y+2	...	y+n-1
' '	' '	' '	...	' '

Raw strings are null-terminated. If the maximum string length is 10 and 3 characters are written, the fourth character is set to NULL, while characters 5-10 are left untouched.

Note: For raw strings, the total number of bytes requested cannot exceed the data portion of the negotiated PDU size. If raw strings exceed the negotiated PDU size, they may fail to be read or written.

String Support

The string subtype follows the STEP 7 string data type definition. The syntax for the string S7 data type is *STRINGy.n* where *y* is the Byte offset, and *n* is the maximum string length. If *n* is not specified, the maximum string length will be 254 characters when PDU size is >= 480, otherwise it will be 210. String values read and written are stored at byte offset y+2 in data block x. The actual string length gets updated with every write based on the string length of the string being written.

y	y+1	y+2	y+3	y+4	...	y+2+n-1
maximum string length (n)	actual string length	' '	' '	' '	...	' '

Notes:

1. String strings are NULL padded. If the maximum string length is 10 and 3 characters are written, characters 4-10 are set to NULL.
2. If a PDU of 240 is negotiated, STEP 7 strings with a length greater than 222 may fail to be read and strings with a length greater than 212 may fail to be written.

Hex Strings

The HEXSTRING subtype is specific to the Siemens TCP/IP Ethernet Driver. The syntax for the HEXSTRING subtype is *HEXSTRINGy.n*, where *y* is the byte offset and *n* is the length. The *n* value must be specified in the range of 1 through 932. String is the only valid data type for a HEXSTRING tag.

The value assigned to a HEXSTRING must be an even number of characters. There is no padding, so the entire string must be specified. For example, tag HexStr defined as DB1,STRING0.10 uses 10 bytes of storage and has a display length of 20. To assign a value, the string must be 20 characters long and contain only valid hexadecimal characters. An example valid hex string for this tag is “56657273696f6E353137”.

Array Support

The [rows][cols] notation is appended to an address to specify an array (such as MW0[2][5]). If no rows are specified, row count of 1 is assumed. Boolean arrays and string arrays are not supported.

For Word, Short, and BCD arrays, the base address + (rows * cols * 2) cannot exceed 65536. Keep in mind that the elements of the array are words, located on a word boundary. For example, IW0[4] would return IW0, IW2, IW4, and IW6.

For Float, DWord, Long, and Long BCD arrays, the base address + (rows * cols * 4) cannot exceed 65536. Keep in mind that the elements of the array are DWord, located on a DWord boundary. For example, ID0[4] will return ID0, ID4, ID8, ID12.

For all arrays, the total number of bytes requested cannot exceed the data portion of the negotiated PDU size. For example, for a 960-byte PDU size, the largest single array that may be read or written is 932 bytes. If arrays exceed the negotiated PDU size, they may fail to be read or written.

Timers

The Siemens TCP/IP Ethernet Driver automatically scales T values based on the Siemens S5 time format. Timer data is stored as a Word in the PLC but scaled to a DWord in the driver. The value returned will already be scaled using the appropriate Siemens time base. As a result, the values are always returned as a count of milliseconds. When writing to T memory, the Siemens time base will also be applied. To assign a value to a timer in the controller, write the desired value as a count of milliseconds to the appropriate timer.

Counters

The value returned for C memory will automatically be converted to a BCD value.

Examples

S7 Data Type	Data Type	Input	Flags	Data Blocks
B	Byte	IB0	MB0	DB1,B0

S7 Data Type	Data Type	Input	Flags	Data Blocks
Byte	Boolean String Array	IBYTE0 IB0.7 IBYTE0.7 IB0.64 IBYTE0.64 IB0[2][5] IBYTE0[2][5]	MBYTE0 MB0.7 MBYTE0.7 MB0.64 MBYTE0.64 MB0[2][5] MBYTE0[2][5]	DB1,BYTE0 DB1,B0.7 DB1,BYTE0.7 DB1,B0.64 DB1,BYTE0.64 DB1,B0[2][5] DB1,BYTE0[2][5]
C Char	Char Boolean String Array	IC0 ICHAR0 IC0.7 ICHAR0.7 IC0.64 ICHAR0.64 IC0[10] ICHAR0[10]	MC0 MCHAR0 MC0.7 MCHAR0.7 MC0.64 MCHAR0.64 MC0[10] MCHAR0[10]	DB1,C0 DB1,CHAR0 DB1,C0.7 DB1,CHAR0.7 DB1,C0.64 DB1,CHAR0.64 DB1,C0[10] DB1,CHAR0[10]
D DWORD	DWord Boolean Array	ID0 IDWORD0 ID0.31 IDWORD0.31 ID0[10] IDWORD0[10]	MD0 MDWORD0 MD0.31 MDWORD0.31 MD0[10] MDWORD0[10]	DB1,D0 DB1,DWORD0 DB1,D0.31 DB1,DWORD0.31 DB1,D0[10] DB1,DWORD0[10]
DATE	String	IDATE0	MDATE0	DB1,DATE0
DI DINT	Long Boolean Array	IDI0 IDINT0 IDI0.31 IDINT0.31 IDI0[4][3] IDINT0[4][3]	MDI0 MDINT0 MDI0.31 MDINT0.31 MDI0[4][3] MDINT0[4][3]	DB1,DI0 DB1,DINT0 DB1,DI0.31 DB1,DINT0.31 DB1,DI0[4][3] DB1,DINT0[4][3]
DT	String Date	IDT0 IDT8	MDT0 MDT8	DB1,DT0 DB1,DT8
I INT	Short Boolean Array	II0 IINT0 II0.15 IINT0.15 II0[5][2] IINT0[5][2]	MI0 MINT0 MI0.15 MINT0.15 MI0[5][2] MINT0[5][2]	DB1,I0 DB1,INT0 DB1,I0.15 DB1,INT0.15 DB1,I0[5][2] DB1,INT0[5][2]
LINT	LLong Boolean Array	ILINT0 ILINT0.63 ILINT0[5][2]	MLINT0 MLINT0.63 MLINT0[5][2]	DB1,LINT0 DB1,LINT0.63 DB1,LINT0[5][2]
LREAL	Double Array	ILREAL0 ILREAL0[10]	MLREAL0 MLREAL0[10]	DB1,LREAL0 DB1,LREAL0[10]
LWORD	QWord	ILWORD0	MLWORD0	DB1,LWORD0

S7 Data Type	Data Type	Input	Flags	Data Blocks
	Boolean Array	ILWORD0.63 ILWORD0[10]	MLWORD0.63 MLWORD0[10]	DB1,LWORD0.63 DB1,LWORD0[10]
REAL	Float Array	IREAL0 IREAL0[10]	MREAL0 MREAL0[10]	DB1,REAL0 DB1,REAL0[10]
String	String	ISTRING0.10	MSTRING0.10	DB1,STRING0.10
TOD	String	ITOD0	MTOD0	DB1,TOD0
T TIME	String	IT0 ITIME4	MT0 MTIME4	DB1,T0 DB1,TIME4
W Word	Word Boolean Array	IW0 IWORD0 IW0.15 IWORD0.15 IW0[10] IWORD0[10]	MW0 MWORD0 MW0.15 MWORD0.15 MW0[10] MWORD0[10]	DB1,W0 DB1,WORD0 DB1,W0.15 DB1,WORD0.15 DB1,W0[10] DB1,WORD0[10]
X	Boolean	IX0.7 IX0[10]	MX0.7 MX0[10]	DB1,X0.7 DB1,X0[10]

Note: The offset for an atomic type tag in a data block is denoted by the column "Address" in Step 7, as shown above. This offset is denoted by the column "Offset" in the Siemens TIA Portal programming environment.

Legacy S7-300/400 Item Syntax

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

*For preferred item syntax, refer to **Standard S7-300/400/1200/1500 Item Syntax**.*

Address Type	Range	Type	Access
Discrete Inputs	I0.b-I65535.b .b is Bit Number 0-7 IB0-IB65535 IW0-IW65534 IW:KT0-IW:KT65534 IW:KC0-IW:KC65534 ID0-ID65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write
Discrete Inputs	E0.b-E65535.b .b is Bit Number 0-7 EB0-EB65535** EW0-EW65534	**Boolean** **Byte**, Char, String**	Read / Write

Address Type	Range	Type	Access
	EW:KT0-EW:KT65534 EW:KC0-EW:KC65534 ED0-ED65532	**Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write
Note: I and E access the same memory area.			
Discrete Outputs	Q0.b-Q65535.b .b is Bit Number 0-7 QB0-QB65535 QW0-QW65534 QW:KT0-QW:KT65534 QW:KC0-QW:KC65534 QD0-QD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write
Discrete Outputs	A0.b-A65535.b .b is Bit Number 0-7 AB0-AB65535 AW0-AW65534 AW:KT0-AW:KT65534 AW:KC0-AW:KC65534 AD0-AD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write
Note: Q and A access the same memory area.			
Peripheral Inputs	PI0.b-PI65535.b .b is Bit Number 0-7 PIB0-PIB65535 PIW0-PIW65534 PIW:KT0-PIW:KT65534 PIW:KC0-PIW:KC65534 PID0-PID65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD,	Read Only Read Only Read Only Read Only

Address Type	Range	Type	Access
		Float	Read Only Read Only Read Only
Peripheral Inputs	PE0.b-PE65535.b .b is Bit Number 0-7 PEB0-PEB65535** PEW0-PEW65534 PEW:KT0-PEW:KT65534 PEW:KC0-PEW:KC65534 PED0-PED65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read Only Read Only Read Only Read Only Read Only Read Only Read Only
Note: PI and PE access the same memory area.			
Peripheral Outputs	PQ0.b-PQ65535.b .b is Bit Number 0-7 PQB0-PQB65535 PQW0-PQW65534 PQW:KT0-PQW:KT65534 PQW:KC0-PQW:KC65534 PQD0-PQD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write
Peripheral Outputs	PA0.b-PA65535.b .b is Bit Number 0-7 PAB0-PAB65535 PAW0-PAW65534 PAW:KT0-PAW:KT65534 PAW:KC0-PAW:KC65534 PAD0-PAD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write Read / Write Read /

Address Type	Range	Type	Access
			Write
Note: PQ and PA access the same memory area.			
Internal Memory	F0.b-F65535.b .b is Bit Number 0-7 FB0-FB65535 FW0-FW65534 FW:KT0-FW:KT65534 FW:KC0-FW:KC65534 FD0-FD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write
Internal Memory	M0.b-M65535.b .b is Bit Number 0-7 MB0-MB65535 MW0-MW65534 MW:KT0-MW:KT65534 MW:KC0-MW:KC65534 MD0-MD65532	**Boolean** **Byte**, Char, String** **Word**, Short, BCD DWord, **Long Word**, Short **DWord**, Long, LBCD, Float	Read / Write Read / Write Read / Write Read / Write Read / Write Read / Write
Note: F and M access the same memory area.			
Data Block Boolean	DB1-N:KM0.b-KM65534.b 1-N is Block Number .b is Bit Number 0-15 *Alternates* DB1DBX0.b-DBNDBX65534.b 1-N is Block Number .b is Bit Number 0-15 DB1D0.b-DBND65534.b 1-N is Block Number .b is Bit Number 0-15	**Boolean** **Boolean** **Boolean**	Read / Write Read / Write Read / Write
Data Block Left Byte	DB1-N:KL0-KL65535 1-N is Block Number	**Byte**, Char, String**	Read / Write

Address Type	Range	Type	Access
	Alternates DB1DBB0-DBNDBB65535 1-N is Block Number DB1DL0-DBNDL65535 1-N is Block Number	**Byte**, Char, String** **Byte**, Char, String**	Read / Write Read / Write
Data Block Right Byte	DB1-N:KR0-KR65534 1-N is Block Number *Alternates* DB1DR0-DBNDR65534 1-N is Block Number	**Byte**, Char, String** **Byte**, Char, String**	Read / Write Read / Write
Data Block Unsigned Word	DB1-N:KH0-KH65534 1-N is Block Number	**Word**, Short, BCD	Read / Write
Data Block Signed Word	DB1-N:KF0-KF65534 1-N is Block Number *Alternates* DB1DBW0-DBNDBW65534 1-N is Block Number DB1DW0-DBNDW65534 1-N is Block Number	Word, **Short**, BCD Word, **Short**, BCD Word, **Short**, BCD	Read / Write Read / Write Read / Write
Data Block Signed Long	DB1-N:KD0-KD65532 1-N is Block Number *Alternates* DB1DBD0-DB1DBD65532 1-N is Block Number DB1DD0-DB1DD65532 1-N is Block Number	DWord, **Long**, LBCD, Float DWord, **Long**, LBCD, Float DWord, **Long**, LBCD, Float	Read / Write Read / Write Read / Write
Data Block Float	DB1-N:KG0-KG65532 1-N is Block Number	**Float**	Read / Write
Data Block BCD	DB1-N:BCD0-BCD65534 1-N is Block Number	**Word**, Short, BCD	Read / Write

Address Type	Range	Type	Access
Data Block S5 Timer as DB	DB1-N:KT0-KT65534 1-N is Block Number	DWord, **Long**	Read / Write
Data Block S5 Counter as DB	DB1-N:KC0-KC65534 1-N is Block Number	**Word**, Short	Read / Write
Data Block String***	DB1S0.n-DB1S65535.n* .n is string length 0<n<= 932	**String**	Read / Write
Data Block String***	DB1STRING0.n-DB1STRING65535.n* .n is string length 0<n<= 254 (PDU size of 480 and above) 0<n<= 210 (PDU size below 480) 0<n<= 254 (Netlink S7300 and Netlink S7400 Models)	String	Read / Write
Timer Current Values****	T0-T65535*	DWord, **Long**	Read / Write
Counter Current Values*****	C0-C65535*	**Word**, Short	Read / Write
Counter Current Values*****	Z0-Z65535*	**Word**, Short	Read / Write

*These memory types/subtypes do not support arrays.
**Byte memory types (like MB) support Strings. The syntax for strings is <*address*>.<*length*> where 0 < *length* <=932.
***For more information, refer to **Data Block Strings**.
****For more information, refer to **Timers**.
*****For more information, refer to **Counters**.

Notes:

1. All offsets for memory types I, Q, and F represent a byte starting location within the specified memory type.
2. Use caution when modifying Word, Short, DWord, and Long types. For I, Q, and F each address starts at a byte offset within the device. Therefore, Words FW0 and FW1 overlap at byte 1. Writing to FW0 will also modify the value held in FW1. Similarly, DWord, and Long types can also overlap. It is recommended that these memory types be used so that overlapping does not occur. For example, DWord, FD0, FD4, FD8 and so on can be used to prevent overlapping bytes.

Data Block Strings

Data block Strings can be referenced by using S subtypes or String subtypes.

S Subtype

The syntax for the S subtype is *DBxSy.n* where *x* is the data block, *y* is the byte offset, and *n* is the maximum String length. String values read and written are stored at byte offset *y* in data block *x*.

y	y+1	y+2	...	y+n-1
''	''	''	...	''

S Strings are null terminated. If the maximum string length is 10 and 3 characters are written, the fourth character is set to NULL, while characters 5-10 are left untouched.

Note: For raw strings the total number of bytes requested cannot exceed the data portion of the negotiated PDU size. If raw strings exceed the negotiated PDU size, they may fail to be read or written.

String Subtype
The String subtype follows the STEP 7 String data type definition. The syntax for the String subtype is *DBx.STRINGy.n*, where *x* is the data block, *y* is the Byte offset, and *n* is the maximum String length. If *n* is not specified, the maximum String length will be 254 characters when PDU size is >= 480, otherwise it will be 210. String values read and written are stored at Byte offset *y*+2 in data block *x*. The first two bytes contain the maximum string length (*n*) and the actual string length. The actual string length gets updated with every write based on the string length of the string being written.

y	y+1	y+2	y+3	y+4	...	y+2+n-1
maximum string length (n)	actual string length	' '	' '	' '	...	' '

Notes:

1. String Strings are NULL padded. If the maximum string length is 10 and 3 characters are written, characters 4-10 are set to NULL.
2. If a PDU of 240 is negotiated, STEP 7 strings with a length greater than 222 may fail to be read and strings with a length greater than 212 may fail to be written.

Hex Strings

The HEXSTRING subtype is specific to the Siemens TCP/IP Ethernet Driver. The syntax for the HEXSTRING subtype is *HEXSTRINGy.n*, where *y* is the byte offset and *n* is the length. The *n* value must be specified in the range of 1 through 932. String is the only valid data type for a HEXSTRING tag.

The value assigned to a HEXSTRING must be an even number of characters. There is no padding, so the entire string must be specified. For example, tag HexStr defined as DB1,STRING0.10 uses 10 bytes of storage and has a display length of 20. To assign a value, the string must be 20 characters long and contain only valid hexadecimal characters. An example valid hex string for this tag is “56657273696f6E353137”.

Note: For HEXSTRINGs, the total number of bytes requested cannot exceed the data portion of the negotiated PDU size. If raw strings exceed the negotiated PDU size, they may fail to be read or written.

Arrays

All memory types/subtypes with the exception of those marked with an asterisk support arrays. The syntax below are valid for declaring an array. If no rows are specified, a row count of 1 is assumed.

<*address*>[*rows*][*cols*]
<*address*>.*rows*.*cols*
<*address*>,*rows*,*cols*
<*address*>_*rows*_*cols*

For Word, Short, BCD and "KT" arrays, the base address + (rows * cols * 2) cannot exceed 65536. Keep in mind that the elements of the array are words, located on a word boundary. For example, IW0[4] would return IW0, IW2, IW4, and IW6. "KT" subtypes fall into the 16-bit category because the data stored in the PLC is contained within a Word. For more information, refer to **Timers**.

For Float, DWord, Long, and Long BCD arrays (excluding "KT" subtypes), the base address + (rows * cols * 4) cannot exceed 65536. Keep in mind that the elements of the array are DWord, located on a DWord boundary. For example, ID0[4] will return ID0, ID4, ID8, ID12.

For all arrays, the total number of bytes being requested cannot exceed the data portion of the negotiated PDU size. For example, for a 960-byte PDU size, the largest single array that may be read or written is 932 bytes. If arrays exceed the negotiated PDU size, they may fail to be read or written.

KL vs. KR vs. DBB

KL and KR determine whether the left byte or right byte of the data block word is returned.

Value	8	9	A	B	C
Byte	0	1	2	3	4

The following examples are from the table above.

Example 1
DB1:KH0=0x89
DB1:KL0=0x8
DB1:KR0=0x9
DB1DBB0=0x8

Example 2
DB1:KH1=0x9A
DB1:KL1=0x9
DB1:KR1=0xA
DB1DBB1=0x9

Timers

The Siemens TCP/IP Ethernet Driver automatically scales T and KT values based on the Siemens S5 time format. Timer data is stored as a Word in the PLC but scaled to a DWord in the driver. The value returned for either a T or KT memory type will already be scaled using the appropriate Siemens time base. As a result, the values are always returned as a count of milliseconds. When writing to T or KT memory types, the Siemens time base will also be applied. To assign a value to a timer in the controller, write the desired value as a count of milliseconds to the appropriate timer.

Counters

The value returned for either C or KC memory type will automatically be converted to a BCD value. DB1:KH0 @ BCD=DB1:KC0 @ Word.

Examples

- To access bit 3 of internal memory F20, declare an address as follows: F20.3
- To access data block 5 as word memory at byte 30, declare an address as follows: DB5:KH30
- To access data block 2 byte 20 and bit 7, declare an address as follows: DB2:KM20.7
- To access data block 1 as left byte memory at byte 10, declare an address as follows: DB1:KL10
- To access internal memory F20 as a DWORD, declare an address as follows: FD20
- To access Input memory I10 as a Word, declare an address as follows: IW10

Note: The offset for an atomic type tag in a data block is denoted by the column "Address" in Step 7, as shown above. This offset is denoted by the column "Offset" in the Siemens TIA Portal programming environment.

Event Log Messages

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

Reason = 'Frame contains errors'.

Error Type:
Warning

Possible Cause:

1. An unexpected frame was received. The response code may be incorrect.
2. The frame sequence is out of order.

Possible Solution:
Cable noise may cause distortion in the frame, resulting in erroneous data or dropped frames. Verify the cabling between the PC and the PLC device.

See Also:

1. Error Matrix
2. Error Codes

Reason = 'Device returned transport error'. Error code = <error>.

Error Type:
Warning

Possible Cause:
An RFC1006 (ISO over TCP/IP) error occurred. This is the portion of the packet that encapsulates the S7 Messaging packet.

Possible Solution:
Follow guidance from the rest of the error message or contact Technical Support.

Note:
No protocol or data access errors can occur for this operation.

See Also:

1. Error Matrix
2. Error Codes

Reason = 'Device returned protocol error'. Error class = <class>, Error code = <error>.

Error Type:
Warning

Possible Cause:

1. An S7 Messaging error occurred. This can occur if a portion is malformed or contains incorrect packet lengths.
2. The tag is too large to be read or written with the currently negotiated PDU.

Possible Solution:

1. Follow guidance from the rest of the error message or contact Technical Support.
2. Adjust the size of the tag, or check the Maximum PDU Size device property.

See Also:

1. Error Matrix
2. Error Codes
3. Device Properties – S7 Comm Parameters

Reason = 'Device returned data access error'. Error code = <error>.

Error Type:
Warning

Possible Cause:
A requested address may be out of range or referenced incorrectly.

Possible Solution:

1. Verify the range is correct and correctly referenced.
2. Follow guidance from the rest of the error message or contact Technical Support.

See Also:

1. Error Matrix
2. Error Codes

Reason = 'Device is not responding'.

Error Type:
Warning

Possible Cause:

1. The connection between the device and the host PC is invalid.
2. The named device may have an incorrect IP address assigned.
3. The response from the device took longer to receive than the amount of time specified in the "Request Timeout" device setting.
4. The device CPU load is too high.

Possible Solution:

1. Verify the cabling between the PC and the PLC device.
2. Verify the IP address for the named device matches the actual device.
3. Decrease the tag group scan rate to reduce the load on the PLC CPU.
4. Increase the values for properties: Request Timeout, Scan Cycle Load from Communication, and/or Scan Cycle Monitoring Time.

See Also:

Error Matrix

Reason = 'Unknown error occurred'.

Error Type:

Warning

Possible Cause:

Process could not complete.

Possible Solution:

Follow guidance from the rest of the error message or retry the process.

See Also:

Error Matrix

Reason = NetLink returned error. Error code = <error>.

