Toyopuc PC3/PC2 Ethernet Driver

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Toyopuc PC3/PC2 Ethernet Driver

Help version 1.049

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Overview

The Toyopuc PC3/PC2 Ethernet Driver provides a reliable way to connect Toyopuc PC3/PC2 Ethernet devices to OPC client applications; including HMI, SCADA, Historian, MES, ERP, and countless custom applications. It is intended for use with Toyopuc PC3, PC2 and PC10G series PLCs using the Ethernet communications interface. The Toyopuc PC3/PC2 Ethernet Driver supports extensive diagnostics tags and the Toyopuc PC3/PC2 multi-point read features. *For more information, refer to **Diagnostics Tags** and **Multi-Point Read Support**.*

Setup

Supported Devices

Toyopuc PC3, PC2 and PC10G series
The PC2 model selection can be used with PC3 > PLCs operating in the PC2 Interchange mode.

Note: This driver is limited to 1024 devices.

Communication Protocol

Toyopuc PC3/PC2 Ethernet Computer Link Protocol

Connection Timeout

This property specifies the time that the driver will wait for a connection to be made with a device. Depending on network load, the connect time may vary with each connection attempt. The default setting is 5 seconds. The valid range is 1 to 30 seconds.

Note: Making a connection with a device can be very time consuming. When connecting with multiple devices located at different IP addresses or port numbers, define an additional Toyopuc Ethernet channel in the OPC Server project for this unique device. Connecting to multiple devices using the Relay Command through a single IP and port number will not cause a new connection to be opened and will not incur a connection delay.

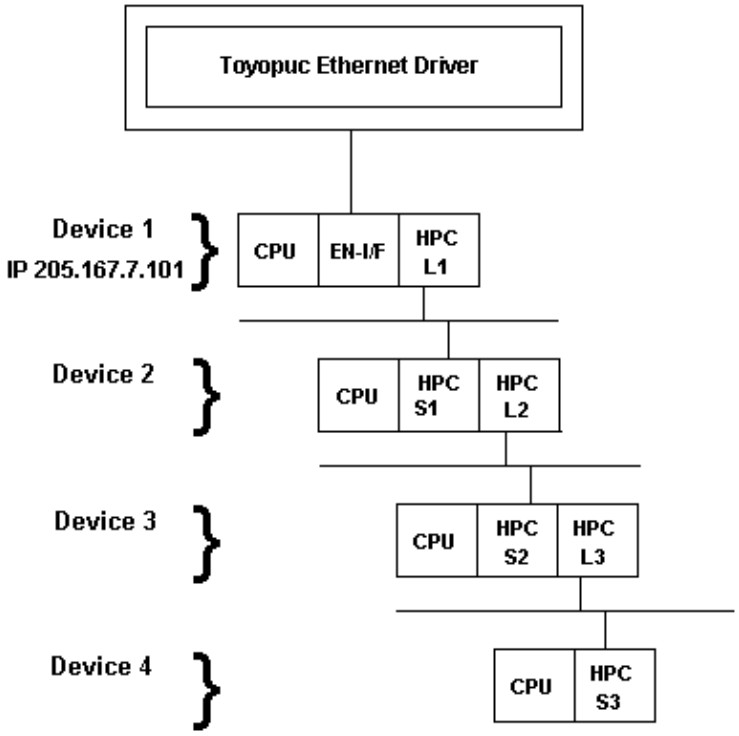
Port Number

This property specifies the port number that will be used to connect to the Toyopuc PLC. The Toyopuc EN-I/F Ethernet PC3/PC2 module supports eight ports for communications. Each port must be dedicated to a single connection. When specifying a port number, ensure that no other Ethernet node will attempt to use this port number on the target Toyopuc PLC. The same port number can be used when communicating with multiple Toyopuc PLCs.

Device IDs

The Device ID, specified as YYY.YYY.YYY.YYY[P1,L1, S1, L2, S2, P3, L3, S3], is used to specify the Device IP address along with Relay Command Link/Exchange information on the Ethernet network. YYY designates the Device IP address: each YYY byte should be in the range of 0 to 255.

Note: A request can be relayed through one device to another device configured with the same link module, such as HPC-Link or FL-net. This relay connection is established by appending a link/exchange path to the device IP address. The following image illustrates the use of the routing path between HPC-linked devices:



A routing command can only be issued through a maximum of four devices. Routing allows the Ethernet driver to request data from non-Ethernet devices. To request data from Device 3, the driver can route a command through Device 1 onto Device 2 then to Device 3.