Error Type:

Warning

Possible Cause:

An error was returned from the PLC or NetLink adapter.

Possible Solution:

1. If error code is 0x11, an incorrect MPI ID may be set. Determine the MPI ID through which communications are occurring and enter it in the MPI ID device property field.
2. If error code is 0x87, the requested data may be out of range for the device. Verify the device address limits and correct the tag references.

See Also:

1. Error Matrix
2. Error Codes

Failed to resolve host. | Host = '<host name>'.

Error Type:
Warning

Possible Cause:

1. The named device may have been assigned an incorrect IP address.
2. Communication with the host failed. Connection may have been lost, a port conflict occurred, or some communication parameter is not valid.

Possible Solution:

1. Verify the IP address given to the named device matches that of the actual device.
2. Verify or correct connections, port number, MPI ID, and other communication parameters.

Auto-generated tag names and descriptions may not appear as expected due to string conversion error.

Error Type:
Warning

Possible Cause:
The Unicode character conversion failed.

Possible Solution:
Verify that the Step 7 language file is present and reflects a character set that can display the Step 7 tag and comment strings.

A required code page is unavailable on this machine. Tag generation may fail or tag names and descriptions may not appear as expected. | Required code page = <page>.

Error Type:
Warning

Possible Cause:

1. The computer is not configured with support for the specified Windows code page specified.
2. The language file was not found.

Possible Solution:

1. Install any language packs necessary for displaying the Windows code page character set.
2. Try again on a computer that supports the Windows code page specified.
3. Modify the Step 7 project to generate a Language file.

Note:
When Language file was not found the value of required code page will be: 0.

Unable to load the Step 7 language file.

Error Type:
Warning

Possible Cause:
The Step 7 language file is altered or corrupt.

Possible Solution:
Verify that the Step 7 project is not corrupt and can be opened in Simatic Step 7.

Memory exception reading the Step 7 language file.

Error Type:
Warning

Possible Cause:
The operating system has insufficient memory to read the Step 7 language file.

Possible Solution:
Ensure that the system resources are adequate for all applications running on the computer.

Step 7 language file failed to open. | OS error = '<error>'.

Error Type:
Warning

Possible Cause:

1. The Step 7 language file is altered or corrupt.
2. The language file is missing.

Possible Solution:

1. Verify that the Step 7 project is not corrupt and can be opened in Simatic Step 7.
2. Modify the Step 7 project to generate a language file.

Tag generation failure. | Data block name = '<block name>', data block number = <block number>.

Error Type:
Warning

Possible Cause:
An unexpected data type or other issue occurred during the parsing of the Step 7 project for the specified data block.

Possible Solution:
Compare the tags that were automatically generated with those in the project for the specified data block to determine which tag caused the incomplete generation. Correct issues with the block and retry.

See Also:
Error Codes

Created tag in group due to internal block size. | Tag address = '<address>', tag name = '<name>', group name = '<name>'.

Error Type:
Warning

Possible Cause:
While parsing the data blocks of the Step 7 project for automatic tag generation, an array variable was encountered that exceeds the internal block size. Although all individual array element tags generate as expected, the array tag itself is generated with a dimension that allows it to fit within the block size.

Possible Solution:
To use array tags and not the individual array element tags, determine the address where the array tag ends, then manually generate another tag to address the remainder of the array. For example, if data block 1 begins with an array of 250 REAL, there would be 250 array element tags with addresses DB1,REAL0; DB1,REAL4;... DB1, REAL992; DB1,REAL996. Because the size of the array exceeds the maximum data payload of 932 bytes, the array tag would only be created with 233 dimensions (DB1,REAL0[233]). The array tag does not provide the client with the data for the last 17 elements. If the client wants to use array tags and not the individual array element tags, another tag with the address "DB1,REAL932[17]" must be created. This warning message only occurs for tags of the first element of the complex type array during automatic tag generation for arrays of complex types (such as structures, user-defined types, function blocks, or system function blocks).

Tag not created because arrays are not supported with specified data type. | Tag name = '<name>', group name = '<name>', data type = '<type>'.

Error Type:
Warning

Possible Cause:

1. A tag address that has been specified dynamically has been assigned an invalid data type.
2. While parsing the data blocks of the Step 7 project for automatic tag generation, an array variable was encountered with a data type for which the driver does not support arrays.

Possible Solution:

1. Modify the requested data type in the client application.
2. The client must access the data using the array element tags that were generated. Variables with the Step 7 data types of DATE, DATE_AND_TIME, STRING, TIME, and TIME_OF_DAY generate tags with the string data type (for which arrays are not supported). During automatic tag generation for arrays of complex types (such as structures, user-defined types, function blocks, or system function blocks), this warning message only occurs for tags of the first element of the complex type array.

Unable to connect to device. |

Error Type:
Warning

Possible Cause:

1. An RFC1006 error (ISO over TCP/IP) occurred. This is the portion of the packet that encapsulates the S7 Messaging packet.
2. The device's CPU work load is too high.
3. This portion is malformed or contains incorrect packet lengths.

Possible Solution:

1. Cable noise may cause distortion in the frame, resulting in erroneous data or dropped frames. Verify the cabling between the PC and the PLC device.
2. Reduce network traffic or increase the Request Timeout and/or Fail After Attempt count.
3. Decrease the tag group Scan Rate to reduce the load on the PLC CPU.
4. Increase the values for properties: Scan Cycle Load from Communication and Scan Cycle Monitoring Time.

See Also:
Error Matrix

Unable to establish association with device. |

Error Type:
Warning

Possible Cause:

1. An S7 Messaging error occurred. This will occur if this portion is malformed or contains incorrect packet lengths.
2. An RFC1006 error (ISO over TCP/IP) occurred. This is the portion of the packet that encapsulates the S7 Messaging packet.
3. The TPDU response size is incorrect.
4. An unexpected frame was received. The response code may be incorrect.
5. The frame sequence is out of order.
6. The device CPU workload is too high.

Possible Solution:

1. Cable noise may cause distortion in the frame, resulting in erroneous data. It may also cause dropped frames. Verify the cabling between the PC and the PLC device.
2. Reduce network traffic. If this error occurs frequently, increase the Request Timeout and/or Fail After attempt count.
3. If this error occurs frequently, decrease the tag group scan rate to reduce the work load on the PLC's CPU.
4. Increase the Scan Cycle Load from Communication and Scan Cycle Monitoring Time.

See Also:

Error Matrix

Unable to read from address on device. | Address = '<address>',

Error Type:

Warning

Possible Cause:

1. A data access error occurred. The requested address may be out of range or referenced incorrectly.
2. An S7 messaging error occurred. A portion is malformed or contains incorrect packet lengths.
3. A TCP/IP error occurred. A portion is malformed or contains incorrect packet lengths.
4. An attempt was made to read an array larger than the PDU size negotiated with the device.

Possible Solution:

1. Verify and correct the address range.
2. Verify and correct the packet format and length.
3. Verify and correct the communications configuration and connections.
4. Verify and correct the data type, values, and ranges.
5. Verify the device's address limits and correct the tag references causing the error.

See Also:
Error Matrix

Unable to read from address on device. Tag deactivated. | Address = '<address>',

Error Type:
Warning

Possible Cause:
1. A data access error occurred. The requested address may be out of range or referenced incorrectly.
2. An S7 Messaging error occurred. A portion is malformed or contains incorrect packet lengths.
3. A TCP/IP error occurred. A portion is malformed or contains incorrect packet lengths.
4. The device CPU work load is too high.
5. If the tag address references a TOD data type, the DWORD value may be larger than the number of milliseconds in a day. For example, 86400000.
6. If the error code=0x11, an incorrect MPI ID may be set.
7. If the error code=0x87, users may be accessing data out of range in the device.

Possible Solution:
1. Verify and correct the address range.
2. Verify and correct the packet format and length.
3. Verify and correct the communications configuration and connections.
4. Verify and correct the data type, values, and ranges.
5. Reduce network traffic or increase the Request Timeout and/or Fail After attempt count.
6. Decrease the tag group scan rate to reduce the workload on the PLC CPU.
7. Increase the Scan Cycle Load from Communication and Scan Cycle Monitoring Time.
8. Change the value in the device to a valid DWORD that can be converted to a time that is less than or equal to 23:59:59.999.
9. Determine the MPI ID in use for communications and re-enter it in the MPI ID Device Property field.
10. Verify the device's address limits and correct the tag references causing the error.

See Also:
Error Matrix

Unable to read data from device. | Data block = '<block>', block start = <address>, block size = <size>,

Error Type:

Warning

Possible Cause:

1. A TCP/IP error occurred. A portion is malformed or contains incorrect packet lengths.
2. The device CPU work load is too high.
3. If the tag address references a TOD data type, the DWORD value may be larger than the number of milliseconds in a day. For example, 86400000.
4. An error was returned from the PLC or NetLink adapter.
5. Cable noise may cause distortion in the frame, resulting in erroneous data or dropped frames. Verify the cabling between the PC and the PLC device.
6. If the error code=0x11, an incorrect MPI ID may be set.
7. If the error code=0x87, users may be accessing data out of range in the device.

Possible Solution:

1. Verify and correct the address range.
2. Verify and correct the packet format and length.
3. Verify and correct the communications configuration and connections.
4. Verify and correct the data type, values, and ranges.
5. Reduce network traffic or increase the Request Timeout and/or Fail After attempt count.
6. Decrease the tag group scan rate to reduce the workload on the PLC CPU.
7. Increase the Scan Cycle Load from Communication and Scan Cycle Monitoring Time.
8. Change the value in the device to a valid DWORD that can be converted to a time that is less than or equal to 23:59:59.999.
9. Determine the MPI ID in use for communications and re-enter it in the MPI ID Device Property field.
10. Verify the device's address limits and correct the tag references causing the error.

See Also:

Error Matrix

Unable to read data from device. Block deactivated. | Data block = '<block>', block start = <address>, block size = <size>,

Error Type:

Warning

Possible Cause:

1. A TCP/IP error occurred. A portion is malformed or contains incorrect packet lengths.
2. The device CPU work load is too high.

3. If the tag address references a TOD data type, the DWORD value may be larger than the number of milliseconds in a day. For example, 86400000.
4. An error was returned from the PLC or NetLink adapter.
5. Cable noise may cause distortion in the frame, resulting in erroneous data or dropped frames. Verify the cabling between the PC and the PLC device.
6. If the error code=0x11, an incorrect MPI ID may be set.
7. If the error code=0x87, users may be accessing data out of range in the device.

Possible Solution:

1. Verify and correct the address range.
2. Verify and correct the packet format and length.
3. Verify and correct the communications configuration and connections.
4. Verify and correct the data type, values, and ranges.
5. Reduce network traffic or increase the Request Timeout and/or Fail After attempt count.
6. Decrease the tag group scan rate to reduce the workload on the PLC CPU.
7. Increase the Scan Cycle Load from Communication and Scan Cycle Monitoring Time.
8. Change the value in the device to a valid DWORD that can be converted to a time that is less than or equal to 23:59:59.999.
9. Determine the MPI ID in use for communications and re-enter it in the MPI ID Device Property field.
10. Verify the device's address limits and correct the tag references causing the error.

See Also:

Error Matrix

Unable to read data from device. | Memory type = '<type>', block start = <address>, block size = <size> (bytes),

Error Type:

Warning

Possible Cause:

1. An S7 Messaging error occurred. A portion is malformed or contains incorrect packet lengths.
2. The device CPU work load is too high.
3. If the tag address references a TOD data type, the DWORD value may be larger than the number of milliseconds in a day. For example, 86400000.
4. An error was returned from the PLC or NetLink adapter.

5. Cable noise may cause distortion in the frame, resulting in erroneous data or dropped frames. Verify the cabling between the PC and the PLC device.
6. If the error code=0x11, an incorrect MPI ID may be set.
7. If the error code=0x87, users may be accessing data out of range in the device.

Possible Solution:

1. Verify and correct the address range.
2. Verify and correct the packet format and length.
3. Verify and correct the communications configuration and connections.
4. Verify and correct the data type, values, and ranges.
5. Reduce network traffic or increase the Request Timeout and/or Fail After attempt count.
6. Decrease the tag group scan rate to reduce the workload on the PLC CPU.
7. Increase the Scan Cycle Load from Communication and Scan Cycle Monitoring Time.
8. Change the value in the device to a valid DWORD that can be converted to a time that is less than or equal to 23:59:59.999.
9. Determine the MPI ID in use for communications and re-enter it in the MPI ID Device Property field.
10. Verify the device's address limits and correct the tag references causing the error.

See Also:
Error Matrix

Unable to read data from device. Block deactivated. | Memory type = '<type>', block start = <address>, block size = <size> (bytes),

Error Type:
Warning

Possible Cause:

1. An S7 Messaging error occurred. A portion is malformed or contains incorrect packet lengths.
2. The device CPU work load is too high.
3. If the tag address references a TOD data type, the DWORD value may be larger than the number of milliseconds in a day. For example, 86400000.
4. An error was returned from the PLC or NetLink adapter.
5. Cable noise may cause distortion in the frame, resulting in erroneous data or dropped frames. Verify the cabling between the PC and the PLC device.
6. If the error code=0x11, an incorrect MPI ID may be set.
7. If the error code=0x87, users may be accessing data out of range in the device.

Possible Solution:

1. Verify and correct the address range.
2. Verify and correct the packet format and length.
3. Verify and correct the communications configuration and connections.
4. Verify and correct the data type, values, and ranges.
5. Reduce network traffic or increase the Request Timeout and/or Fail After attempt count.
6. Decrease the tag group scan rate to reduce the workload on the PLC CPU.
7. Increase the Scan Cycle Load from Communication and Scan Cycle Monitoring Time.
8. Change the value in the device to a valid DWORD that can be converted to a time that is less than or equal to 23:59:59.999.
9. Determine the MPI ID in use for communications and re-enter it in the MPI ID Device Property field.
10. Verify the device's address limits and correct the tag references causing the error.

See Also:
Error Matrix

Unable to write to address on device. | Address = '<address>',

Error Type:
Warning

Possible Cause:

1. The connection between the device and the host PC is broken.
2. The named device may have been assigned an incorrect IP address.
3. The device CPU workload is too high.
4. An attempt was made to write to an array larger than the PDU size negotiated with the device.

Possible Solution:

1. Verify the cabling between the PC and the PLC device.
2. Verify the IP address given to the named device matches that of the actual device.
3. Decrease the tag group scan rate to reduce the work load on the PLC CPU.
4. Increase the Scan Cycle Load from Communication and Scan Cycle Monitoring Time.

See Also:
Error Matrix

Unable to write to address on device. HEXSTRING length is different from tag length. | Address = '<address>', HEXSTRING length = <length> (bytes), tag length = <length> (bytes).

Error Type:
Warning

Possible Cause:
The tag and hexstring length do not match. The syntax for the HEXSTRING subtype is HEXSTRINGy.n, where y is the byte offset and n is the length. The n value must be specified in the range of 1 through 932. String is the only valid data type for a HEXSTRING tag. The value assigned to a HEXSTRING must be an even number of characters. There is no padding, so the entire string must be specified. For example, tag HexStr defined as DB1,STRING0.10 uses 10 bytes of storage and has a display length of 20. To assign a value, the string must be 20 characters long and contain only valid hexadecimal characters.

Possible Solution:
Correct the mismatch between the tag and hexstring length.

Unable to write to address on device. HEXSTRING contains a non-hexadecimal character. | Address = '<address>'.

Error Type:
Warning

Possible Cause:
The hexstring format is invalid. The syntax for the HEXSTRING subtype is HEXSTRINGy.n, where y is the byte offset and n is the length. The n value must be specified in the range of 1 through 932. String is the only valid data type for a HEXSTRING tag. To assign a value, the string must be 20 characters long and contain only valid hexadecimal characters.

Possible Solution:
Correct the format and syntax of the hexstring.

Unable to write to address on device. HEXSTRING length must be an even number of characters. | Address = '<address>'.

Error Type:
Warning

Possible Cause:
The hexstring length contains on odd number of characters, which is not valid.

Possible Solution:
Correct the hexstring to contain an even number of hexadecimal characters.

Unable to write to address on device. Time of Day string contains a syntax error. Expected 'hh:mm:ss.hhh' format. | Address = '<address>', Time of Day string = '<string>'.

Error Type:
Warning

Possible Cause:
The string written is not in the correct hh:mm:ss.hhh format.

Possible Solution:
Format the string as hh:mm:ss.hhh and retry.

Error Codes

NetLink Errors

Error Code	Source	Description
0x00		Service could be executed without an error
0x01	Remote Station	Timeout from remote station
0x02	Remote Station	Resource unavailable
0x03	Remote Station	Requested function of Siemens client is not activated within the remote station
0x11	Remote Station	No response of the remote station
0x12	Network	Siemens client not into the logical token ring
0x14	Host	Resource of the local FDL controller not available or not sufficient
0x15	Host	The specified msg.data_cnt parameter is invalid
0x30	Remote Station	Timeout. The requested message was accepted but no indication was sent back by the remote station
0x39	Remote Station	Sequence fault, internal state machine error
0x85	Host	Specified offset address out of limits or unknown in the remote station
0x86	Device	Wrong PDU coding in the MPI response of the remote station
0x87	Host	Specified length to write or to read results in an access outside of limits

Transport Errors

Error Code	Description
0x00	Error reason not specified
0x01	Invalid parameter code
0x02	Invalid TPDU type
0x03	Invalid parameter value

Protocol Errors

Error Class	Description
0x00	No error
0x81	Error in the application ID of the request
0x82	Error in the object definition (e.g. bad data type)
0x83	No resources available
0x84	Error in the structure of the service request
0x85	Error in the communication equipment
0x87	Access error
0xD2	OVS error
0xD4	Diagnostic error
0xD6	Protection system error
0xD8	BuB error
0xEF	Layer 2 specific error

Data Access Errors

Error Code	Description
0xFF	No error
0x01	Hardware fault
0x03	Illegal object access
0x05	Invalid address (incorrect variable address)
0x06	Data type is not supported
0x07	Invalid data size / too much data
0x0A	Object does not exist or length error

Siemens TCP/IP Ethernet Channel Properties

Below is a full list of all Siemens TCP/IP Ethernet channel-level properties.


```
{
"common.ALLTYPES_NAME": "MyChannel",
"common.ALLTYPES_DESCRIPTION": "",
"servermain.MULTIPLE_TYPES_DEVICE_DRIVER": "Siemens TCP/IP Ethernet",
"servermain.CHANNEL_DIAGNOSTICS_CAPTURE": false,
"servermain.CHANNEL_UNIQUE_ID": 2799355699,
"servermain.CHANNEL_ETHERNET_COMMUNICATIONS_NETWORK_ADAPTER_STRING": "",
"servermain.CHANNEL_WRITE_OPTIMIZATIONS_METHOD": 2,
"servermain.CHANNEL_WRITE_OPTIMIZATIONS_DUTY_CYCLE": 10,
"servermain.CHANNEL_NON_NORMALIZED_FLOATING_POINT_HANDLING": 0
}
```


Siemens TCP/IP Ethernet Device Properties

Below is a full list of all Siemens TCP/IP Ethernet device-level properties.


```
{
"common.ALLTYPES_NAME": "MyDevice",
"common.ALLTYPES_DESCRIPTION": "",
"servermain.MULTIPLE_TYPES_DEVICE_DRIVER": "Siemens TCP/IP Ethernet",
"servermain.DEVICE_MODEL": 4,
"servermain.DEVICE_UNIQUE_ID": 3569401335,
"servermain.DEVICE_CHANNEL_ASSIGNMENT": "Siemens",
"servermain.DEVICE_ID_FORMAT": 0,
"servermain.DEVICE_ID_STRING": "10.10.114.61",
"servermain.DEVICE_ID_HEXADECIMAL": 0,
"servermain.DEVICE_ID_DECIMAL": 0,
"servermain.DEVICE_ID_OCTAL": 0,
"servermain.DEVICE_DATA_COLLECTION": true,
"servermain.DEVICE_SIMULATED": false,
"servermain.DEVICE_SCAN_MODE": 0,
"servermain.DEVICE_SCAN_MODE_RATE_MS": 1000,
"servermain.DEVICE_SCAN_MODE_PROVIDE_INITIAL_UPDATES_FROM_CACHE": false,
"servermain.DEVICE_CONNECTION_TIMEOUT_SECONDS": 3,
"servermain.DEVICE_REQUEST_TIMEOUT_MILLISECONDS": 2000,
"servermain.DEVICE_RETRY_ATTEMPTS": 2,
"servermain.DEVICE_INTER_REQUEST_DELAY_MILLISECONDS": 0,
"servermain.DEVICE_AUTO_DEMOTION_ENABLE_ON_COMMUNICATIONS_FAILURES": false,
"servermain.DEVICE_AUTO_DEMOTION_DEMOTE_AFTER_SUCCESSIVE_TIMEOUTS": 3,
"servermain.DEVICE_AUTO_DEMOTION_PERIOD_MS": 10000,
"servermain.DEVICE_AUTO_DEMOTION_DISCARD_WRITES": false,
"servermain.DEVICE_TAG_GENERATION_ON_STARTUP": 0,
"servermain.DEVICE_TAG_GENERATION_DUPLICATE_HANDLING": 0,
"servermain.DEVICE_TAG_GENERATION_GROUP": "",
"servermain.DEVICE_TAG_GENERATION_ALLOW_SUB_GROUPS": true,
"siemens_tcpip_ethernet.DEVICE_COMMUNICATIONS_PORT_NUMBER": 102,
"siemens_tcpip_ethernet.DEVICE_COMMUNICATIONS_MPI_ID": 0,
"siemens_tcpip_ethernet.DEVICE_S7_COMMUNICATIONS_MAX_PDU": 960,
"siemens_tcpip_ethernet.DEVICE_S7_COMMUNICATIONS_200_LOCAL_TSAP": 19799,
"siemens_tcpip_ethernet.DEVICE_S7_COMMUNICATIONS_200_REMOTE_TSAP": 19799,
```

```
"siemens_tcpip_ethernet.DEVICE_S7_COMMUNICATIONS_300_400_1200_1500_LINK_TYPE": 3,
"siemens_tcpip_ethernet.DEVICE_S7_COMMUNICATIONS_CPU_RACK": 0,
"siemens_tcpip_ethernet.DEVICE_S7_COMMUNICATIONS_CPU_SLOT": 1,
"siemens_tcpip_ethernet.DEVICE_ADDRESSING_BYTE_ORDER": 0,
"siemens_tcpip_ethernet.DEVICE_TAG_IMPORT_TYPE": 1,
"siemens_tcpip_ethernet.DEVICE_TAG_IMPORT_CODE_PAGE": 4294967295,
"siemens_tcpip_ethernet.DEVICE_TAG_IMPORT_STEP_7_PROJECT_FILE": "",
"siemens_tcpip_ethernet.DEVICE_TAG_IMPORT_PROGRAM_PATH": "",
"siemens_tcpip_ethernet.DEVICE_TAG_IMPORT_TIA_EXPORT_FILE": ""
}
```


Siemens TCP/IP Ethernet Tag Properties

Below is a full list of all Siemens TCP/IP Ethernet tag properties.


```
{
"common.ALLTYPES_NAME": "MyTag",
"common.ALLTYPES_DESCRIPTION": "",
"servermain.TAG_ADDRESS": "DB1,W0.00",
"servermain.TAG_DATA_TYPE": 1,
"servermain.TAG_READ_WRITE_ACCESS": 1,
"servermain.TAG_SCAN_RATE_MILLISECONDS": 100,
"servermain.TAG_AUTOGENERATED": false,
"servermain.TAG_SCALING_TYPE": 0,
"servermain.TAG_SCALING_RAW_LOW": 0,
"servermain.TAG_SCALING_RAW_HIGH": 1000,
"servermain.TAG_SCALING_SCALED_DATA_TYPE": 9,
"servermain.TAG_SCALING_SCALED_LOW": 0,
"servermain.TAG_SCALING_SCALED_HIGH": 1000,
"servermain.TAG_SCALING_CLAMP_LOW": false,
"servermain.TAG_SCALING_CLAMP_HIGH": false,
"servermain.TAG_SCALING_NEGATE_VALUE": false,
"servermain.TAG_SCALING_UNITS": ""
}
```

Appendix — Configuring Siemens Connections

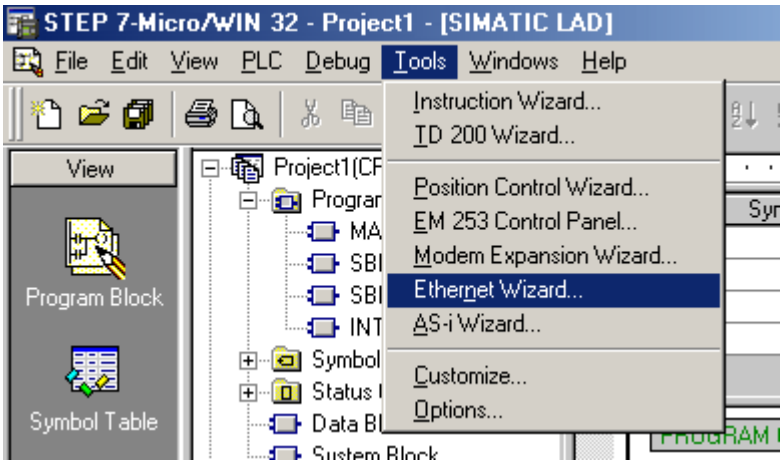
How To Configure S7-200 Connections in Micro/WIN

Configured connections are accomplished through the Ethernet wizard in Micro/WIN. The following instructions illustrate each step in the Ethernet wizard and also describe any precautions that should be taken. Follow these instructions closely to use configured connections with the Siemens TCP/IP Ethernet Driver correctly.

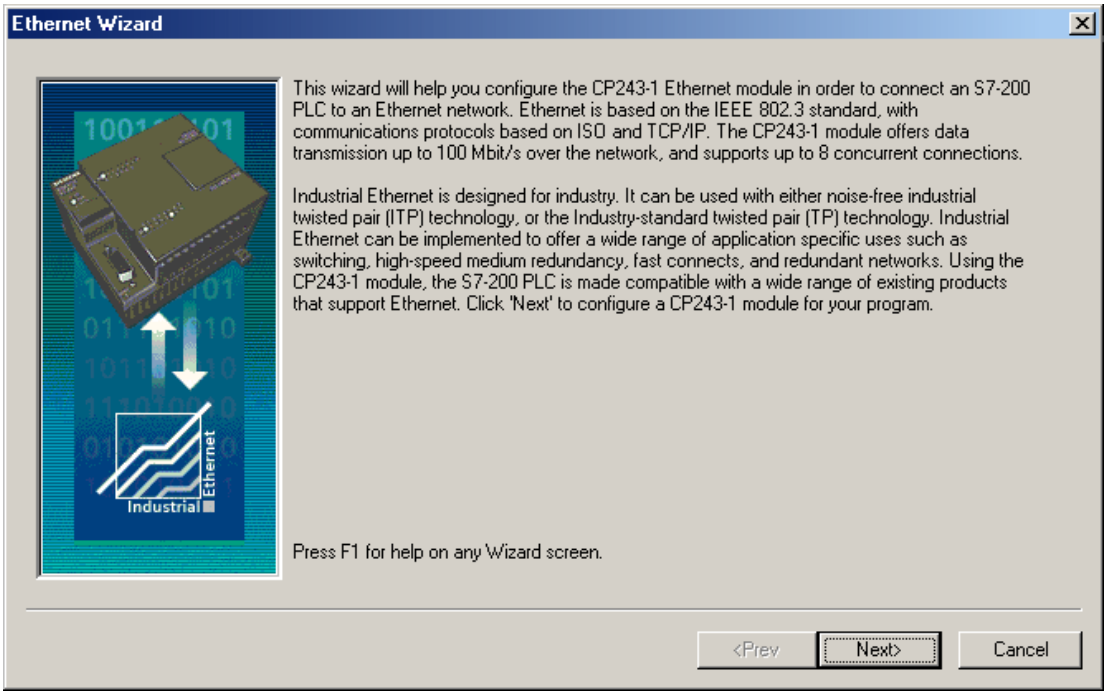
Note: The Micro/WIN software may require an upgrade before the Ethernet wizard is made available.

Step 1: Launching the Ethernet Wizard

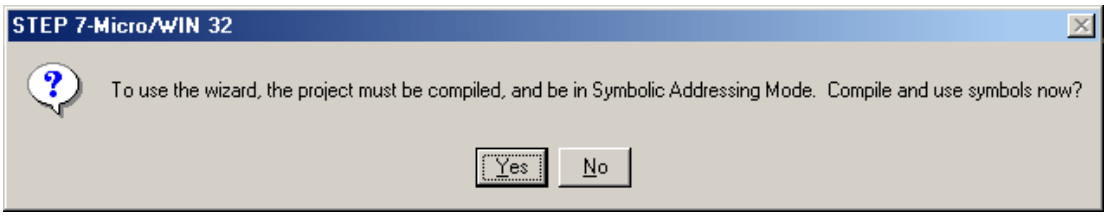
1. In the Micro/WIN main menu, click **Tools** | **Ethernet Wizard**.



2. Then, click **Next**.



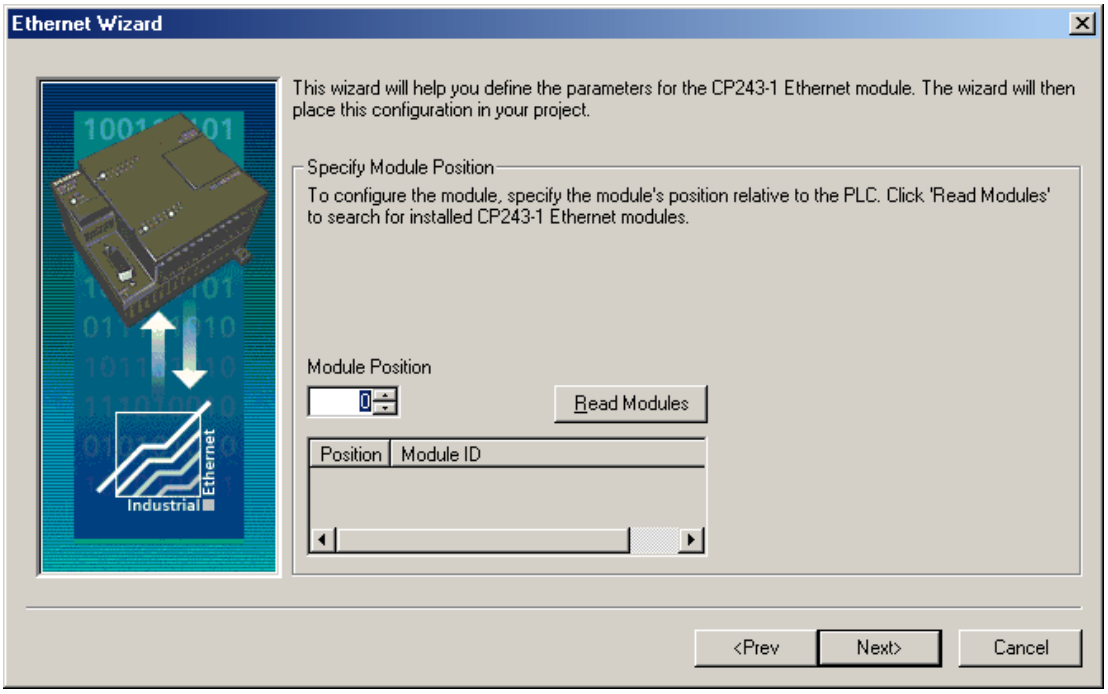
3. Click **Yes** to proceed.



Note: The program must be compiled before the Ethernet wizard can execute. Correct any errors in the program before continuing.

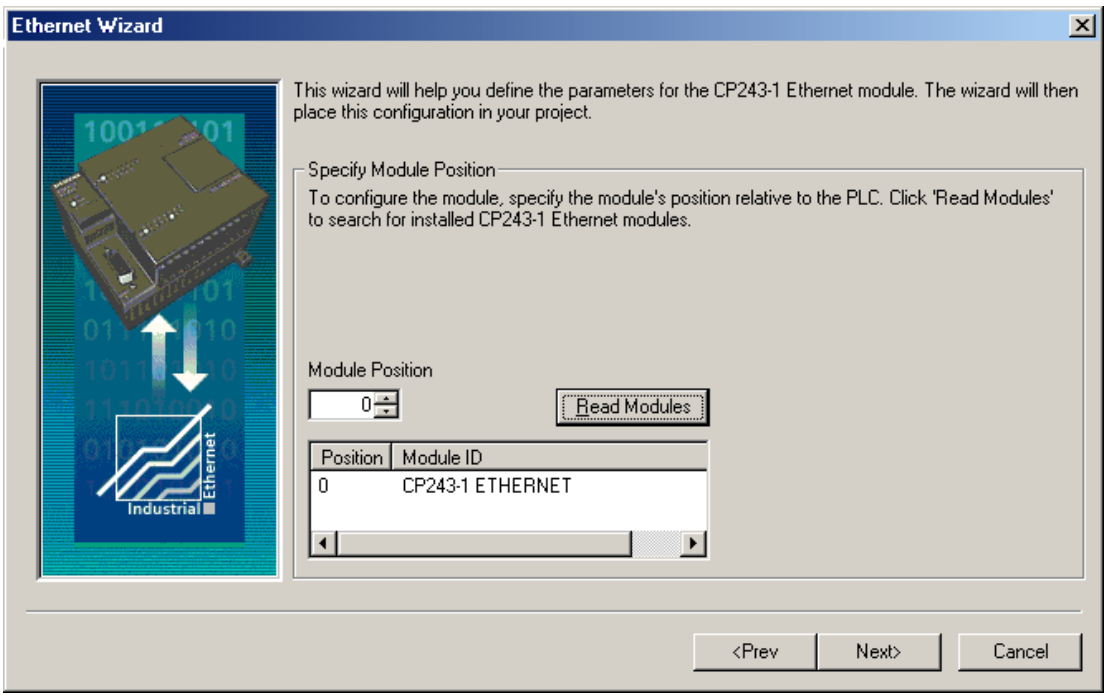
Step 2: Setting CP243-1 Module Position

1. Click **Read Modules**.



Note: While it is recommended that the **Read Modules** function be used, this does require that the PLC be connected to the PC either serially or by Ethernet. In either case, the communications parameters for **Micro/WIN** must be properly set for the Read Modules operation to occur.

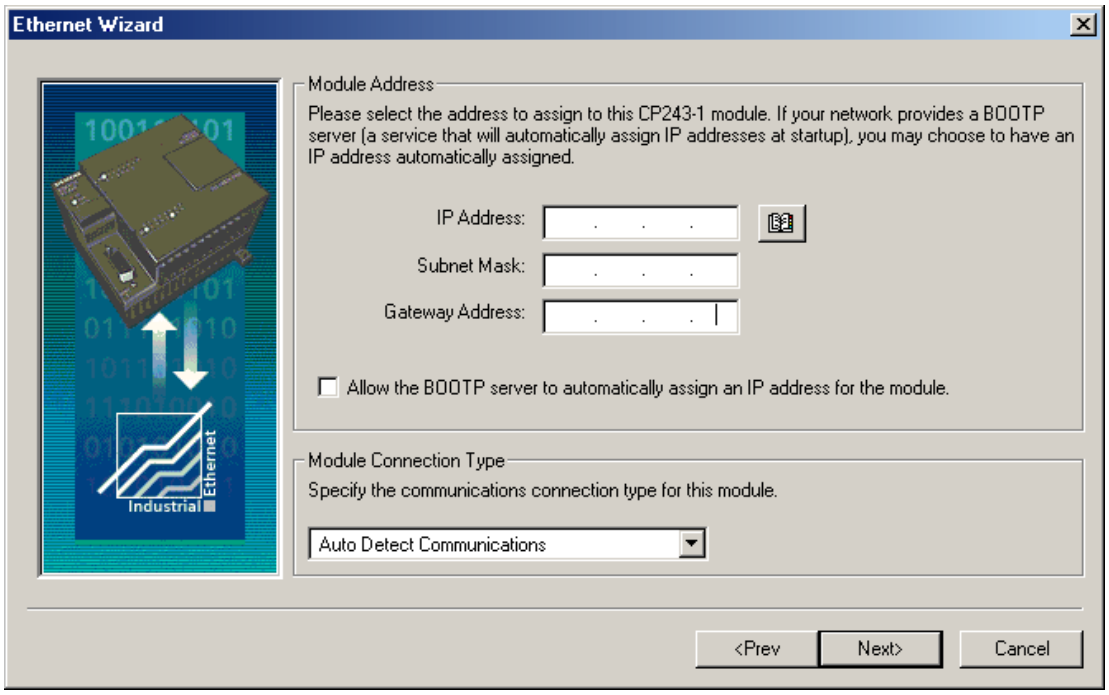
2. To view the results of Read Modules, select the **Ethernet module**. Click **Next**.



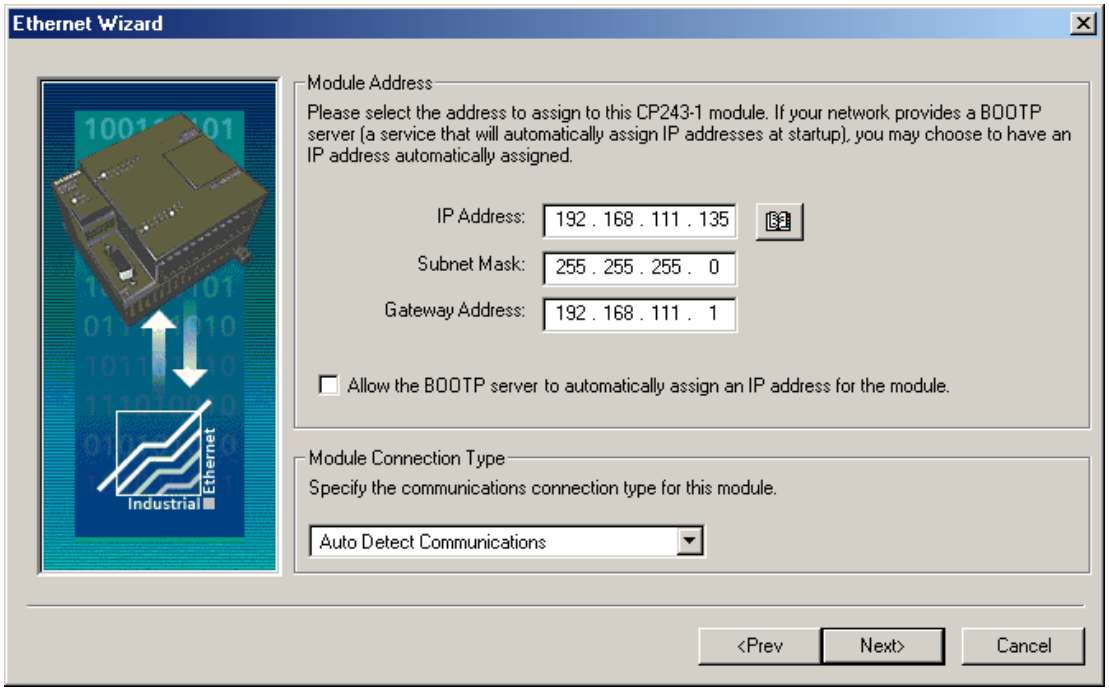
Step 3: Assigning Module Address

1. Enter the **IP Address**, **Subnet Mask** and **Gateway Address** if applicable. Alternatively, enable **BOOTP** if applicable.

2. Select **Auto Detect Communications** to allow the module to automatically select either **10BaseT** or **100BaseT**. In rare cases where there may be a cable issue that does not allow the module to operate properly at 100BaseT, force the module to use 10BaseT. This will increase the modules' tolerance to a bad Ethernet line.

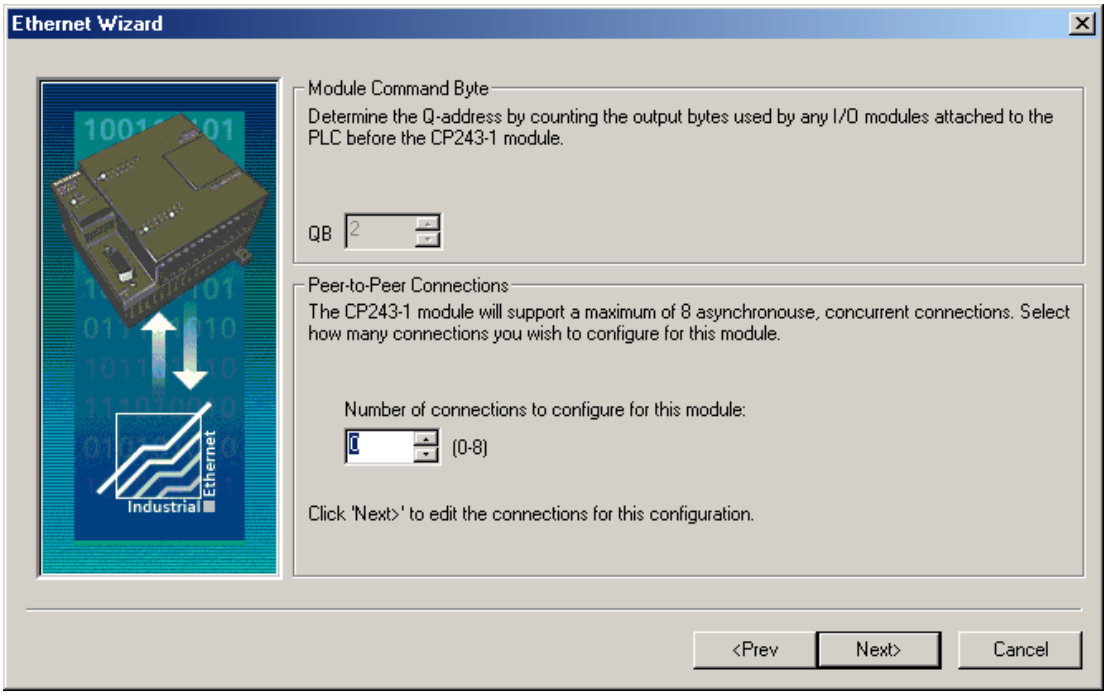


3. The image shown below contains demonstration values.



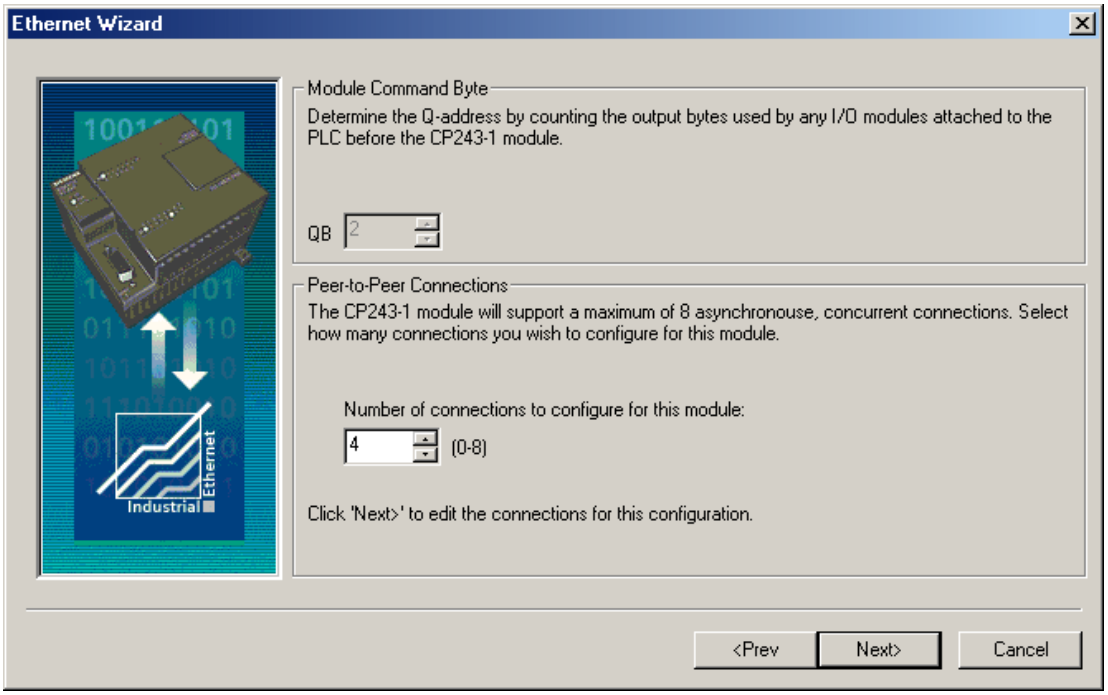
Step 4: Number of Configured Connections

1. Enter the number of desired available connections for this device. If 0 is entered, the only connection available will be the PG connection used by Micro/WIN.