Examples

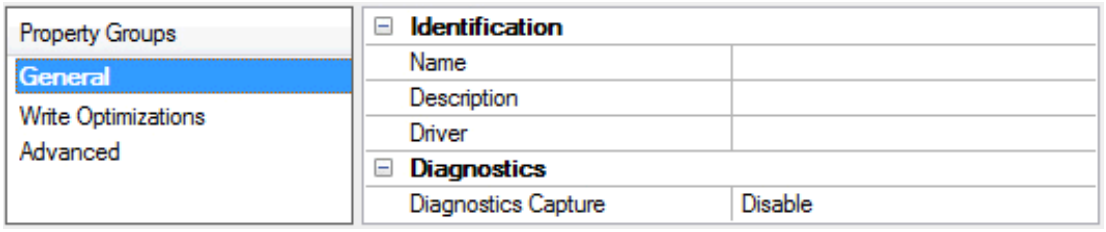
1. Defining a Device ID to request data from Device 1. Device ID: 205.167.7.101.
2. Defining a Device ID to request data from Device 3. Device ID: 205.167.7.101[L1,S1,L2,S2].

Note: Lx and Sx represent the Link/Station numbers assigned to a device. . Consult the Toyopuc PC2 EN-I/F manual, HPC Link manual, or FL/ET-T-V2H manual for more information on link/station numbers. The L and S must be included as part of the Relay routing information when specifying a Device ID. The Px represents the program number for PC3J systems. The Px value should precede the link variable on each layer of the route.

Example
Device ID: 205.167.7.101[P2,L1,S1,P1,L2,S2].

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

Description: User-defined information about this channel.
Many of these properties, including Description, have an associated system tag.

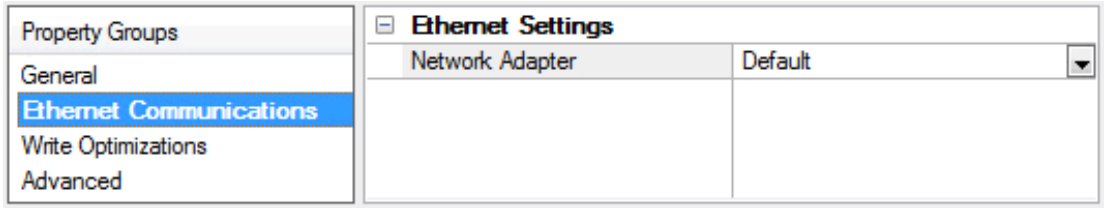
Driver: Selected protocol / driver for this channel. This property specifies the device driver that was selected during channel creation. It is a disabled setting in the channel properties.
Note: With the server's online full-time operation, these properties can be changed at any time. This includes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

Diagnostics

Diagnostics Capture: When enabled, this option makes the channel's diagnostic information available to OPC applications. Because the server's diagnostic features require a minimal amount of overhead processing, it is recommended that they be utilized when needed and disabled when not. The default is disabled.
Note: This property is disabled if the driver does not support diagnostics.
For more information, refer to "Communication Diagnostics" in the server help.

Channel Properties — Ethernet Communications

Ethernet Communication can be used to communicate with devices.

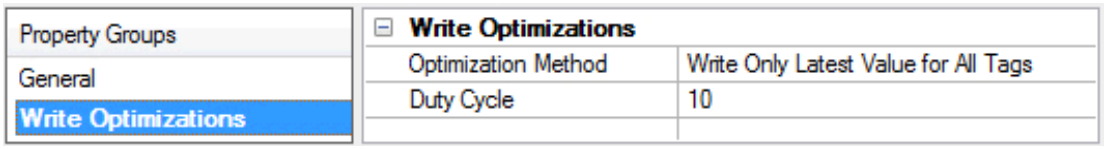


Ethernet Settings

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

Channel Properties — Write Optimizations

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



Write Optimizations

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

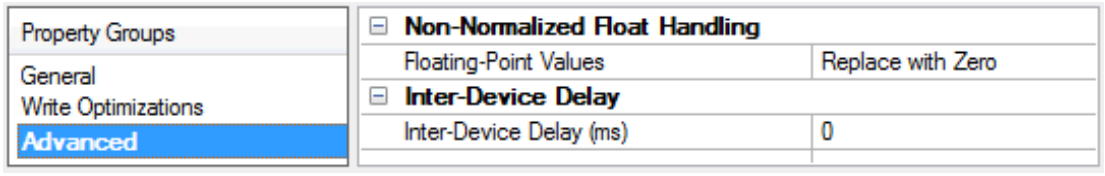
- **Write All Values for All Tags**: This option forces the server to attempt to write every value to the controller. In this mode, the server continues to gather write requests and add them to the server's internal write queue. The server processes the write queue and attempts to empty it by writing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