Note: The number of connections selected determines how many simultaneous connections the PLC can support. When intending to have only one OPC server talking to the PLC, set up only one connection. This will ensure the best performance for the OPC server. When intending to have more than one active connection to the PLC, use multiple connections. Keep in mind, however, that the performance of the module will be impacted as each connection is used.

2. The image shown below contains 4 connections.



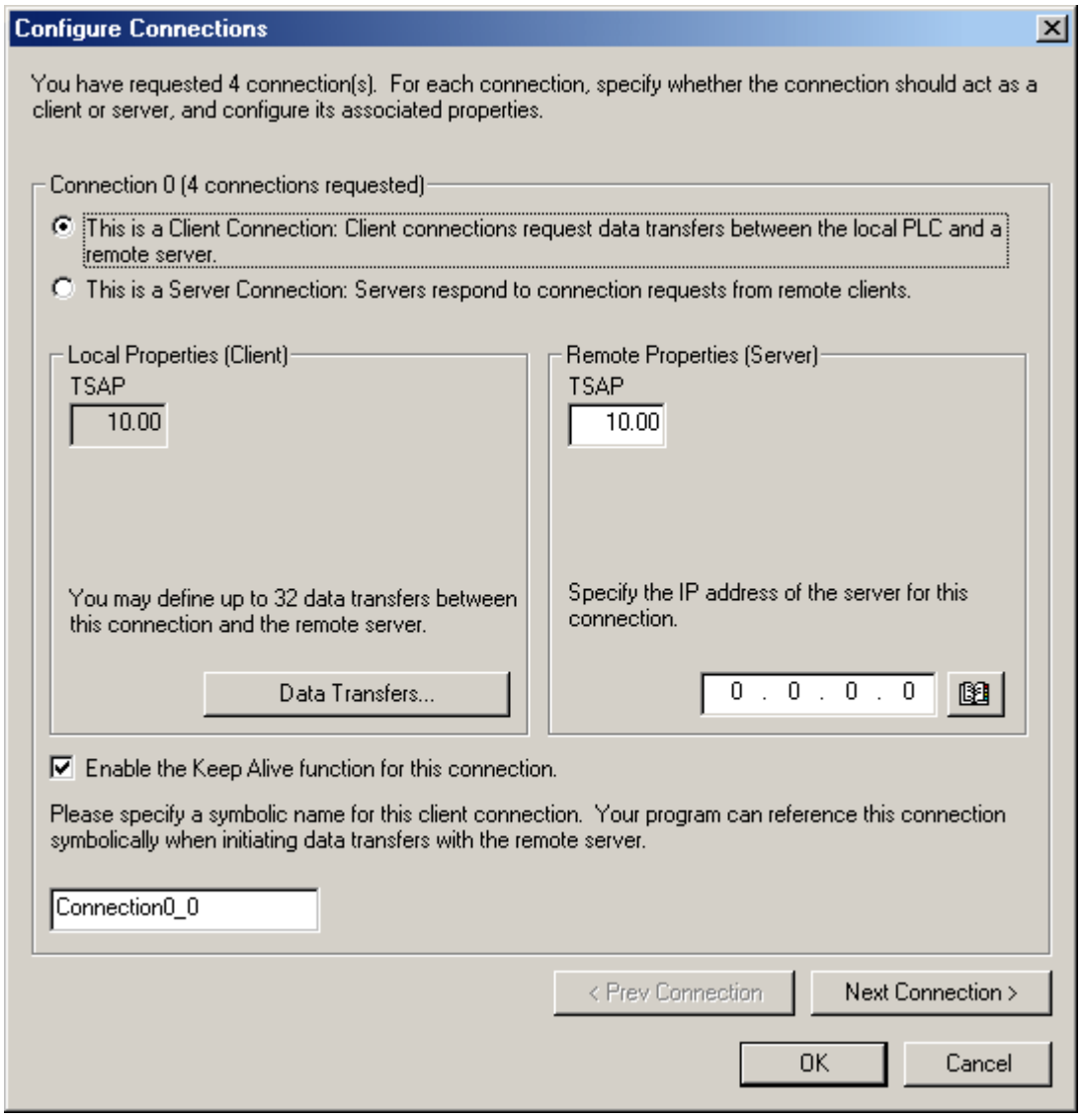
Step 5: Configuring Connections

Each connection is configured individually. For this example, 4 connections have been selected.

Step 5a: Connection 0

There are two types of connections, client and server. In a client connection, the device is a client and makes request with servers (other devices). In a server connection, the device is a server and handles requests from clients (such as the OPC server and other devices). The latter is required for communications with the Siemens TCP/IP Ethernet Driver.

1. Select **This is a Server Connection**.



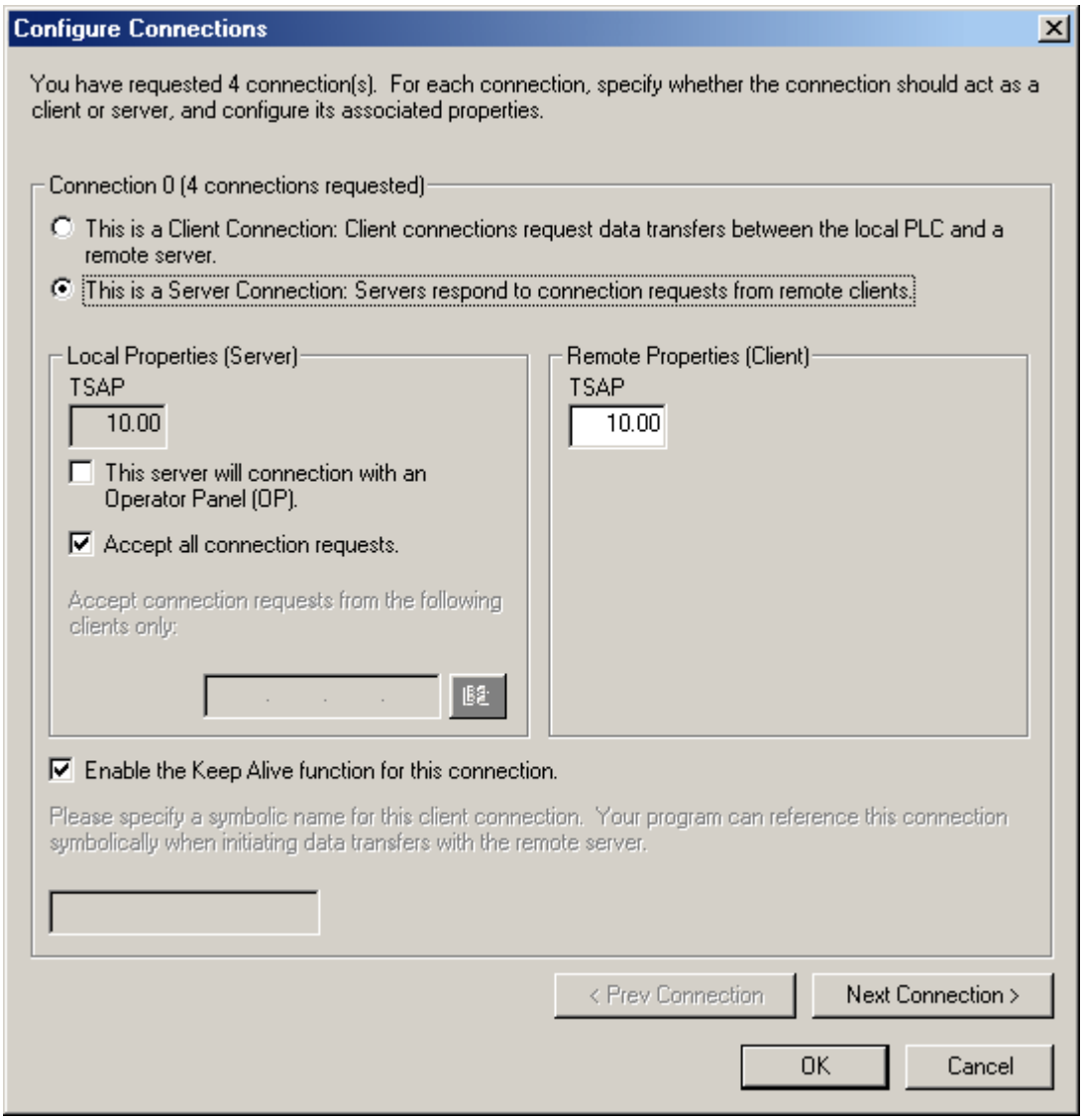
2. From this standpoint, the **CP243-1** is considered the **Server** (local) and the **OPC Server Channel**. The device is considered the **Client (Remote)**.

3. Enter a **Remote TSAP** or accept the default. This will be the **Local TSAP** in the **OPC Server**.

4. **Optional:** Accept all connection requests or limit to a particular remote machine. It is recommended that **Accept all connection requests** be selected. If concerned about device security (or if intending to access this device over the Internet) select a specific IP address. Users must ensure that the OPC server is running on a PC that has a known and fixed IP address.

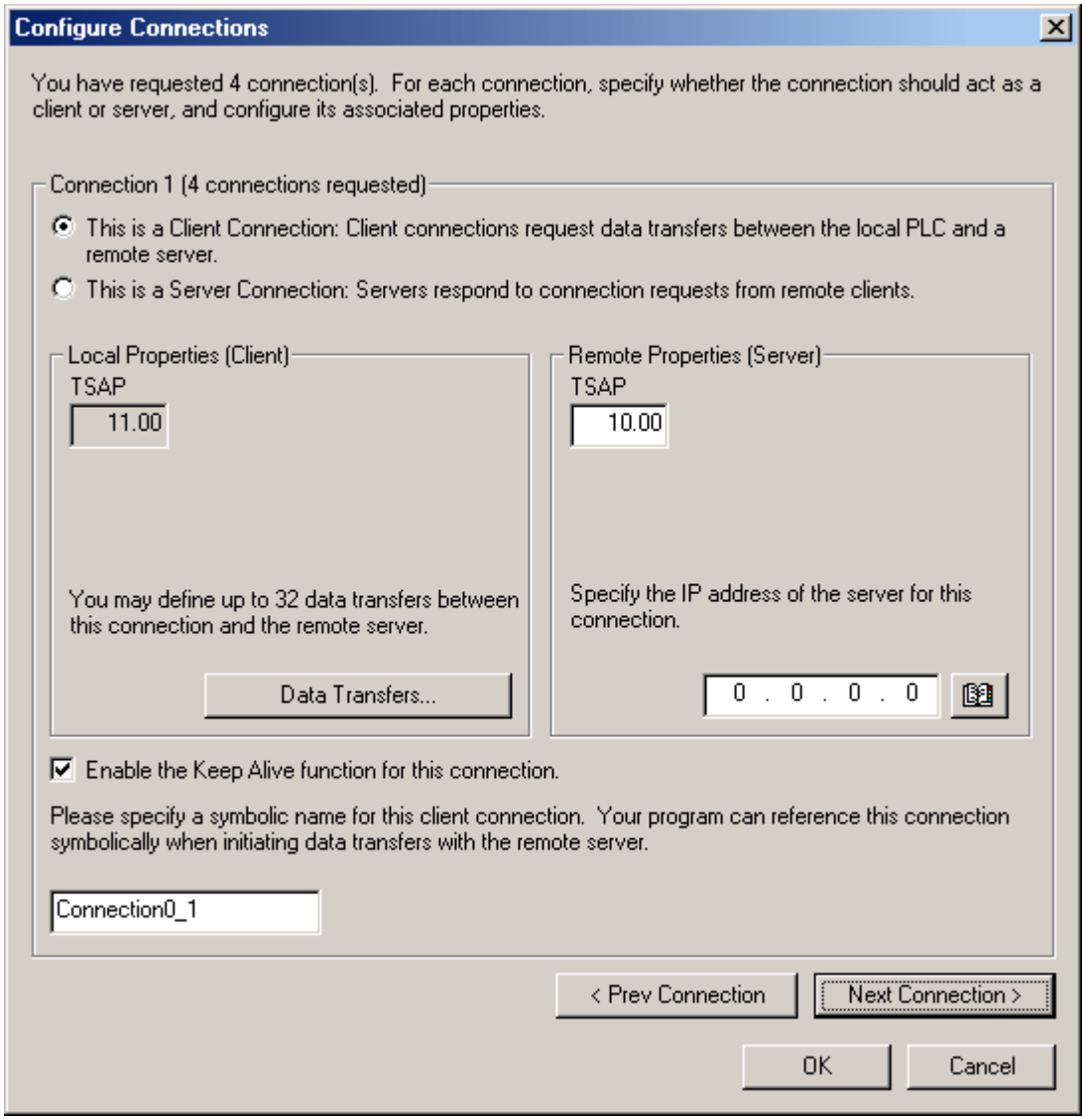
5. Select **Enable the Keep Alive**.

6. Click **Next Connection**.



Step 5b: Connection 1

1. Select **This is a Server Connection**.



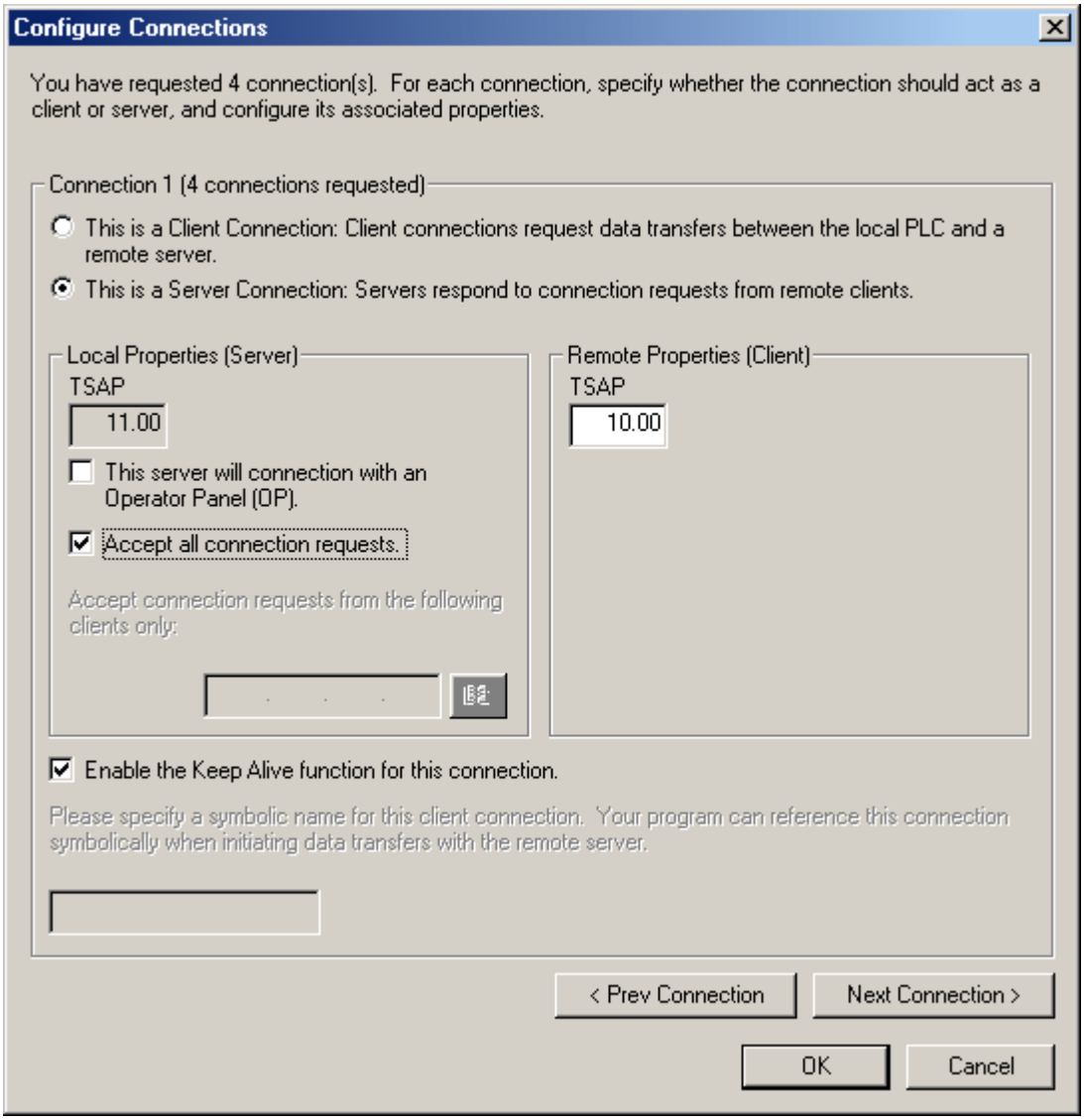
2. Notice the **Local TSAP** automatically incremented to 11.00.

3. Enter a **Remote TSAP** or accept the default. This will be the **Local TSAP** in the **OPC Server**.

4. **Optional: Accept all connection requests**.

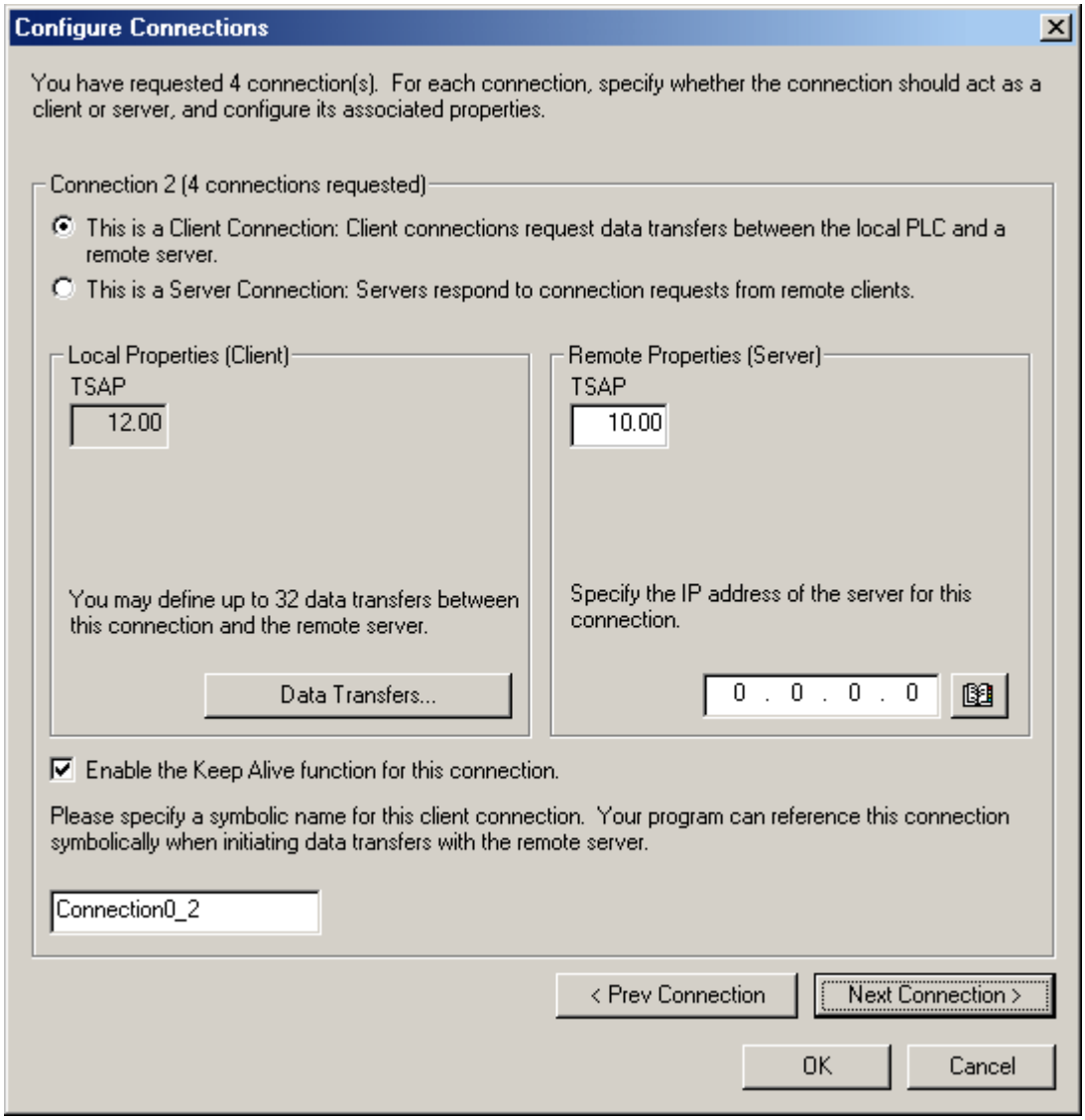
5. Select **Enable the Keep Alive**.

6. Click **Next Connection**.



Step 5c: Connection 2

1. Select **This is a Server Connection**.



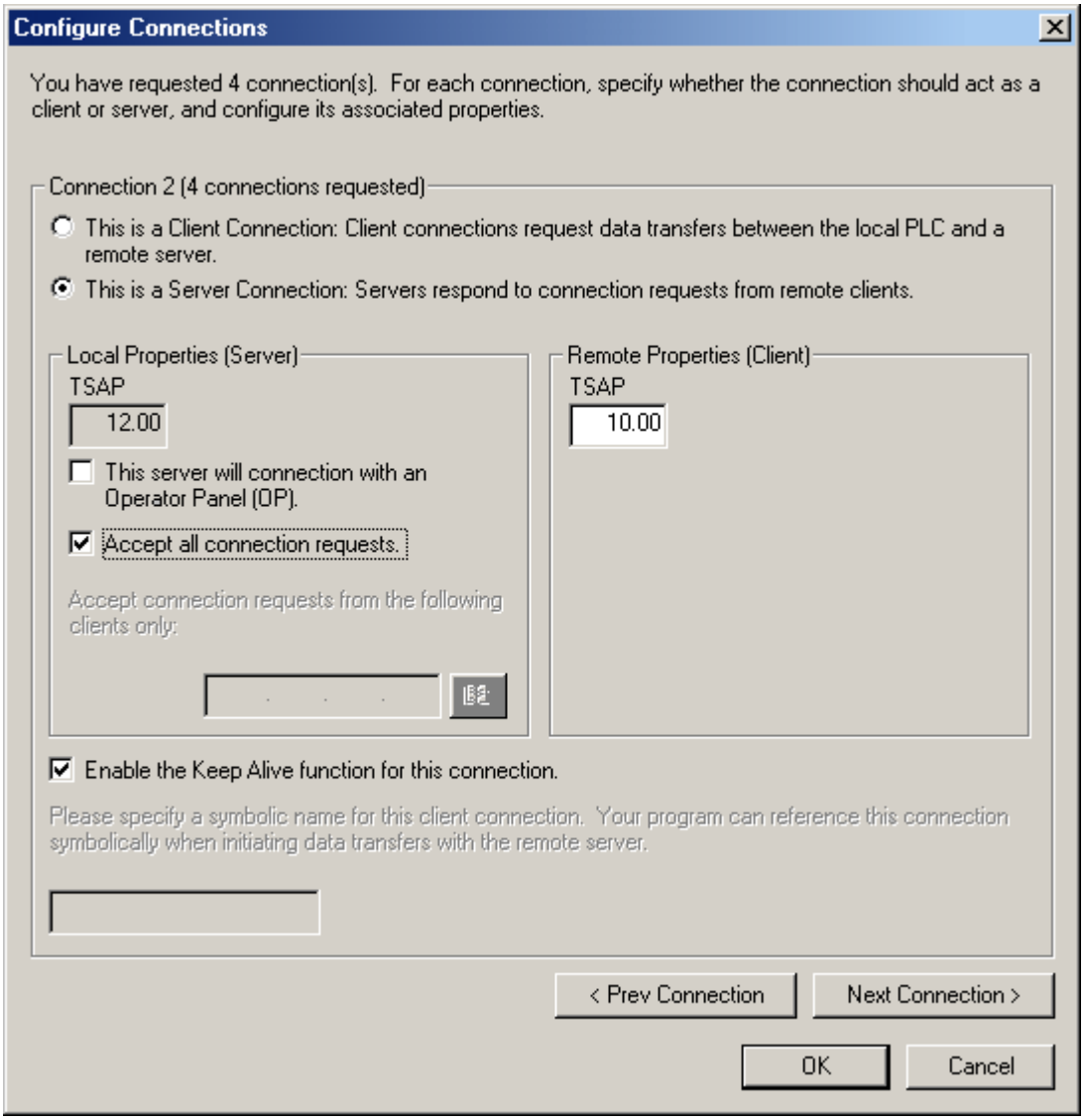
2. Notice the **Local TSAP** automatically incremented to 12.00.

3. Enter a **Remote TSAP** or accept the default. This will be the **Local TSAP** in the **OPC Server**.

4. **Optional: Accept all connection requests**.

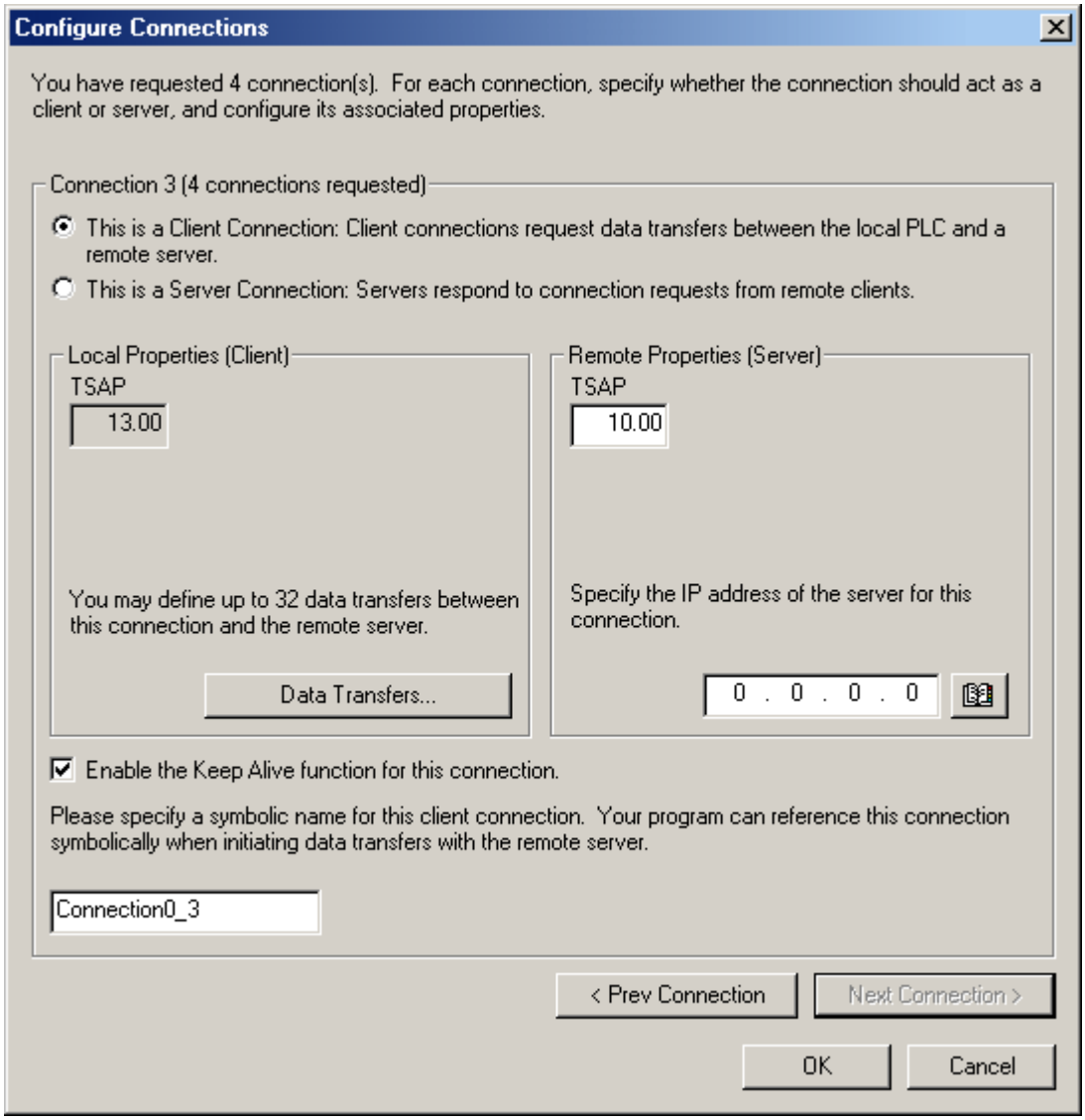
5. Select **Enable the Keep Alive**.

6. Click **Next Connection**.



Step 5d: Connection 3

1. Select **This is a Server Connection...**.



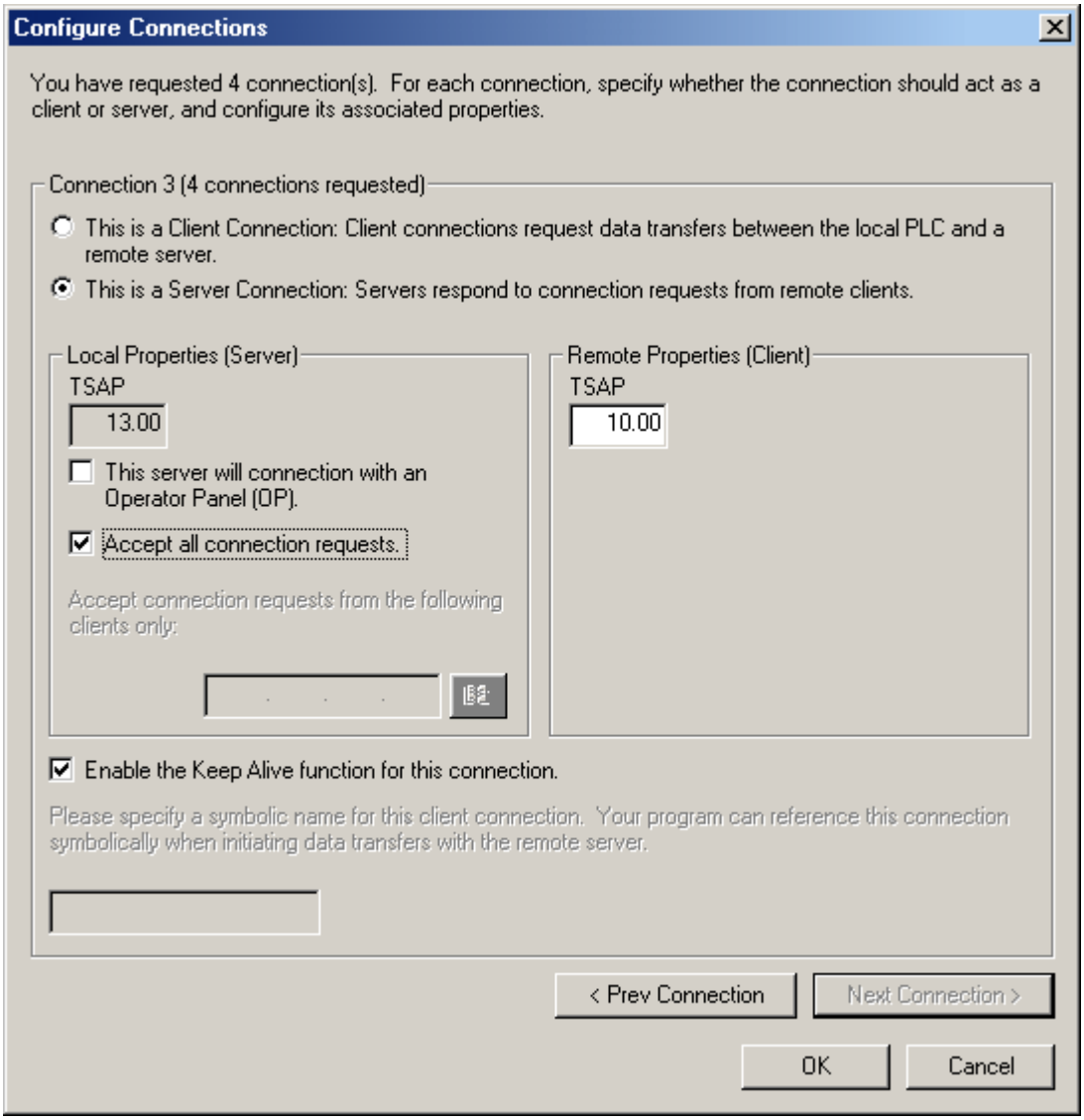
2. Notice the **Local TSAP** automatically incremented to 13.00.

3. Enter a **Remote TSAP** or accept the default. This will be the Local TSAP in the OPC server.

4. **Optional: Accept all connection requests**.

5. Select **Enable the Keep Alive**.

6. Click **Next Connection**.



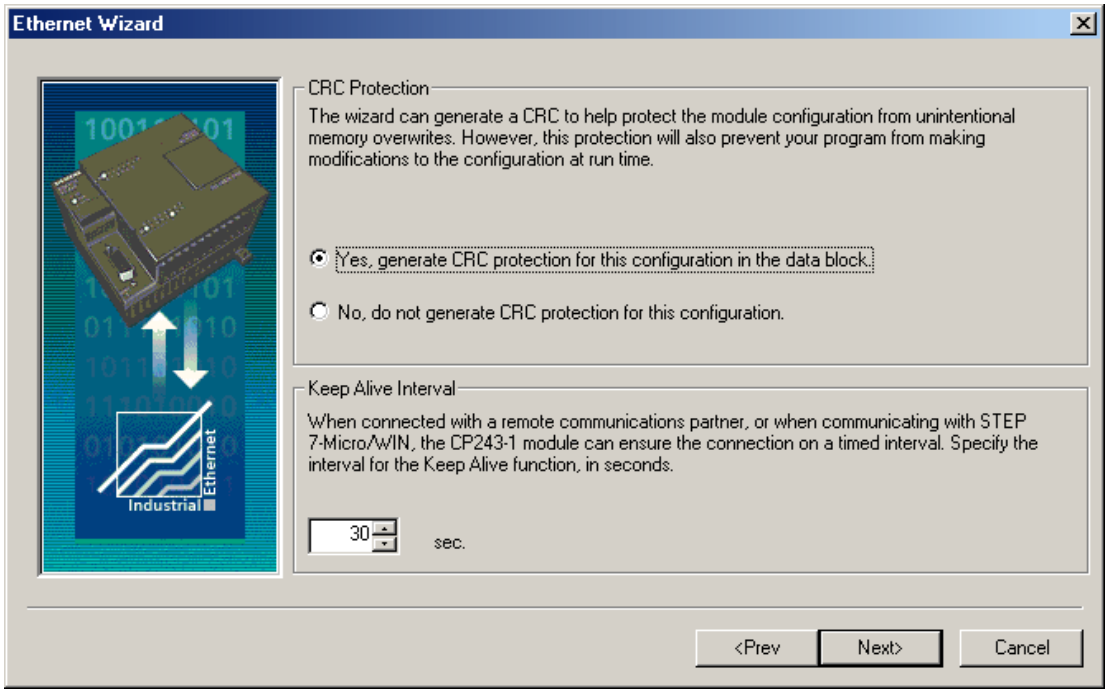
That completes the configuration of the four connections that were selected.

Note: Notice that the **Local TSAP** in the **Connection dialog** was automatically advanced for each connection. This TSAP number will need to be used in the OPC server setup when defining a device as the remote TSAP number.

Step 6: CRC and Keep Alive Interval

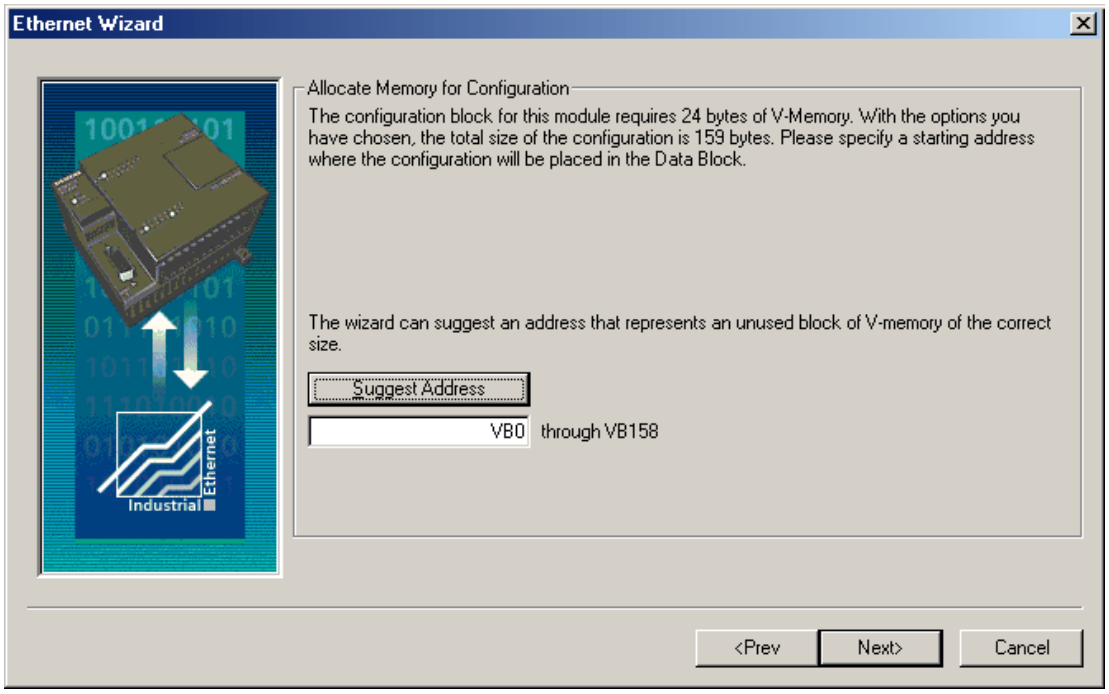
Optional: Enable CRC protection to monitor for accidental configuration corruption.

1. Set the **Keep Alive Interval**. The longer the interval, the longer the connection between the device and the OPC server will exist during idle time. A long Keep Alive Interval may not be desirable if connections are being shared (nonconcurrent). Each remote client will need to wait this amount of time before it will be able to connect with the device once the last connected remote client is finished communications. The 30 second default is suggested.

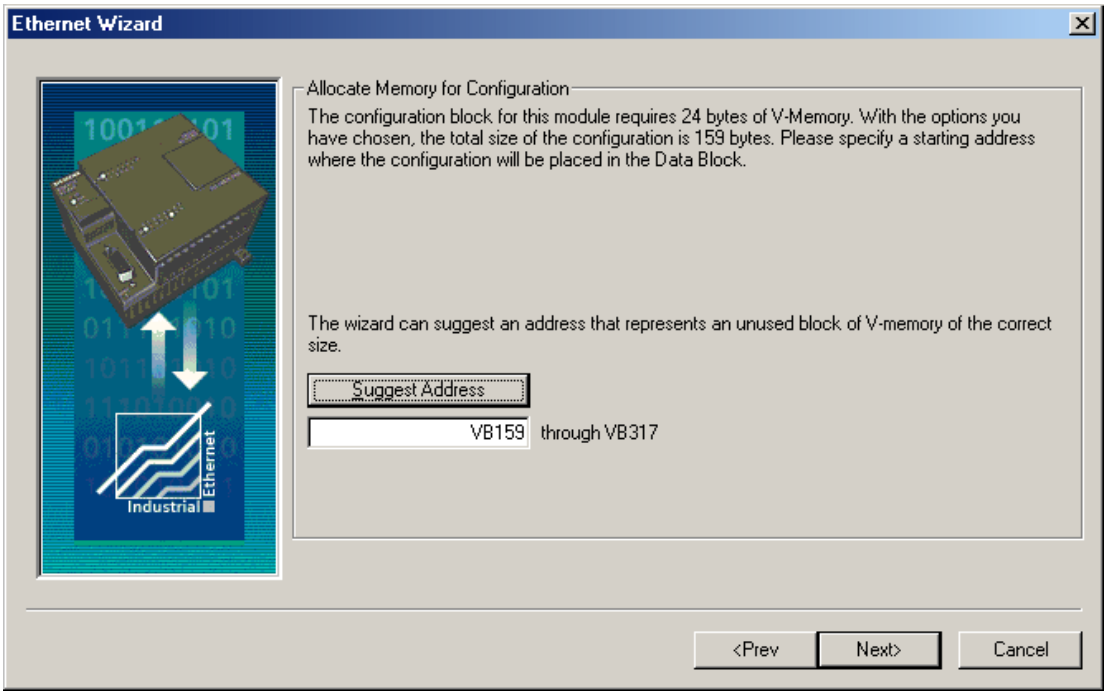


Step 7: Memory for Configuration

1. Click **Suggest Address** to let the wizard find the best available location to store the **Ethernet configuration**.



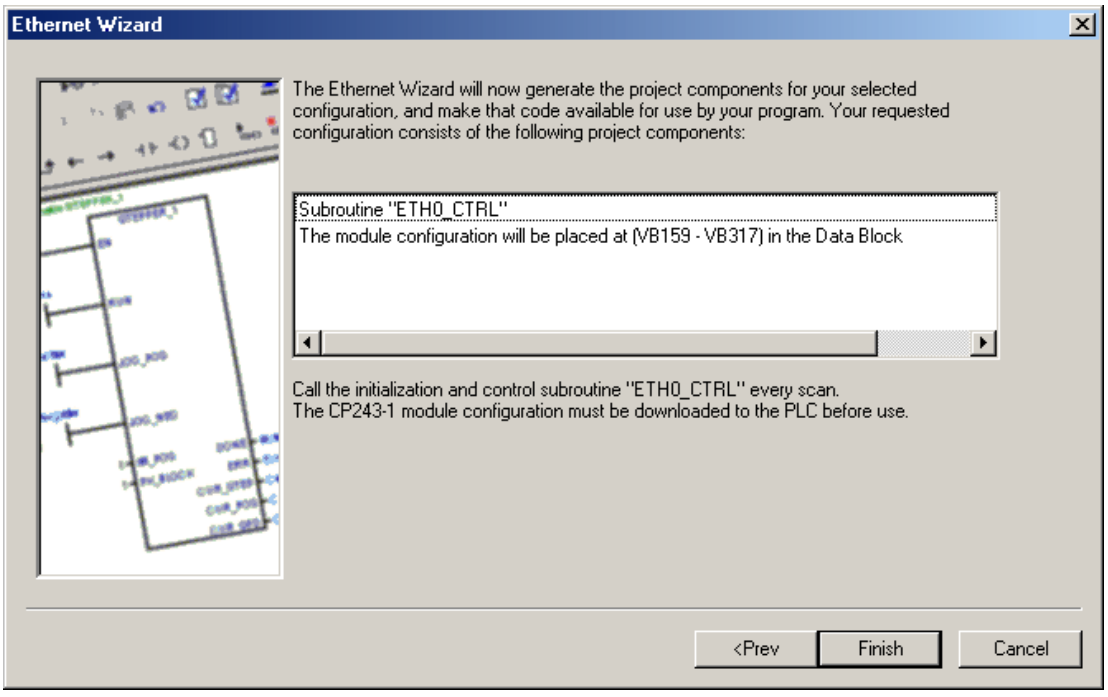
2. The image shown below displays the results.



Note: It is recommended that the Micro/WIN software pick this location for the application. If a CRC was not generated for the configuration data, please take steps to ensure that no other aspect of the PLC program will overwrite this area of memory.