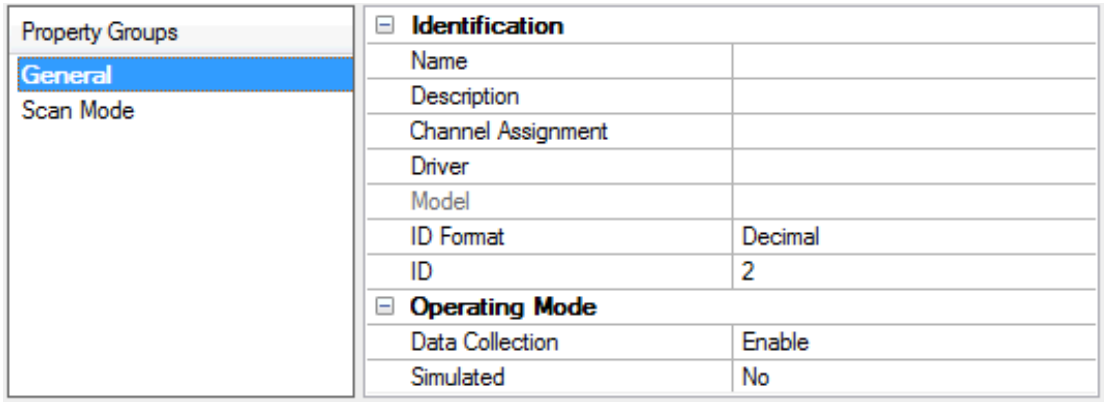
For more information on the floating point values, refer to "How To ... Work with Non-Normalized Floating Point Values" in the server help.

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

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



Identification

Name: This property specifies the name of the device. It is a logical user-defined name that can be up to 256 characters long, and may be used on multiple channels.
Note: Although descriptive names are generally a good idea, some OPC client applications may have a limited display window when browsing the OPC server's tag space. The device name and channel name become part of the browse tree information as well. Within an OPC client, the combination of channel name and device name would appear as "ChannelName.DeviceName".
For more information, refer to "How To... Properly Name a Channel, Device, Tag, and Tag Group" in server help.

Description: User-defined information about this device.
Many of these properties, including Description, have an associated system tag.

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

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

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

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

ID: This property specifies the device's station / node / identity / address. The type of ID entered depends on the communications driver being used. For many drivers, the ID is a numeric value. Drivers that support a Numeric ID provide users with the option to enter a numeric value whose format can be changed to suit the needs of the application or the characteristics of the selected communications driver. The ID format can be Decimal, Octal, and Hexadecimal. If the driver is Ethernet-based or supports an unconventional station or node name, the device's TCP/IP address may be used as the device ID. TCP/IP addresses consist of four values that are separated by periods, with each value in the range of 0 to 255. Some device IDs are string based. There may be additional properties to configure within the ID field, depending on the driver.

Operating Mode

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

Simulated: This option places the device into Simulation Mode. In this mode, the driver does not attempt to communicate with the physical device, but the server continues to return valid OPC data. Simulated stops physical communications with the device, but allows OPC data to be returned to the OPC client as valid data. While in Simulation Mode, the server treats all device data as reflective: whatever is written to the simulated device is read back and each OPC item is treated individually. The item's memory map is based on the group

Update Rate. The data is not saved if the server removes the item (such as when the server is reinitialized). The default is No.

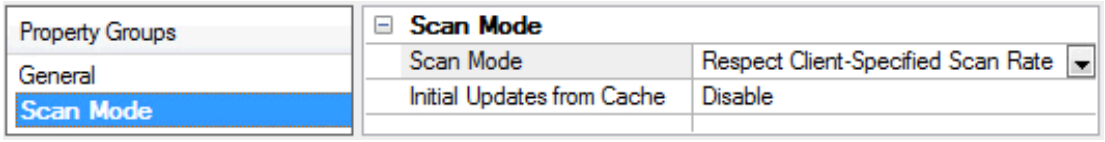
Notes:

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

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

Device Properties — Scan Mode

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



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

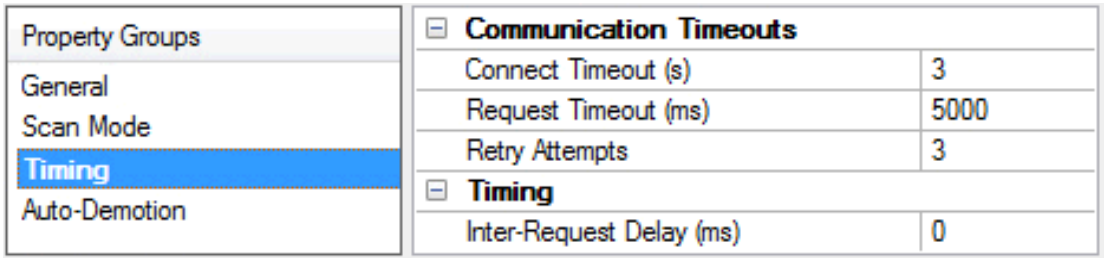
- **Respect Client-Specified Scan Rate**: This mode uses the scan rate requested by the client.
- **Request Data No Faster than Scan Rate**: This mode specifies the maximum scan rate to be used. The valid range is 10 to 99999990 milliseconds. The default is 1000 milliseconds.
  Note: When the server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

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

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

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

Timing

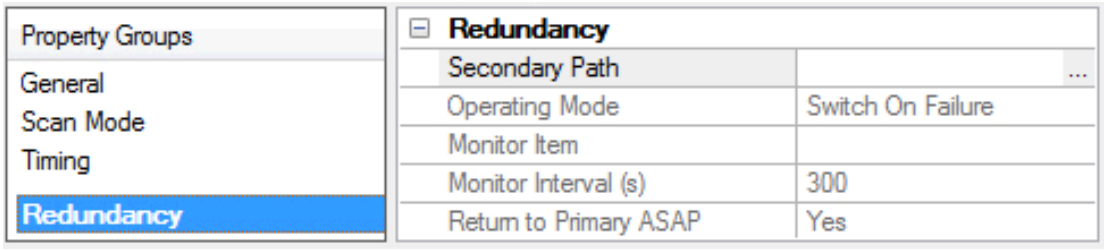
Inter-Request Delay: This property specifies how long the driver waits before sending the next request to the target device. It overrides the normal polling frequency of tags associated with the device, as well as one-time reads and writes. This delay can be useful when dealing with devices with slow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

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

Device Properties — Communications Parameters

Port Number: Specify the port number to be used to connect to the Toyopuc PLC. The Toyopuc EN-I/F Ethernet PC3/PC2 module supports eight ports for communications. Each port must be dedicated to a single connection. When specifying a port number, ensure that no other Ethernet node will attempt to use this port number on the target Toyopuc PLC. The same port number can be used when communicating with multiple Toyopuc PLCs.

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.

Diagnostics Tags

Diagnostics Tags provide information on how the Toyopuc PC3/PC2 Ethernet Driver is performing at both the channel level and device level. At the channel level, diagnostics tags provide information that covers all operations performed by the driver when communicating with any PLC on the network. At the device level, diagnostics tags provide information that pertains only to the device under which the diagnostic tags have been requested.

Channel-Level Diagnostics Tags

Tag Name	Functional Description
ChannelReadTime	Contains the amount of time in milliseconds required to read all currently active data for all devices on this channel. This value is a signed long.
ChannelHighTime	Contains the amount of time in milliseconds of longest read cycle. This value is a signed long.
ChannelLowTime	Contains the amount of time in milliseconds of shortest read cycle. This value is a signed long.
ChannelReadsPerformed	Contains a count of the reads performed on this channel for all devices. This is a signed long and will roll over.
ChannelWritesPerformed	Contains a count of the writes performed on this channel for all devices. This is a signed long and will roll over.
ChannelTimeouts	Contains a count of the number of timeout/message failures that have occurred for all devices. The _ChannelTimeouts count is for any error that may occur on a message attempt. The value does not necessarily indicate how many messages failed to be sent altogether. It should be used to diagnose possible communication issues with specific devices. This is a signed long and will roll over.

Device-Level Diagnostics Tags

Tag Name	Functional Description
DeviceReadTime	Contains the amount of time in milliseconds required to read a block of data from the specified device. This value is a signed long.
DeviceHighTime	Contains the longest amount of time in milliseconds required to read a block of data from the specified device. This value is a signed long.
DeviceLowTime	Contains the shortest amount of time in milliseconds required to read a block of data from the specified device. This value is a signed long.
DeviceReadsPerformed	Contains a count of the reads performed on this device. This is a signed long and will roll over.
DeviceWritesPerformed	Contains a count of the writes performed on this device. This is a signed long and will roll over.
DeviceTimeouts	Contains a count of the number of timeout/message failures that have occurred on the specified device. The _ DeviceTimeouts count is for any error that may occur on a message attempt. The value does not necessarily indicate how many messages failed to be sent altogether. It should be used to diagnose possible communication issues with this specific device. This is a signed long and will roll over.
DeviceMultiPointReads	Contains a count of the number of multi-point read requests that are currently being used to acquire all data that is marked for multi-point operation. This tag

Tag Name	Functional Description
	can be used to tune multi-point read operation. The goal of course being to limit the number of multi-point reads being done to the lowest count possible, preferably 1. This is a signed long and will roll over.

Note: All diagnostics tags are Read/Write. The only value that can be written to the tags is zero (which will clear or reset them).