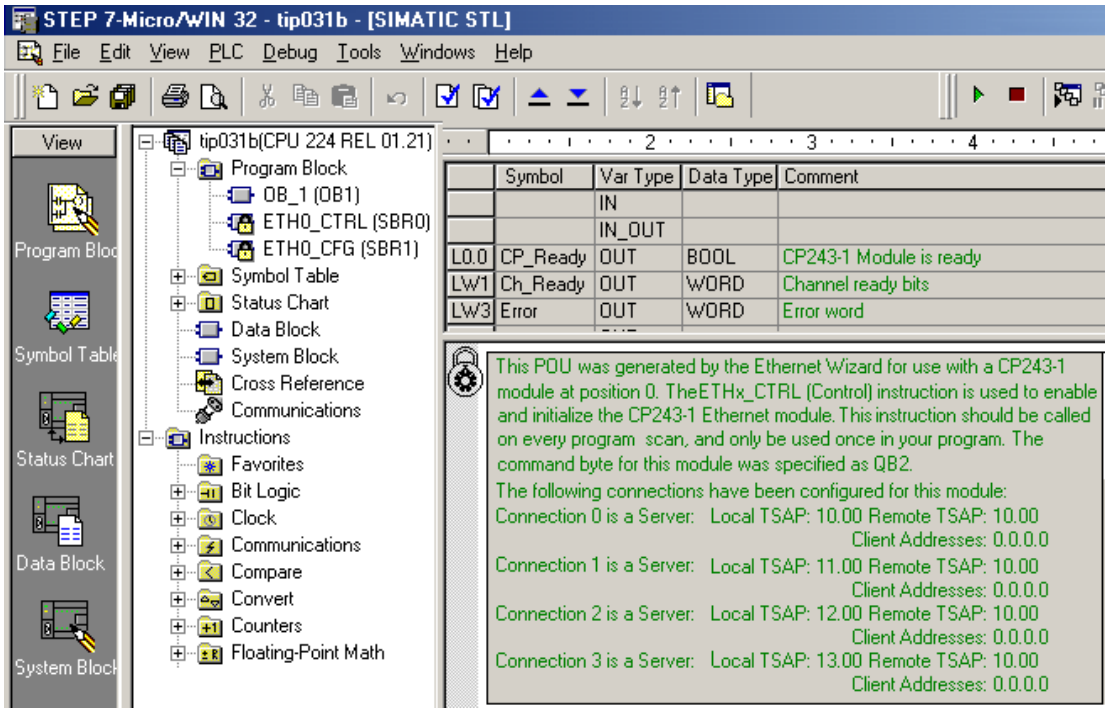
Step 8: Ethernet Wizard Summary

1. Click **Finish** or **Prev** to modify the **Configured Connections**.

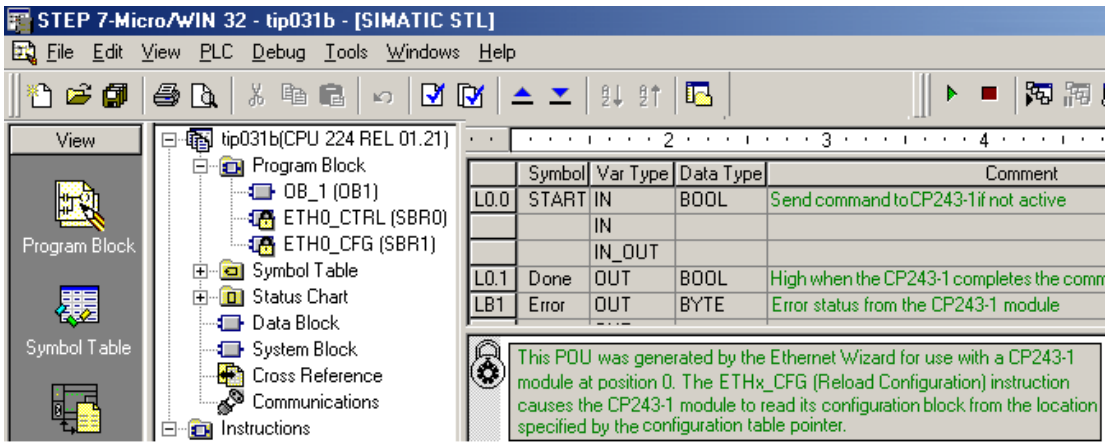


2. To review what the Ethernet wizard produced, double-click **ETH0_CTRL** under the **Program Block**. All **TSAPs** configured are listed for future reference. Remember, the **Local TSAP** below is the **Remote TSAP** in the OPC server and the remote TSAP below is the Local TSAP in the OPC server.

3. The image below shows **ETH0_CTRL**.



4. The image below shows **ETH0_CFG**.

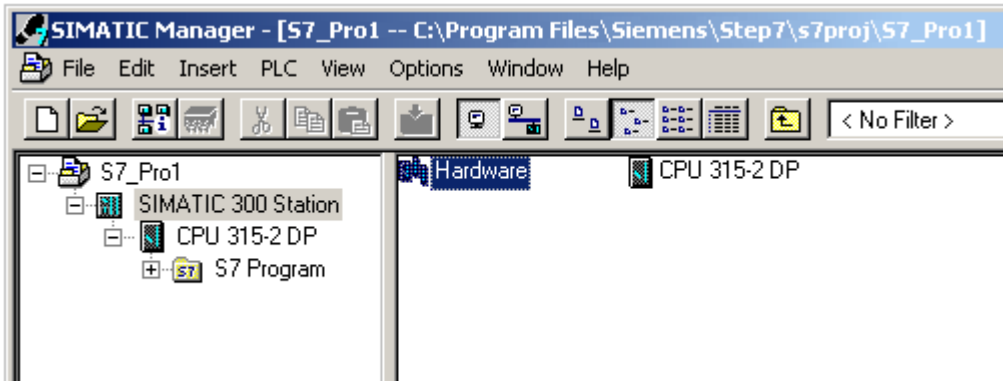


5. Now that the results of the Ethernet wizard have been confirmed, a connection can be made using the OPC server.

How To Configure S7-300/400 Connections in STEP 7

To configure the S7-300/400 for communications with the Siemens TCP/IP Ethernet Driver, both the CPU and the Ethernet module will need to be configured as well. To do so, follow the directions below.

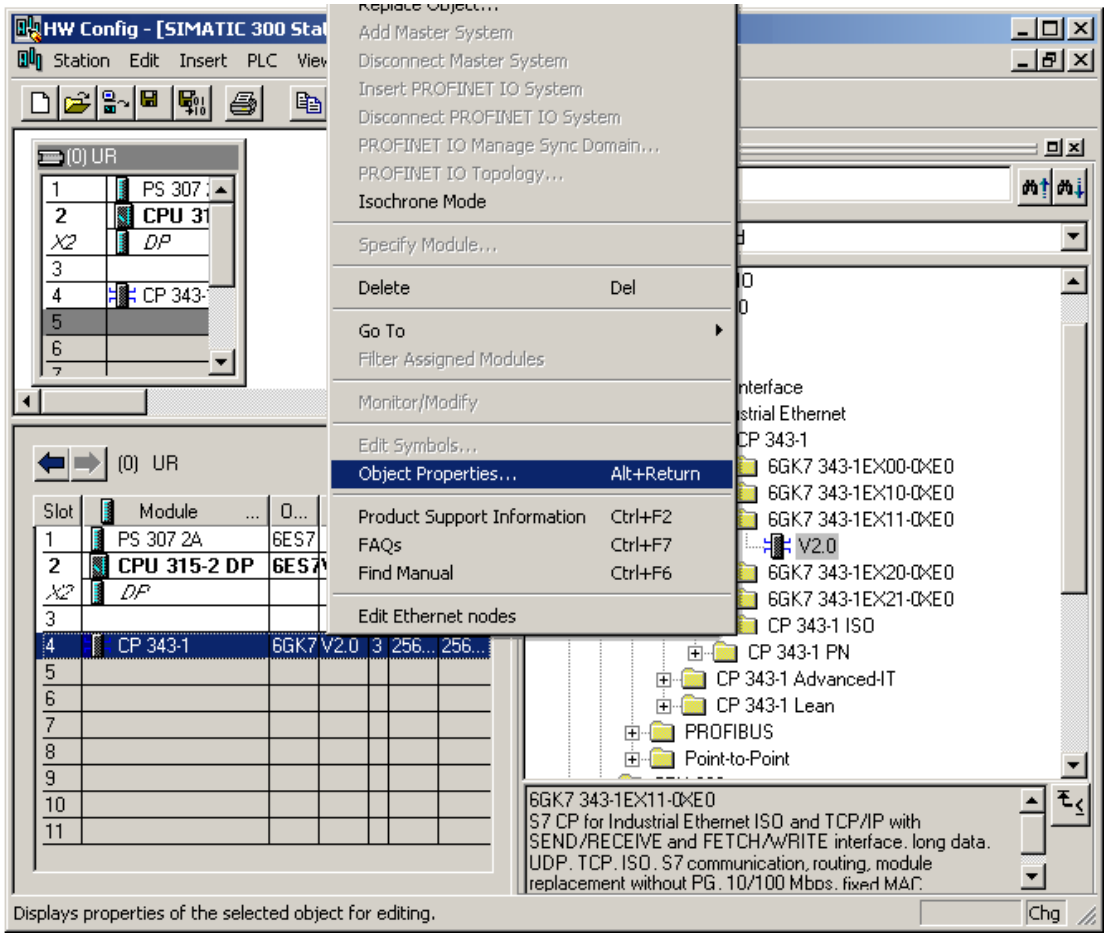
1. From the **Simatic Manager**, launch **HW Config** by double-clicking **Hardware** under the **SIMATIC Station**.



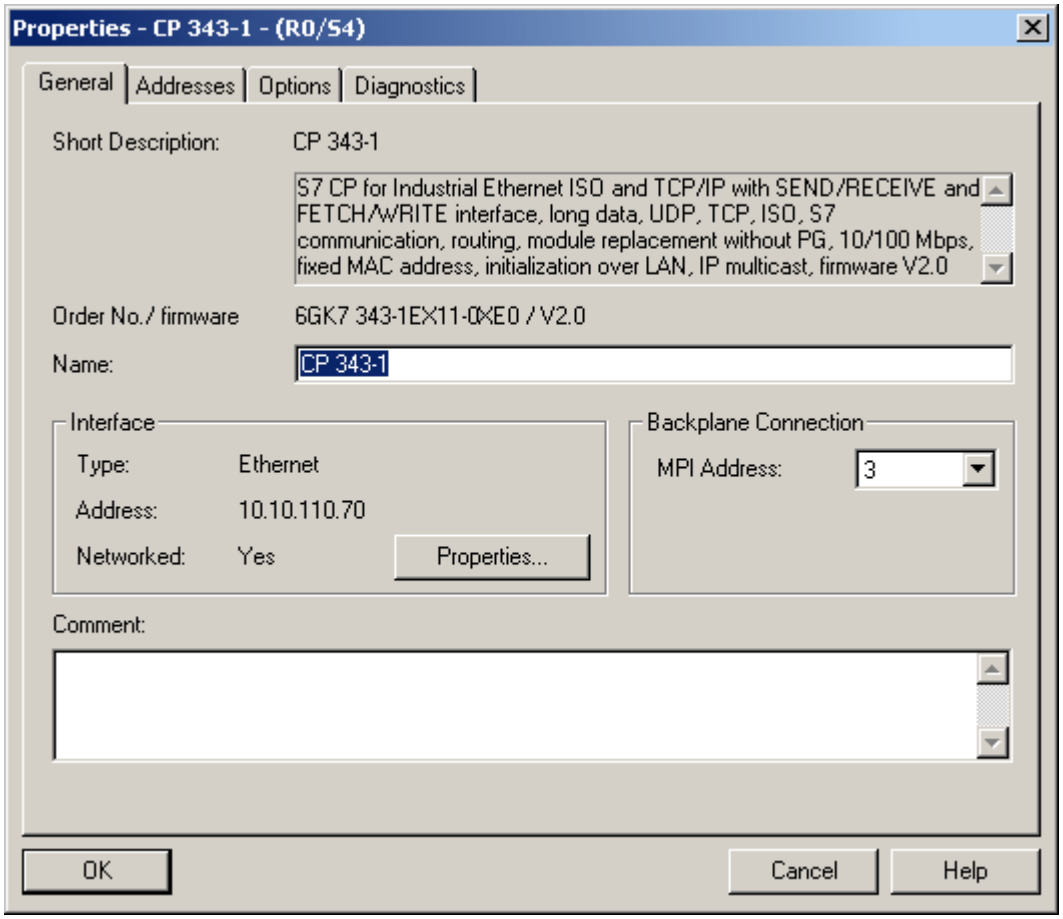
2. If this is a new Simatic project, add the necessary modules to the **Rack** in HW Config. For the Siemens TCP/IP Ethernet Driver to communicate with the CPU, there will need to be at least one Ethernet module capable of **S7 Communications**. This may be built into the CPU.

Configuring an Ethernet Module

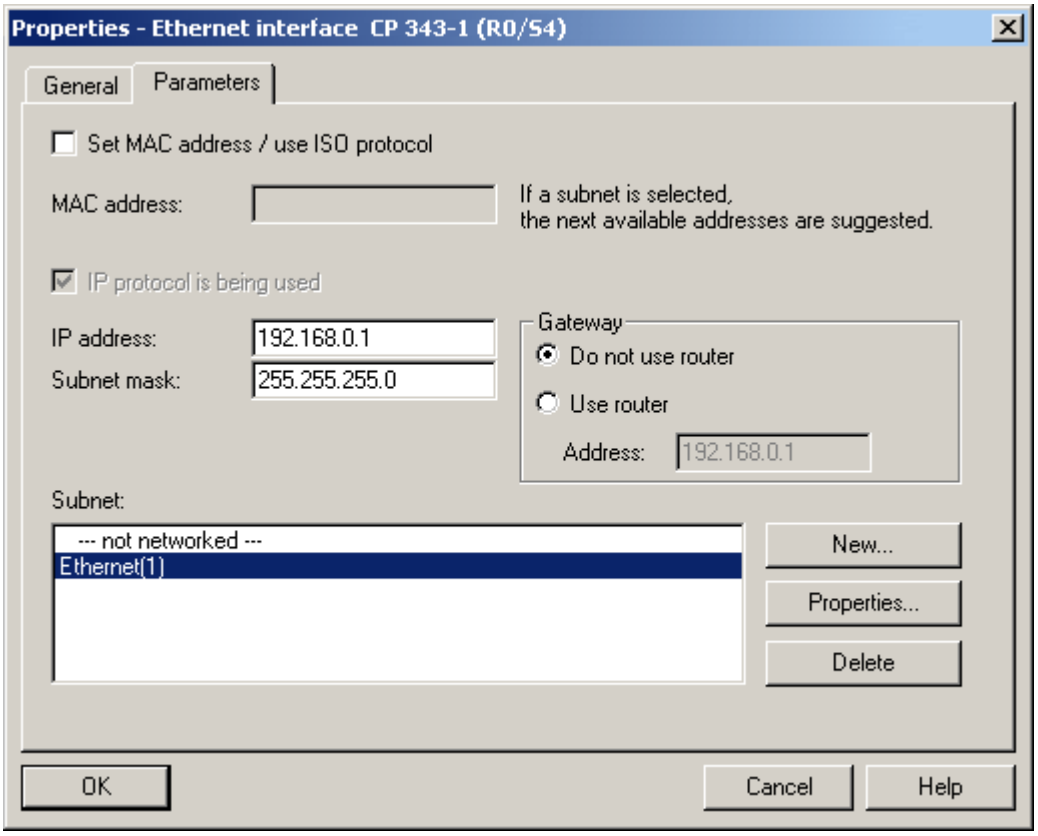
1. Right-click on the particular module in the rack and then select **Object Properties**.



2. The dialog should appear as shown below.



3. From the **General** tab, click the **Interface** | **Properties** button.



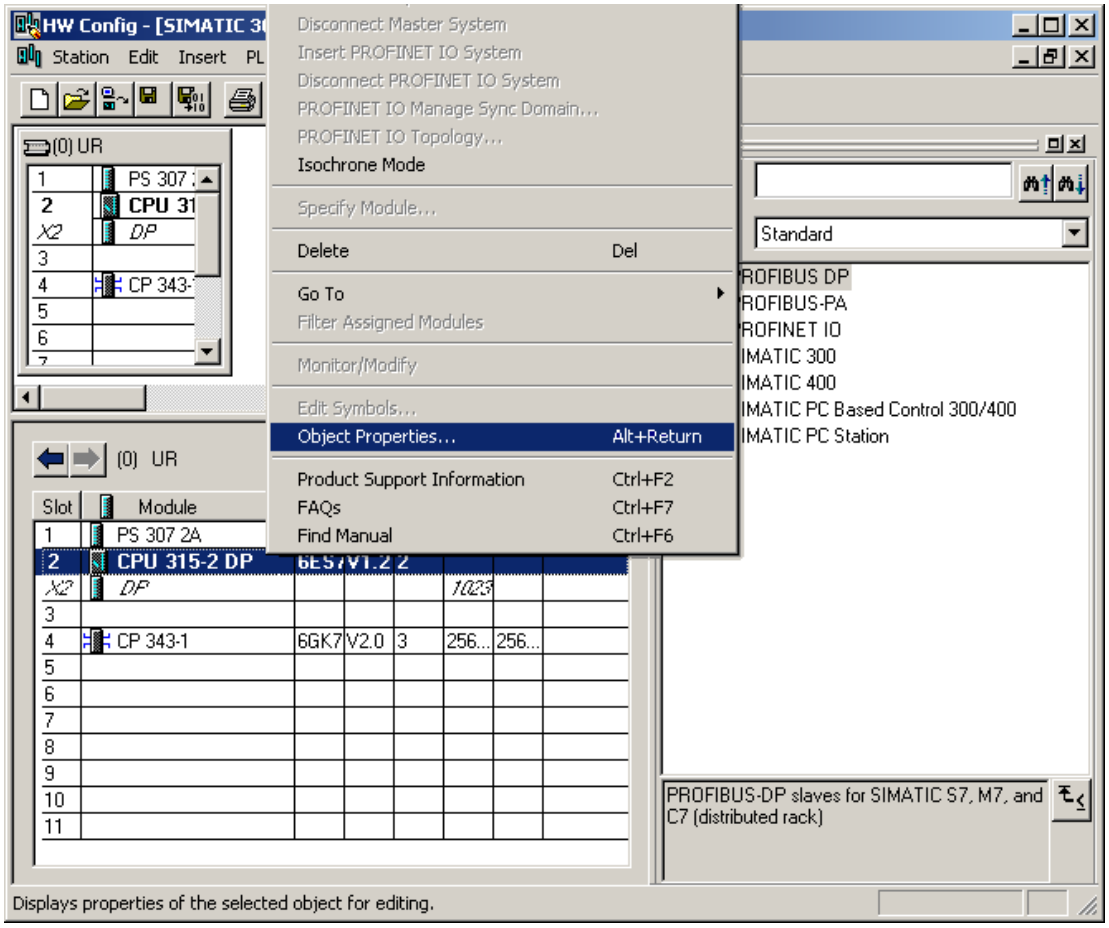
4. Specify the **IP** and **Subnet Mask** for this module.

5. To network this module, click **New** under **Subnet**. Next, select the network created and the click **OK**.

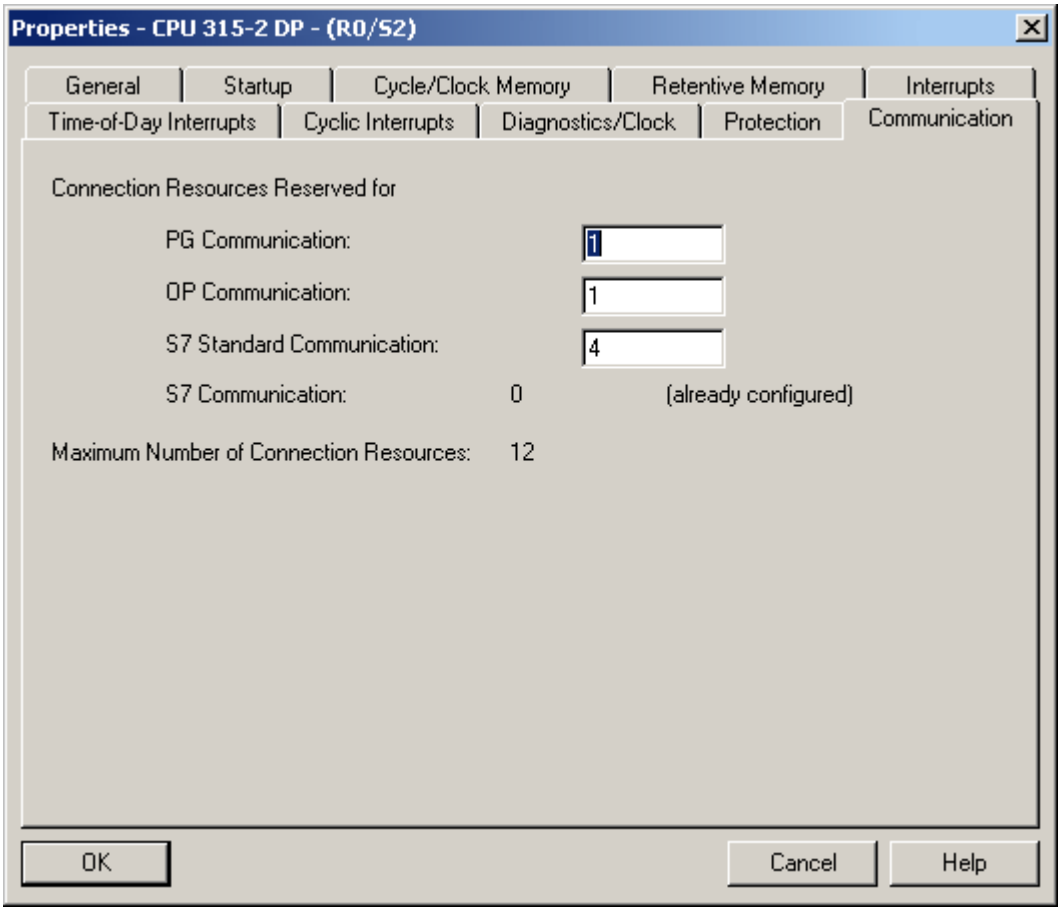
6. Return to the HW Config main window.

Configuring Connections

1. Right-click on the CPU module in the rack and select **Object Properties**.



2. The dialog should appear as shown below.



3. Configure the desired number of **PG/OP** and **PC (S7 Communication)** connections.

Type	Description
PG Communication	Used for program loading, diagnostics
OP Communication	Used for operator control and monitoring
S7 Standard Communication	Communication connections not configured, MPI communications with PUT/GET function blocks
S7 Communication (PC)	Configured connections, data communications

Note: The maximum number of PC connections for the CPU equals the Maximum Number of Connection Resources **minus** the S7 Standard Communication resources **minus** the OP Communication resources **minus** the PG Communication resources. Note that the Maximum Number of Connection Resources is based on the CPU/version/firmware.

In the example shown above, there are six S7 communication (PC) connections available (12-4-1-1=6). Likewise, the number of PG and OP connections can be increased using the same concept.

If the **Device returned protocol [Class=0x83, Code=0x04]** error is encountered, increase the number of S7 Standard Communication connections, thereby decreasing the number of S7 Communication connections.

4. After the connections have been configured, click **OK**. Next, in the main HW Config window click **Station | Save and Compile**.