Multi-Point Read Support

The Toyopuc PLC supports the ability to read data spread randomly throughout the PLC using a single command. By using this command, users can read crucial data items quickly and efficiently. The Toyopuc PC3/PC2 Ethernet Driver automatically attempts to make the use of the multi-point command both easy and efficient. Any memory type that can be acquired by the Toyopuc PC3/PC2 Ethernet Driver can be part of a multi-point read command. To mark a particular data item to be part of a multi-point request, place the '#' character in front of any current address. The table below is shown with the addition of the '#' character to each address. For information on the maximum data that can be read with a multi-point command, refer to **Multi-Point Limitations**.

There are some things that should be considered when using the multi-point read functions. The multi-point command can increase the speed of the data acquisition but if overused, it will need to make multiple multi-point commands to read all the requested data. When this occurs, the overall performance of the driver will be reduced. The key is to use the multi-point command wisely.

The driver will automatically group data from memory types like bit memory into 16 bit values. For example, for the PC3 model, if P1-X1, P1-X3, P1-X4, P1-X6, P1-X9, P1-XA, P1-XB are marked as part of a multi-point read using the '#', users would enter an address of #P1-X1, #P1-X3, #P1-X4, #P1-X6, #P1-X9, #P1-XA, #P1-XB. These seven items would be placed into a single 16 bit value; therefore, users would use only one of the 128 16 bit values available in a single multi-point read command. The 7 items were grouped together because the address of each bit fell within a single 16 bit word value of X memory. If 7 items like #P1-X1,#P1-X20,#P1-X55,#P1-X77,#P1-X99,#P1-XAA,#P1-XBB are entered as part of a multi-point read, each bit in this case would require an entire 16 bit value in the multi-point read command to receive the data. Plan the data usage in the controller. If possible, make sure that the bits being read are grouped closely. This prudent planning applies primarily to the bit memory types. Register memory requires a single 16 bit value (two 16 bit values in the case of DWords) for each register that is added to the multi-point read.

By using this information, users can plan the multi-point reads. The Toyopuc PC3/PC2 Ethernet Driver can perform as many multi-point reads as are needed to acquire all the data that has been marked for multi-point operation. Remember, however, that the driver will run slower when there are many read being run. To determine how many multi-point read requests the Toyopuc Ethernet PC3PC2 driver is using to acquire all currently defined multi-point data, use the special diagnostic tag "_DeviceMultiPointReads". *For more information on this tag, refer to **Diagnostics**.*

The multi-point read operation can be combined with the normal data reads of the Toyopuc PC3/PC2 Ethernet Driver. For example, if a block of 50 D registers consecutively ordered is being read, it may be more efficient to read the 50 D registers as part of a normal block read and save the space in the multi-point read function for data that is spread more randomly throughout the PLC memory. Use the diagnostics tags to help determine the most efficient way of acquiring the data for the application.

Multi-Point Limitations

Note: Strings do not support multi-point reads/writes.

For tags belonging to device models PC3 Device and PC10G Device, the maximum data requested for the data types are as follows:

Boolean: 1024*
Byte: 128
Word: 64
DWord: 32

*If contiguous Booleans are requested, the request will be done in one multi-point read.

Combination of any of the above data types in a single multi request has to be within the following limit:
(No. of Booleans/16) + (No. of Bytes/2) + No. of Words + (No. of DWords * 2) <= 64

For tags belonging to device model PC2/PC2 Interchange, the maximum data requested for the data types are as follows:

Boolean: 2048*
Byte: 256
Word: 128
DWord: 64

*If contiguous booleans are requested, the request will be done in one multi-point read.

Combination of any of the above data types in a single multi request has to be within the following limit:
(No. of Booleans/16) + (No. of Bytes/2) + No. of Words + (No. of DWords * 2) <= 128

Memory Types Shown with the Multi-Point Marker

Memory Type	Syntax	Data Types	Access
Edge Relay (P)	#P0000-#P01FF #P000-#P01F #P000-#P01E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Keeping Relay (K)	#K0000-#K02FF #K000-#K02F #K000-#K02E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Specific Relay (V)	#V0000-#V00FF #V000-#V0F #V000-#V0E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Timer Bits (T)	#T0000-#T01FF #T000-#T01F #T000-#T01E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Count Bits (C)	#C0000-#C01FF #C000-#C01F #C000-#C01E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Link Relay (L)	#L0000-#L07FF #L000-#L07F #L000-#L07E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
I/O Relay (X)	#X0000-#X07FF #X000-#X07F #X000-#X07E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write

Memory Type	Syntax	Data Types	Access
I/O Relay (Y)	#Y0000-#Y07FF #Y000-#Y07F #Y000-#Y07E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Internal Relay (M)	#M0000-#M07FF #M000-#M07F #M000-#M07E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Specific Register (S)	#S0000-#S03FF #S0000-#S03FE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write
Timer/Present Value Register (N)	#N0000-#N01FF #N0000-#N01FE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write
Link Register (R)	#R0000-#R07FF #R0000-#R07FE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write
Data Register (D)	#D0000-#D2FFF #D0000-#D2FFE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write
File Register (B)	#B0000-#B1FFF #B0000-#B1FFE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write
Extended I/O Relay (EX)	#EX0000- #EX07FF #EX000-#EX07F #EX000-#EX07E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Extended I/O Relay (EY)	#Y0000-#Y07FF #Y000-#Y07F #Y000-#Y07E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Extended Internal Relay (EM)	#EM0000- #EM1FFF #EM000-#EM1FF #EM000- #EM1FE	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Extended Keep Relay (EK)	#EK0000- #EK0FFF #EK000-#EK0FF #EK000-#EK0FE	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Extended Special Relay (EV)	#EV0000- #EV0FFF #EV000-#EV0FF #EV000-#EV0FE	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Extended Timer Bits (ET)	#ET0000- #ET07FF #ET000-#ET07F #ET000-#ET07E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Extended Counter Bits (EC)	#EC0000- #EC07FF #EC000-#EC07F #EC000-#EC07E	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Extended Link Relay (EL)	#EL0000- #EL1FFF	**Boolean** Byte, Word, Short, BCD DWord, Long,	Read/Write

Memory Type	Syntax	Data Types	Access
	#EL000-#EL1FF #EL000-#EL1FE	LBCD	
Extended Edge Direction (EP)	#EP0000-#EP0FFF #EP000-#EP0FF #EP000-#EP0FE	**Boolean** Byte, Word, Short, BCD DWord, Long, LBCD	Read/Write
Extended Data Register (U)	#U0000-#U7FFF #U0000-#U7FFE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write
Extended Timer/Counter Value (EN)	#EN0000-#EN07FF #EN0000-#EN07FE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write
Extended Setup Value Register (H)	#H0000-#H07FF #H0000-#H07FE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write
Extended Special Register	#ES0000-#ES07FF #ES0000-#ES07FE	Byte, **Word**, Short, BCD DWord, Long, LBCD	Read/Write

Data Type Description

Data Type	Description
BCD	Two byte packed BCD Value range is 0-9999. Behavior is undefined for values beyond this range.
Boolean	Single bit
Byte	Unsigned 8-bit value bit 0 is the low bit bit 7 is the high bit
DWord	Unsigned 32-bit value bit 0 is the low bit bit 31 is the high bit
Float	32-bit floating point value
LBCD	Four byte packed BCD Value range is 0-99999999. Behavior is undefined for values beyond this range.
Long	Signed 32-bit value bit 0 is the low bit bit 30 is the high bit bit 31 is the sign bit
Short	Signed 16-bit value

Data Type	Description
	bit 0 is the low bit bit 14 is the high bit bit 15 is the sign bit
Word	Unsigned 16-bit value bit 0 is the low bit bit 15 is the high bit
String	An ASCII string. The byte order must be specified as part of the address syntax: H - High Byte Order (Big Endian) L – Low Byte Order (Little Endian)

Address Descriptions

The Toyopuc PC3 driver supports the PC2 PLC, PC3 PLC and PC10G PLC. When configuring the OPC Server application, users must choose a PLC model type when defining a device connection. Based on that model selection, two different PLC data addressing modes will be available to access data within the PLC. Select a link from the following list to obtain specific address information for the model of interest.

PC2/PC2 Interchange
PC3 Device
PC10G

PC2/PC2 Interchange Mode Address Descriptions

When the PC2 model has been selected, the Toyopuc Computer Link Protocol supports the following addresses. These address types are only available when using a PC2 PLC or using a PC3 PLC in PC2 Interchange mode. For more information, refer to **Addressing Examples**.

Note: The valid address range of each memory type depends on the data type being accessed. Please refer to the Syntax and Data Types columns below. The valid range (syntax) is shown on the same line as the data type(s). For example, the valid range for Edge Relay is P0000-P01FF if the data type being accessed is Boolean. If the data type being accessed is byte, word, short or BCD, the valid range is P000-P01F. If the data type is DWord, Long or LBCD, the valid range is P000-P01E. The default data types for dynamically defined tags are shown in **bold**.