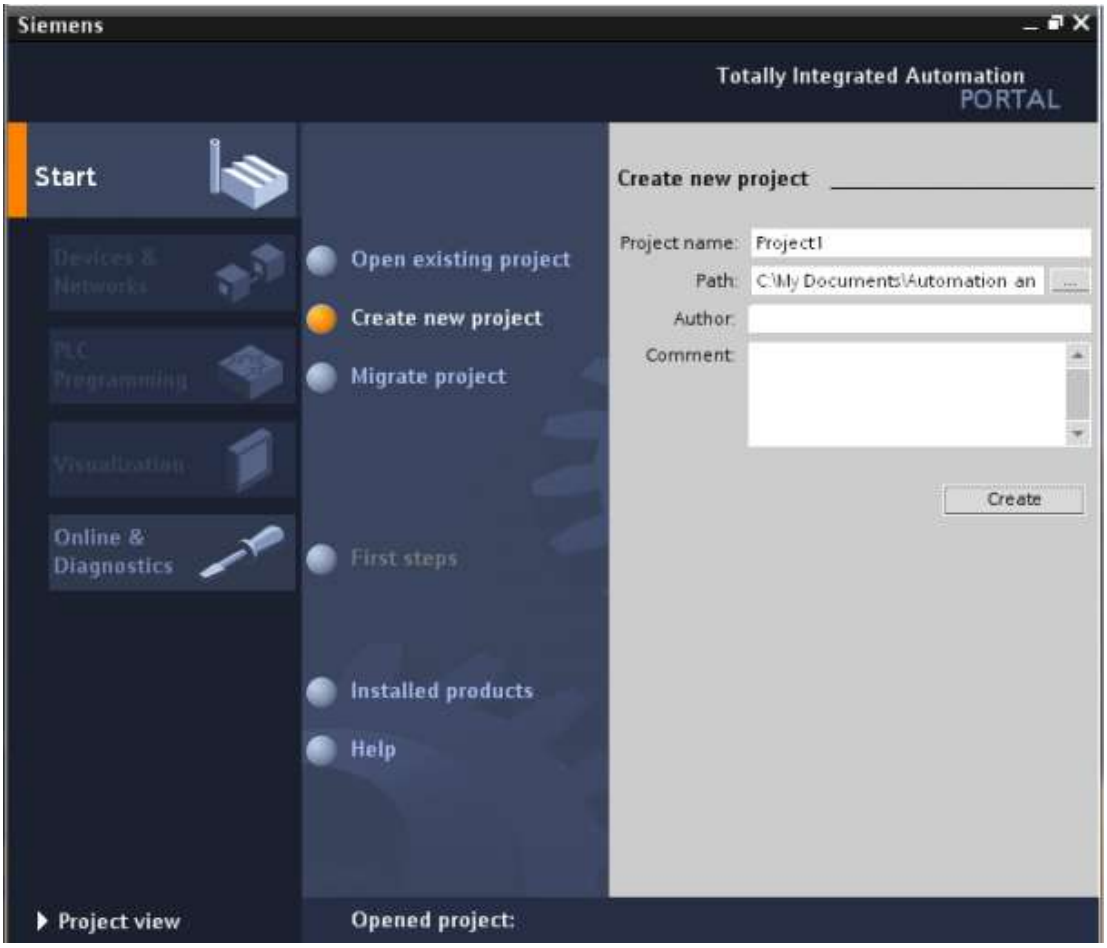
5. Click **PLC | Download** to commit to the changes.

How To Configure S7-1200 Connections with the Totally Integrated Automation (TIA) Portal

To configure the S7-1200 for communications with the Siemens TCP/IP Ethernet Driver, an online connection is required between the programming device and the target system. Users may have to configure the programming device to talk to the target system. For more information, follow the instructions below.

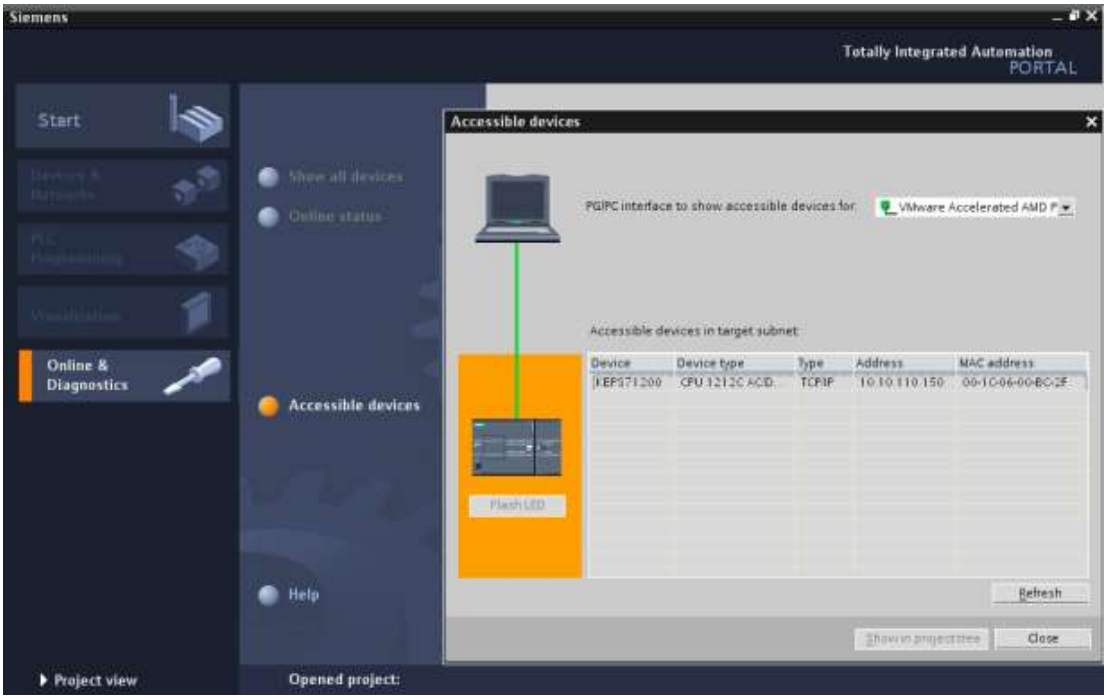
Note: For new Simatic projects, refer to the PLC's documentation for information on the default IP address settings.

1. Start the TIA Portal. In the Portal View, click **Create new project**.

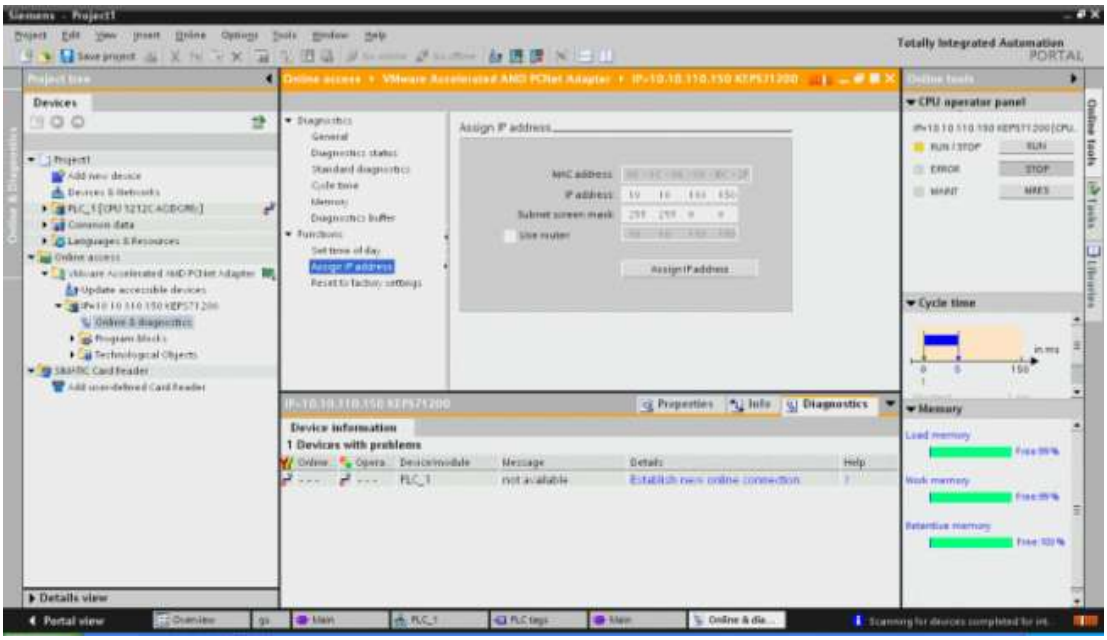


2. Next, select the **Online & Diagnostics** tab and then click **Accessible Devices**.

3. Select the appropriate PG/PC interface. This will prompt the TIA to scan the network for the device.



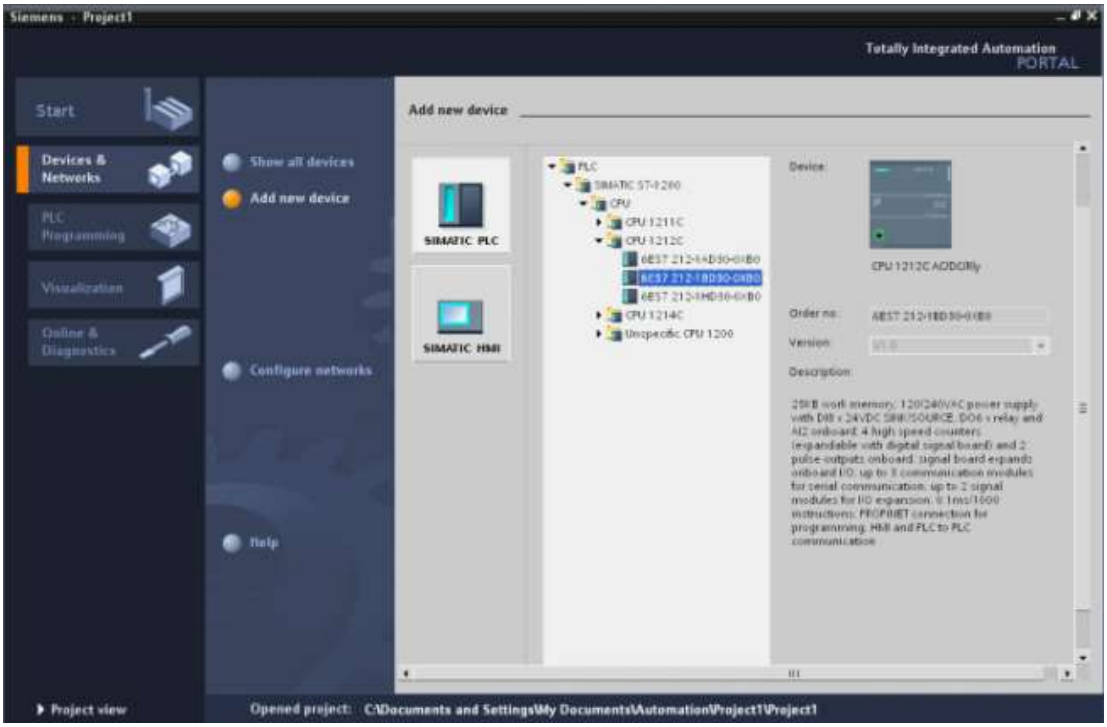
4. Once the scan is complete, select the device and then click **Show**. This will invoke the Project View.
5. In the project tree, locate the IP address and then open **Online & Diagnostics**.
6. Next, double-click **Online & Diagnostics** to invoke **Online Access**.
7. Select **Functions** and then click **Assign IP Address**.



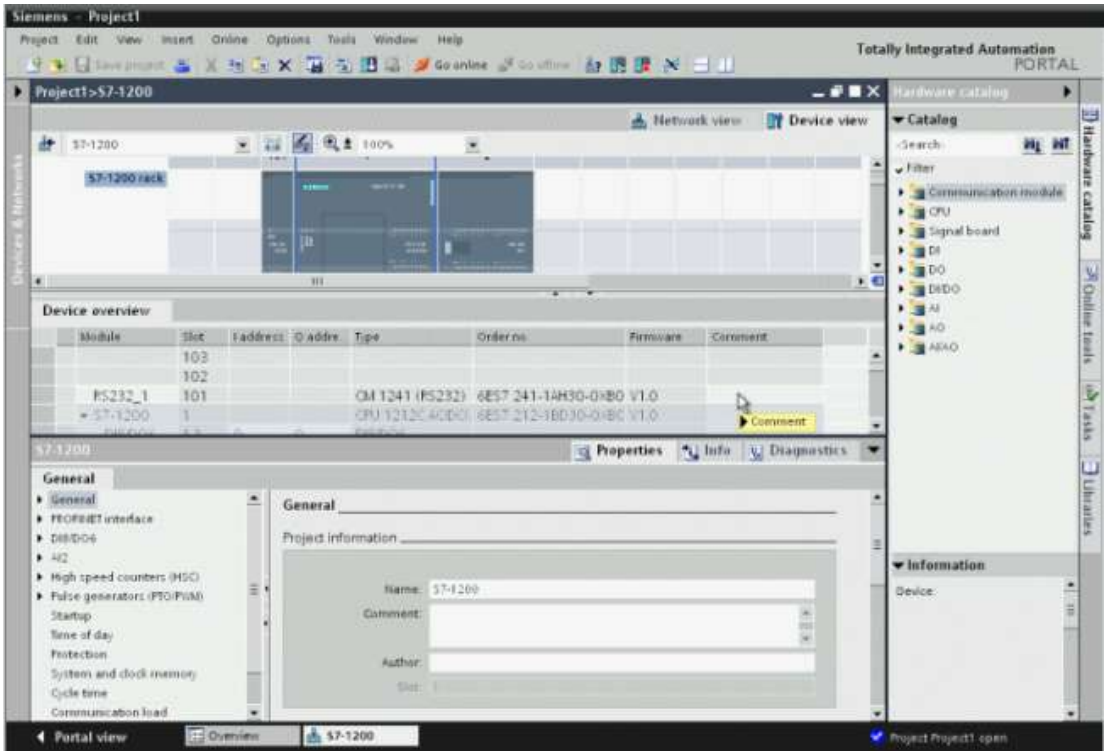
8. Enter the communication settings and click **Assign IP Address**.

   Note: The device is now ready to be configured.

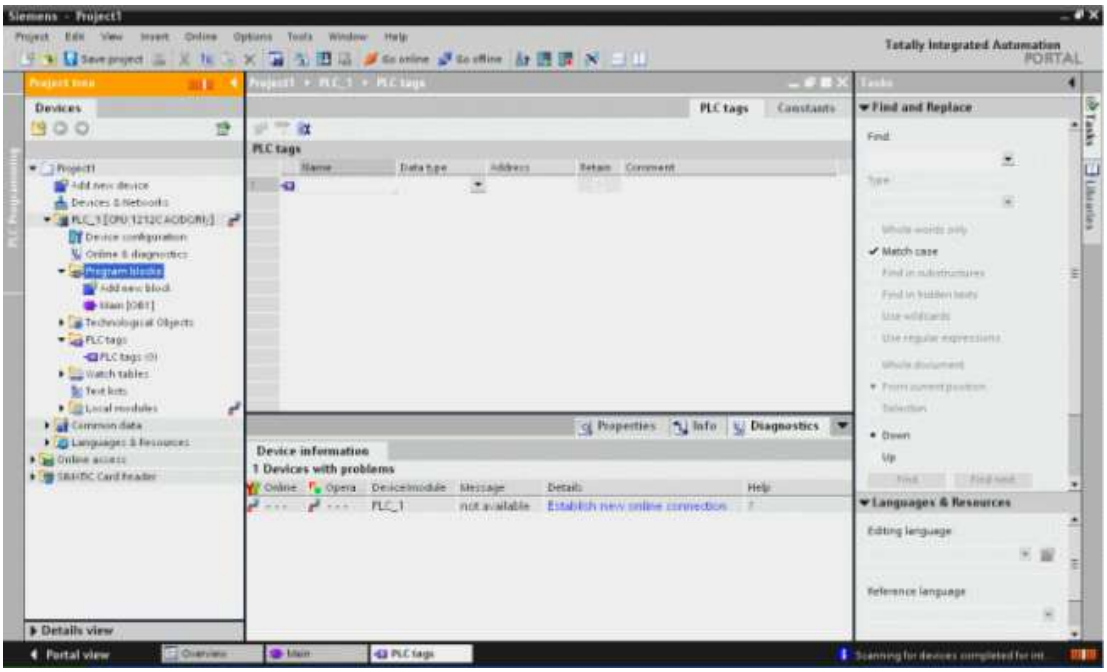
9. Return to the Portal View and then select the **Device & Networks** tab. Then, click **Add new device**.



10. Next, select the device's configuration and then click **Add device**. This will invoke the Project View, where the device's hardware can be further configured.



11. Once finished, view the project tree. Locate **Program Blocks** and **PLC Tags** and then configure the addresses that will be used in the PLC project.



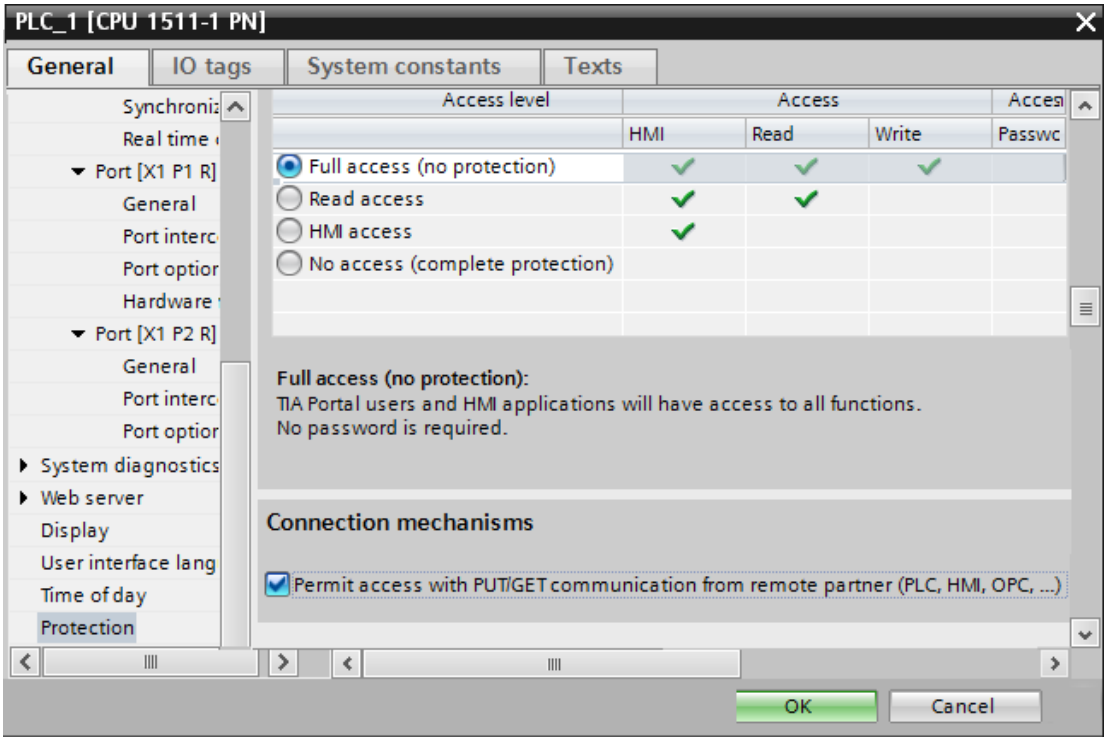
Note: The device is now configured and can be placed in Run Mode for communications.

How To Configure S7-1500 Connections

The S7-1500 controller has an embedded Ethernet port that supports S7 communications over the Ethernet protocol. It must be configured to allow access from the server, however. For more information, refer to the instructions below.

1. To start, open the PLC project in the S7 TIA Portal software.
2. Next, open **PLC Properties**.
3. In the **General** tab, select **Protection**. Then, ensure that **Full access (no protection)** is enabled.

   Note: At this time, the Siemens TCP/IP Ethernet Driver does not support the use of a password.
4. Next, check **Permit access with PUT/GET communication from remote partner**. Then, save the settings.



5. In the server, create a new channel. In **Device Driver**, select **Siemens TCP/IP Ethernet Driver** from the drop-down list. Continue through the channel wizard, specifying channel properties as needed. Then, click **Finish**.
6. Next, create a new device. In **Model**, select **S7-1500** from the **Device Model** drop-down list. Continue through the device wizard, specifying device properties as needed. Then, click **Finish**.

Note: The controller Protection settings are directly related to the device returning protocol error [Class-s=0x81, Code=0x04]. If this error occurs, the controller's memory (such as the Simatic memory card) may need to be reset. Once the controller's memory is reset, downloading the S7 project to the controller should not prompt for a password.

Appendix — Alternate Syntax Support

Limited addressing support is available for the following applications.

Note: All brand and product names are trademarks, registered trademarks, or service marks of their respective holders.

Note: The offset for an atomic type tag in a data block is denoted by the column "Address" in Step 7, as shown above. This offset is denoted by the column "Offset" in the Siemens TIA Portal programming environment.

Applicom Direct-Link Item Syntax

The following support for the Applicom Direct-Link OPC server is considered to be limited. Care must be taken because the data type for a given S7 data type/suffix may differ from the data type for the same S7 data type/suffix in the specified product. Applicom ASCII strings are not supported by this driver. The following information is intended to be a guideline for users that are already familiar with and/or prefer the syntax of the specified product. For preferred item syntax, refer to **Standard S7-300/400/1200/1500 Item Syntax**.

Address Syntax

Input, Output, Peripheral, Flag Memory Types
<memory type><S7 data type><address>[*<Data Type suffix>*] [*<Byte Switching suffix>*]
<memory type><S7 data type><address>[*<Data Type suffix>*]*<_row_col>*

Timer and Counter Memory Types
<memory type><address>

DB Memory Type

DB*<num>.<S7 data type><address>*[*<Data Type suffix>*][*< Byte Switching suffix>*]
DB*<num>.<S7 data type><address>*[*<Data Type suffix>*]*<_row_col>*
where <num> ranges from 1 to 65535.
***See Also**: Examples*

Memory Types

Memory Type	Description	Address Range	Data Type	Access
I E	Inputs	Dependent on S7 Data Type		Read / Write
Q A	Outputs			Read / Write
PI PE	Peripheral Inputs			Read Only
PQ PA	Peripheral Outputs			Read / Write

Memory Type	Description	Address Range	Data Type	Access
M F	Flag Memory			Read / Write
DB	Data Blocks			Read / Write
T	Timers	T0-T65535	DWord, **Long**	Read / Write
C Z	Counters	C0-C65535 Z0-Z65535	**Word**, Short	Read / Write

***See Also**: Examples*

S7 Data Types

The S7 data type is used to coerce the data type for a tag. It does not apply to Timers and Counters. The default data types are shown in **bold**. Suffixes are not required.