Memory Type	Syntax	Data Type	Access
Edge Relay (P)	P0000-P01FF P000-P01F P000-P01E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write
Keeping Relay (K)	K0000-K02FF K000-K02F K000-K02E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write
Specific Relay (V)	V0000-V00FF V000-V0F V000-V0E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write
Timer Bits (T)	T0000-T01FF T000-T01F T000-T01E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write
Count Bits (C)	C0000-C01FF C000-C01F C000-C01E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write
Link Relay (L)	L0000-L07FF L000-L07F L000-L07E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write

Memory Type	Syntax	Data Type	Access
I/O Relay (X)	X0000-X07FF X000-X07F X000-X07E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write
I/O Relay (Y)	Y0000-Y07FF Y000-Y07F Y000-Y07E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write
Internal Relay (M)	M0000-M07FF M000-M07F M000-M07E	**Boolean** Byte*, Word, Short, BCD DWord, Long, LBCD String**	Read/Write
Specific Register (S)	S0000.0...S0000.F-S03FF.0...S03FF.F S0000-S03FF S0000-S03FE	**Boolean** Byte*, **Word**, Short, BCD DWord, Long, LBCD String**	Read/Write
Present Value Register (N)	N0000.0...N0000.F-N01FF.0...N01FF.F N0000-N01FF N0000-N01FE	**Boolean** Byte*, **Word**, Short, BCD DWord, Long, LBCD String**	Read/Write
Link Register (R)	R0000.0...R0000.F-R07FF.0...R07FF.F R0000-R07FF R0000-R07FE	**Boolean** Byte*, **Word**, Short, BCD DWord, Long, LBCD String**	Read/Write
Data Register (D)	D0000.0...D0000.F-D02FFF.0...D2FFF.F D0000-D2FFF D0000-D2FFE	**Boolean** Byte*, **Word**, Short, BCD DWord, Long, LBCD String**	Read/Write
File Register (B)	B0000.0...B0000.F-B01FFF.0...B1FFF.F B0000-B1FFF B0000-B1FFE	**Boolean** Byte*, **Word**, Short, BCD DWord, Long, LBCD String**	Read/Write

*Low/High Byte Modifier

An optional Low (L) or High (H) byte modifier can be appended to any address. This modifier instructs the driver that the low or high byte of the address word is requested. For more information, refer to **Addressing Examples**.

Note: When adding a static tag with a low / high byte modifier, the data type must be set to Byte. For more information on static vs. dynamic tags consult the OPC Server's online documentation.

** String Length and Byte Order

Strings require that a length and byte order be specified as part of the address syntax. The syntax is as follows:

```
<Base Addr>.<Length><Byte Modifier>
```

Base Addr: This is the base address to specify for any other data type. Examples are Y01FF or L00FF.

Length: The length is the length of the string, not including the null terminator. Unlike the base address, the length is specified in decimal (base-10).

Byte Modifier: Specify either High or Low byte order with a 'H' for High Byte Order (Big Endian) or 'L' for Low Byte Order (Little Endian).

Examples:
Y01FF.10H – A 10 character string at Y01FF stored in High Byte Order.
L00FF.32L – A 32 character string at L00FF stored in Low Byte Order.

Multi-Point Read Support

Multi-point read support allows the Toyopuc Ethernet driver to read data from multiple memory types (based on program number) in a single request. The multi-point read function is available for both the PC3 and PC2 models and can be used across HPC Link or FL-net modules using relay routing. *For more information, refer to* ***Multi-Point Read Support***.

Diagnostics Tags

The Diagnostics Tags provide information on how the Toyopuc Ethernet driver is performing. *For more information, refer to* ***Diagnostic Tags***.

Array Support

All memory types support arrays, which can be of any data type. Only the following exceptions apply:

1. Byte arrays are not supported (this also means that low/high byte modifiers cannot be used with array syntax).
2. Boolean arrays are not supported for bit within word type addresses. For example, addresses like 'S0000.0' cannot be used with array notation. Discrete types support Boolean arrays.
3. Multi-point read is not supported for arrays.

The array size cannot exceed the internal block size of 512 bytes. Array syntax is specified by adding '[r]' (rows) or '[r][c]' at the end of the address string. [r]: rows, [c]: columns.

Addressing Examples

1. Request 'Specific Relay FF' from program 1 --> P1-VFF.
2. Request High Byte of 'Data Register 10' --> D10H.
3. Request 'Data Register 1000' --> D1000.
4. Request Long value (2 consecutive 16 bit registers) starting at 'Link Register 7E' in program 1 --> P1-L7E@LONG (set data type to Long for static tags, or append '@LONG' to address for dynamic tags. For more information on static vs. dynamic tags consult the OPC Server online Help.
5. Request 20 bits starting at 'I/O Relay 256' --> X0256[20](set data type to BOOLEAN for static tags, or append '@BOOLEAN' to address for dynamic tags).