Data Type	Description	Address Range	Data Type	Suffix	Data Type w/ Suffix
None* DBX**	Bit	0.b-65534.b DBX0.b-DBX65534.b .b is Bit Number 0-15	**Boolean**		
B DBB**	Unsigned Byte	B0-B65535 DBB0-DBB65535	**Byte**, Char		
W DBW**	Unsigned Word	W0-W65534 DBW0-DBW65534	**Word**, Short, BCD		
D DBD**	Unsigned Double Word	D0-D65532 DBD0-DBD65532	**DWord**, Long, LBCD, Float	F	Float

*No S7 data type specified. Applies to non-DB memory types only.
**Applies to DB memory types only.

***See Also:** Examples*

Data Type Suffixes

Suffix	Description	Data Type
F	32-bit IEEE floating point value	Float

Byte Switching Suffixes

These suffixes are used to switch the bytes that compose data of type 16-bit Word, 32-bit DWord, or 32-bit Float. The switching is applied after the device-level addressing option for byte Order is applied. For more information, refer to **Addressing Options**.

Byte Switching Suffixes can be used with all memory types except Timers and Counters (T, C, and Z) and Peripheral Inputs and Outputs (PI, PE, PQ, and PA). For information on the various types of switching that depend on the suffix and data type of the item, refer to the table below.

Suffix	16-Bit Data Types (Word, Short, BCD)	32-Bit Data Types (DWord, Long, LBCD, Float)
_X1	O1 O2 -> O2 O1 (byte switching)	O1 O2 O3 O4 -> O4 O3 O2 O1 (byte switching)
_X2	O1 O2 -> O2 O1 (byte switching)	O1 O2 O3 O4 -> O3 O4 O1 O2 (Word switching)
_X3	O1 O2 -> O2 O1 (byte switching)	O1 O2 O3 O4 -> O2 O1 O4 O3 (Switching bytes in the words)

Array Support

The *<.array size>* notation is appended to an address to specify an array (such as "MW0.10"). Boolean arrays and string arrays are not supported.

Examples

S7 Data Type	Data Type	Input	Flags	Data Blocks
None DBX	Boolean Boolean	I0.7 ----	M0.7 ----	---- DB1.DBX0.7
B DBB	Byte Array	IB0 ---- IB0_2_5 ----	MB0 ---- MB0_2_5 ----	---- DB1.DBB0 ---- DB1.DBB0_2_5
W DBW	Word Array	IW0 ---- IW0_X1 IW0_10 ----	MW0 ---- MW0_X2 MW0_10 ----	---- DB1.DBW0 DB1.DBW0_X3 ---- DB1.DBW0_10
D DBD	DWord Float (F) Array	ID0 ---- ID0_X1 ID0F ID0F_X1 ID0_4_3 ----	MD0 ---- MD0_X2 MD0F MD0F_X2 MD0_4_3 ----	---- DB1.DBD0 DB1.DBD0_X3 DB1.DBD0F DB1.DBD0F_X3 ---- DB1.DBD0F_4_3

INAT OPC Server TCPIPH1 Item Syntax

The following support for the INAT OPC Server TCPIPH1 (V1.22 and up) is considered to be limited. Care must be taken as the data type for a given S7 data type/suffix may differ from the data type for the same S7 data type/suffix in the specified product. S7 data type and suffixes not included below are not supported by this driver. The following information is intended to be a guideline for users that are already familiar with and/or prefer the syntax of the specified product. For preferred item syntax, refer to **Standard S7-300/400/1200/1500 Item Syntax**.

Address Syntax

Input, Output, Peripheral, Flag Memory Types
<memory type><S7 data type><address>[*<suffix>*]
*<memory type><S7 data type><address><.string length>**
<memory type><S7 data type><address><.array size>[*<suffix>*]

Timer and Counter Memory Types
<memory type><address>

DB Memory Type

DB*<num>.<S7 data type><address>*[*<suffix>*]
DB*<num>.<S7 data type><address><.string length>**
DB*<num>.<S7 data type><address><.array size>*[*<suffix>*]

where <num> ranges from 1 to 65535.

*Applies to S7 data types that support string.

See Also: ***Examples***

Memory Types

Memory Type	Description	Address Range	Data Type	Access
I E	Inputs	Dependent on S7 Data Type		Read / Write
Q A	Outputs			Read / Write
PI PE	Peripheral Inputs			Read Only
PQ PA	Peripheral Outputs			Read / Write
M F	Flag Memory			Read / Write
DB	Data Blocks			Read / Write
T	Timers	T0-T65535	DWord, **Long**	Read / Write
C Z	Counters	C0-C65535 Z0-Z65535	**Word**, Short	Read / Write

See Also: ***Examples***

S7 Data Types

The S7 data type is used to coerce the data type for a tag. It does not apply to Timers and Counters. Default data types are shown in **bold**. A suffix is not required.

Data Type	Description	Address Range	Data Type	Suffix	Data Type w/ Suffix
X	Bit	X0.b-X65534.b .b is Bit Number 0-15	**Boolean**		
B Byte	Unsigned Byte	B0-B65535 BYTE0-BYTE65535	**Byte**, Char	KF	Char

Data Type	Description	Address Range	Data Type	Suffix	Data Type w/ Suffix
W Word	Unsigned Word	W0-W65534 WORD0-WORD65534	**Word**, Short, BCD	BCD KF	BCD Short
I INT	Signed Word	I0-I65534 INT0-INT65534	Word, **Short**, BCD	BCD	BCD
D DWORD	Unsigned Double Word	D0-D65532 DWORD0-DWORD65532	**DWord**, Long, LBCD, Float	BCD IEEE KF	LBCD Float Long
DI DINT	Signed Double Word	DI0-DI65532 DINT0-DINT65532	DWord, **Long**, LBCD, Float	BCD IEEE	LBCD Float
R REAL	IEEE Float	R0-R65532 REAL0-REAL65532	**Float**		
G String	S7 String	G0.n-G65532.n STRING0.n-STRING65532.n .n is string length 0<n<= 254 (PDU size of 480 and above) 0<n<= 210 (PDU size below 480) 0<n<= 254 (Netlink S7300 and Netlink S7400 Models)	**String**		

See Also: ***Examples***

Suffixes

Suffix	Description	Data Type
BCD	Two-byte packed BCD for Word references Value range is 0-9999 Four-byte packed BCD for DWord references Value range is 0-99999999	BCD LBCD
IEEE	32-bit IEEE floating point value	Float
KF	Signed	Char Short Long

Array Support

The <*.array size*> notation is appended to an address to specify an array (such as MW0.10). Boolean arrays and string arrays are not supported.

Examples

S7 Data Type	Data Type	Input	Flags	Data Blocks
X	Boolean	IX0.7	MX0.7	DB1.X0.7
B Byte	Byte	IB0 IBYTE0	MB0 MBYTE0	DB1.B0 DB1.BYTE0

S7 Data Type	Data Type	Input	Flags	Data Blocks
	Char (KF)	IB0KF IBYTE0KF	MB0KF MBYTE0KF	DB1.B0KF DB1.BYTE0KF
	Array	IB0KF.10 IBYTE0KF.10	MB0KF.10 MBYTE0KF.10	DB1.B0KF.10 DB1.BYTE0KF.10
W Word	Word	IW0 IWORD0	MW0 MWORD0	DB1.W0 DB1.WORD0
	BCD (BCD)	IW0BCD IWORD0BCD	MW0BCD MWORD0BCD	DB1.W0BCD DB1.WORD0BCD
	Short (KF)	IW0KF IWORD0KF	MW0KF MWORD0KF	DB1.W0KF DB1.WORD0KF
	Array	IW0BCD.10 IWORD0BCD.10	MW0BCD.10 MWORD0BCD.10	DB1.W0BCD.10 DB1.WORD0BCD.10
I INT	Short	II0 IINT0	MI0 MINT0	DB1.I0 DB1.INT0
	BCD (BCD)	II0BCD IINT0BCD	MI0BCD MINT0BCD	DB1.I0BCD DB1.INT0BCD
	Array	II0.10 IINT0.10	MI0.10 MINT0.10	DB1.I0.10 DB1.INT0.10
D DWORD	DWord	ID0 IDWORD0	MD0 MDWORD0	DB1.D0 DB1.DWORD0
	LBCD (BCD)	ID0BCD IDWORD0BCD	MD0BCD MDWORD0BCD	DB1.D0BCD DB1.DWORD0BCD
	Float (IEEE)	ID0IEEE IDWORD0IEEE	MD0IEEE MDWORD0IEEE	DB1.D0IEEE DB1.DWORD0IEEE
	Long (KF)	ID0KF IDWORD0KF	MD0KF MDWORD0KF	DB1.D0KF DB1.DWORD0KF
	Array	ID0IEEE.10 IDWORD0IEEE.10	MD0IEEE.10 MDWORD0IEEE.10	DB1.D0IEEE.10 DB1.DWORD0IEEE.10
DI DINT	Long	IDI0 IDINT0	MDI0 MDINT0	DB1.DI0 DB1.DINT0
	LBCD (BCD)	IDI0BCD IDINT0BCD	MDI0BCD MDINT0BCD	DB1.DI0BCD DB1.DINT0BCD
	Float (IEEE)	IDI0IEEE IDINT0IEEE	MDI0IEEE MDINT0IEEE	DB1.DI0IEEE DB1.DINT0IEEE

S7 Data Type	Data Type	Input	Flags	Data Blocks
	Array	IDI0BCD.10 IDINT0BCD.10	MDI0BCD.10 MDINT0BCD.10	DB1.DI0BCD.10 DB1.DINT0BCD.10
R REAL	Float Array	IR0 IREAL0 IR0.10 IREAL0.10	MR0 MREAL0 MR0.10 MREAL0.10	DB1.R0 DB1.REAL0 DB1.R0.10 DB1.REAL0.10
G String	String	IG0.10 ISTRING0.10	MG0.10 MSTRING0.10	DB1.G0.10 DB1.STRING0.10

Siemens Simatic Net Item Syntax

The following support for the Siemens Simatic Net OPC server is considered to be limited. Care must be taken as the data type for a given S7 data type may differ from the data type for the same S7 data type in the specified product. S7 data types not included below are not supported by this driver. The following information is intended to be a guideline for users that are already familiar with and/or prefer the syntax of the specified product. For preferred item syntax, refer to **Standard S7-300/400/1200/1500 Item Syntax**.

Address Syntax

Input, Output, Peripheral, Flag Memory Types

<memory type><S7 data type><address>
<memory type><S7 data type><address><.string length>
<memory type><S7 data type><address><,array size>

Timer and Counter Memory Types

<memory type><address>

DB Memory Type

DB*<num>*,*<S7 data type><address>*
DB*<num>*,*<S7 data type><address><.string length>**
DB*<num>*,*<S7 data type><address><,array size>*

where *<num>* ranges from 1 to 65535.

*Applies to S7 data types that support String.

See Also**: **Examples

Memory Types

Memory Type	Description	Address Range	Data Type	Access
I E	Inputs	Dependent on S7 Data Type		Read / Write
Q A	Outputs			Read / Write
PI PE	Peripheral Inputs			Read Only

Memory Type	Description	Address Range	Data Type	Access
PQ PA	Peripheral Outputs			Read / Write
M F	Flag Memory			Read / Write
DB	Data Blocks			Read / Write
T	Timers	T0-T65535	DWord, **Long**	Read / Write
C Z	Counters	C0-C65535 Z0-Z65535	**Word**, Short	Read / Write

***See Also**: Examples*

S7 Data Types

The S7 data type is used to coerce the data type for a tag. It does not apply to Timers and Counters. The default data types are shown in **bold**.

Data Type	Description	Address Range	Data Type
X	Bit	X0.b-X65534.b .b is Bit Number 0-15	**Boolean**
B Byte	Unsigned Byte	B0-B65535 BYTE0-BYTE65535	**Byte**, Char
Char	Signed Byte	CHAR0-CHAR65535	Byte, **Char**
W Word	Unsigned Word	W0-W65534 WORD0-WORD65534	**Word**, Short, BCD
INT	Signed Word	INT0-INT65534	Word, **Short**, BCD
D DWORD	Unsigned Double Word	D0-D65532 DWORD0-DWORD65532	**DWord**, Long, LBCD, Float
DINT	Signed Double Word	DINT0-DINT65532	DWord, **Long**, LBCD, Float
REAL	IEEE Float	REAL0-REAL65532	**Float**
String	S7 String	STRING0.n-STRING65532.n .n is string length. 0<n<= 254.	**String**

***See Also**: Examples*

Array Support

The <.*array size*> notation is appended to an address to specify an array (such as MW0.10). Boolean arrays and string arrays are not supported.

Examples

S7 Data Type	Data Type	Input	Flags	Data Blocks
X	Boolean	IX0.7	MX0.7	DB1,X0.7
B	Byte	IB0	MB0	DB1,B0

S7 Data Type	Data Type	Input	Flags	Data Blocks
Byte	Array	IBYTE0 IB0,10 IBYTE0,10	MBYTE0 MB0,10 MBYTE0,10	DB1,BYTE0 DB1,B0,10 DB1,BYTE0,10
Char	Char Array	ICHAR0 ICHAR0,10	MCHAR0 MCHAR0,10	DB1,CHAR0 DB1,CHAR0,10
W Word	Word Array	IW0 IWORD0 IW0,10 IWORD0,10	MW0 MWORD0 MW0,10 MWORD0,10	DB1,W0 DB1,WORD0 DB1,W0,10 DB1,WORD0,10
INT	Short Array	IINT0 IINT0,10	MINT0 MINT0,10	DB1,INT0 DB1,INT0,10
D DWORD	DWord Array	ID0 IDWORD0 ID0,10 IDWORD0,10	MD0 MDWORD0 MD0,10 MDWORD0,10	DB1,D0 DB1,DWORD0 DB1,D0,10 DB1,DWORD0,10
DINT	Long Array	IDINT0 IDINT0,10	MDINT0 MDINT0,10	DB1,DINT0 DB1,DINT0,10
REAL	Float Array	IREAL0 IREAL0,10	MREAL0 MREAL0,10	DB1,REAL0 DB1,REAL0,10
String	String	ISTRING0.10	MSTRING0.10	DB1,STRING0.10

Siemens STEP 7 Item Syntax

The following support for Siemens STEP 7 Variable Table (VAT) syntax is considered to be limited. Care must be taken as the data type for a given S7 data type/suffix may differ from the data type for the same S7 data type/suffix in the specified product. S7 data types not included below are not supported by this driver. The following information is intended to be a guideline for users that are already familiar with and/or prefer the syntax of the specified product. For preferred item syntax, refer to **Standard S7-300/400/1200/1500 Item Syntax**.

Address Syntax

Input, Output, Peripheral, Flag Memory Types

<memory type><S7 data type><address>

Timer and Counter Memory Types

<memory type><address>

DB Memory Type

DB*<num>.<S7 data type><address>*

where <num> ranges from 1 to 65535.

See Also: ***Examples***

Memory Types

Memory Type	Description	Address Range	Data Type	Access
I E	Inputs	Dependent on S7 Data Type		Read / Write
Q A	Outputs			Read / Write
PI PE	Peripheral Inputs			Read Only
PQ PA	Peripheral Outputs			Read / Write
M F	Flag Memory			Read / Write
DB	Data Blocks			Read / Write
T	Timers	T0-T65535	DWord, **Long**	Read / Write
C Z	Counters	C0-C65535 Z0-Z65535	**Word**, Short	Read / Write

See Also: ***Examples***

Accessing Structured Elements in STEP 7

For the Siemens S7-1200 model, STEP 7 accesses the Counter and Timer structured elements as complete whole structures instead of individual tags. For more information on the element offset and its server address equivalent, refer to the tables below.

Counters

Element	Data Type	Offset	Server Address Equivalent
Count_UP	Boolean	0.0	DB1,C00.0
Count_Down	Boolean	0.1	DB1,C00.1
Reset	Boolean	0.2	DB1,C00.2
Load	Boolean	0.3	DB1,C00.3
Q_UP	Boolean	0.4	DB1,C00.4
Q_Down	Boolean	0.5	DB1,C00.5
PAD	Byte	1.0	DB1,B1
Preset_Value	Short	2.0	DB1,I2
Count_Value	Short	4.0	DB1,I4

Timers

Element	Data Type	Offset	Server Address Equivalent
Start	DWord	0.0	DB1,D0

Element	Data Type	Offset	Server Address Equivalent
Preset	DWord	4.0	DB1,D4
Elapsed	DWord	8.0	DB1,D8
Running	Bool	12.0	DB1,DBX12.0
IN	Bool	12.1	DB1,DBX12.1
Q	Bool	12.2	DB1,DBX12.2
PAD	Byte	13.0	DB1,DBB13
PAD_2	Byte	14.0	DB1,DBB14
PAD_3	Byte	15.0	DB1,DBB15

For more information, refer to ***Standard S7-300/400/1200/1500 Item Syntax****.*

S7 Data Types

The S7 data type is used to coerce the data type for a tag. It does not apply to Counters and Timers. The default data types are shown in **bold**.

Data Type	Description	Address Range	Data Type	Suffix	Data Type w/ Suffix
None* DBX**	Bit	0.b-65534.b DBX0.b-DBX65534.b .b is Bit Number 0-15	**Boolean**		
B DBB**	Unsigned Byte	B0-B65535 DBB0-DBB65535	**Byte**, Char		
W DBW**	Unsigned Word	W0-W65534 DBW0-DBW65534	**Word**, Short, BCD		
D DBD**	Unsigned Double Word	D0-D65532 DBD0-DBD65532	**DWord**, Long, LBCD, Float	F	Float

*No S7 data type specified. Applies to non-DB memory types only.
**Applies to DB memory types only.

See Also: ***Examples***

Examples

S7 Data Type	Data Type	Input	Flags	Data Blocks
None DBX	Boolean	I0.7 ----	M0.7 ----	---- DB1.DBX0.7
B DBB	Byte	IB0 ----	MB0 ----	---- DB1.DBB0
W DBW	Word	IW0 ----	MW0 ----	---- DB1.DBW0
D DBD	DWord	ID0 ----	MD0 ----	---- DB1.DBD0

Note: The offset for an atomic type tag in a data block is denoted by the column "Address" in Step 7, as shown above. This offset is denoted by the column "Offset" in the Siemens TIA Portal programming environment.

Softing S7/S5 OPC Server Item Syntax

The following support for the Softing S7/S5 OPC server is considered to be limited. Care must be taken as the data type for a given S7 data type/suffix may differ from the data type for the same S7 data type/suffix in the specified product. The following information is intended to be a guideline for users that are already familiar with and/or prefer the syntax of the specified product. For preferred item syntax, refer to **Standard S7-300/400/1200/1500 Item Syntax**.

Address Syntax

Input, Output, Peripheral, Flag Memory Types
<memory type><S7 data type><address>:[*<suffix>*]

Timer and Counter Memory Types
<memory type><address>

DB Memory Type

DB*<num>.<S7 data type><address>*:[*<suffix>*]

Where *<num>* ranges from 1 to 65535.

See Also: ***Examples***

Memory Types

Memory Type	Description	Address Range	Data Type	Access
I E	Inputs	Dependent on S7 Data Type		Read / Write
Q A	Outputs			Read / Write
PI PE	Peripheral Inputs			Read Only
PQ PA	Peripheral Outputs			Read / Write
M F	Flag Memory			Read / Write
DB	Data Blocks			Read / Write
T	Timers	T0-T65535	DWord, **Long**	Read / Write
C Z	Counters	C0-C65535 Z0-Z65535	**Word**, Short	Read / Write

See Also: ***Examples***

S7 Data Types

The S7 data type is used to coerce the data type for a tag. It does not apply to Timers and Counters. The default data types are shown in **bold**. Suffix is not required.

Data Type	Description	Address Range	Data Type	Suffix	Data Type w/ Suffix
None* DBX**	Bit	0.b-65534.b DBX0.b-DBX65534.b .b is Bit Number 0-15	**Boolean**		
B DBB**	Unsigned Byte	B0-B65535 DBB0-DBB65535	**Byte**, Char	Byte Char String	Byte Char String
W DBW**	Unsigned Word	W0-W65534 DBW0-DBW65534	**Word**, Short, BCD	Word INT BCD	Word INT BCD
D DBD**	Unsigned Double Word	D0-D65532 DBD0-DBD65532	**DWord**, Long, LBCD, Float	DWord DINT BCD REAL	DWord DINT BCD REAL

*No S7 data type specified. Applies to non-DB memory types only.
**Applies to DB memory types only.

See Also: ***Examples***

Suffixes

Suffix	Description	Data Type
Byte	Unsigned Byte	Byte
Char	Signed Byte	Char
Word	Unsigned Word	Word
INT	Signed Word	Short
DWORD	Unsigned DWord	DWord
DINT	Signed DWord	Long
BCD	Two byte packed BCD for Word references Value range is 0-9999 Four byte packed BCD for DWord references Value range is 0-99999999	BCD LBCD
REAL	32-bit IEEE floating point value	Float
String	S7 String	String

Examples

S7 Data Type	Data Type	Input	Flags	Data Blocks
None DBX	Boolean	I0.7 ----	M0.7 ----	---- DB1.DBX0.7

S7 Data Type	Data Type	Input	Flags	Data Blocks
B DBB	Byte String (String)	IB0 ---- IB0:String ----	MB0 ---- MB0:String ----	---- DB1.DBB0 ---- DB1.DBB0:String
W DBW	Word BCD (BCD)	IW0 ---- IW0:BCD ----	MW0 ---- MW0:BCD ----	---- DB1.DBW0 ---- DB1.DBW0:BCD
D DBD	DWord LBCD (BCD) Float (REAL)	ID0 ---- ID0:BCD ---- ID0:REAL ----	MD0 ---- MD0:BCD ---- MD0:REAL ----	---- DB1.DBD0 ---- DB1.DBD0:BCD ---- DB1.DBD0:REAL

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