6. Request 24 bits starting at 'Edge Relay 100' --> P0100[4][6](set data type to BOOLEAN for static tags, or append '@BOOLEAN' to address for dynamic tags).
7. Request 16 words starting at 'Specific Register 64' --> S0064[4][4].
8. Request 50 LBCDs starting at 'File Register 6' --> B0006[50](set data type to LBCD for static tags, or append '@LBCD' to address for dynamic tags).
9. Request a 64-character string; 65 characters including the null terminator, starting at 'Data Register 32' in Low Byte Order --> D0032.64L (set data type to String, or append '@STRING' to address for dynamic tags).

PC3 Address Descriptions

When the PC3 model has been selected, the Toyopuc Computer Link Protocol supports the following addresses. These address types are only available when using a PC3 PLC. For more information, refer to **Addressing Examples**.

Note: The valid address range of each memory type depends on the data type being accessed. Please refer to the Syntax and Data Types columns below. The valid range (syntax) is shown on the same line as the data type(s). For example, the valid range for Edge Relay is P0000-P01FF if the data type being accessed is Boolean. If the data type being accessed is byte, word, short or BCD, the valid range is P000-P01F. If the data type is DWord, Long or LBCD, the valid range is P000-P01E. The default data types for dynamically defined tags are shown in **bold**.

Memory Type	Syntax*	Data Type	Access
Edge Relay (P)	P0000-P01FF P000-P01F P000-P01E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Keeping Relay (K)	K0000-K02FF K000-K02F K000-K02E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Specific Relay (V)	V0000-V00FF V000-V0F V000-V0E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Timer Bits (T)	T0000-T01FF T000-T01F T000-T01E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Count Bits (C)	C0000-C01FF C000-C01F C000-C01E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD	Read/Write

Memory Type	Syntax*	Data Type	Access
		String***	
Link Relay (L)	L0000-L07FF L000-L07F L000-L07E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
I/O Relay (X)	X0000-X07FF X000-X07F X000-X07E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
I/O Relay (Y)	Y0000-Y07FF Y000-Y07F Y000-Y07E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Internal Relay (M)	M0000-M07FF M000-M07F M000-M07E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Specific Register (S)	S0000.0...S0000.F-S03FF.0...S03FF.F S0000-S03FF S0000-S03FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write
Present Value Register (N)	N0000.0...N0000.F-N01FF.0...N01FF.F N0000-N01FF N0000-N01FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write
Link Register (R)	R0000.0...R0000.F-R07FF.0...R07FF.F R0000-R07FF R0000-R07FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write
Data Register (D)	D0000.0...D0000.F-D02FFF.0...D2FFF.F D0000-D2FFF D0000-D2FFE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write
File Register (B)	B0000.0...B0000.F-B01FFF.0...B1FFF.F B0000B1FFF B0000B1FFE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write

Memory Type	Syntax*	Data Type	Access
Extended I/O Relay (EX)	EX0000-EX07FF EX000-EX07F EX000-EX07E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended I/O Relay (EY)	EY0000-EY07FF EY000-EY07F EY000-EY07E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Internal Relay (EM)	EM0000-EM1FFF EM000-EM1FF EM000-EM1FE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Keep Relay (EK)	EK0000-EK0FFF EK000-EK0FF EK000-EK0FE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Special Relay (EV)	EV0000-EV0FFF EV000-EV0FF EV000-EV0FE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Timer Bits (ET)	ET0000-ET07FF ET000-ET07F ET000-ET07E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Counter Bits (EC)	EC0000-EC07FF EC000-EC07F EC000-EC07E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Link Relay (EL)	EL0000-EL1FFF EL000-EL1FF EL000-EL1FE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Edge Direction (EP)	EP0000-EP0FFF EP000-EP0FF EP000-EP0FE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Data Register (U)	U0000.0...U0000.F -U07FFF.0...U7FFF.F U0000-U7FFF	**Boolean** Byte**, **Word**, Short,	Read/Write

Memory Type	Syntax*	Data Type	Access
	U0000-U7FFE	BCD DWord, Long, LBCD String***	
Extended Timer/Counter Value (EN)	EN0000.0...EN0000.F- EN07FF.0...EN07FF.F EN0000-EN07FF EN0000-EN07FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Setup Value Register (H)	H0000.0...H0000.F-H07FF.0...H07FF.F H0000-H07FF H0000-H07FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Special Register (ES)	ES0000.0...ES0000.F- ES07FF.0...ES07FF.F ES0000-ES07FF ES0000-ES07FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Input Relay (GX)	GX0000-GXFFFF GX000-GX0FFF GX000-GX0FFE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Output Relay (GY)	GY0000-GYFFFF GY000-GY0FFF GY000-GY0FFE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Internal Relay (GM)	GM0000-GMFFFF GM000-GM0FFF GM000-GM0FFE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD String***	Read/Write

*Syntax

Addresses should be prefixed with "P1-", "P2-" or "P3-" to denote which PLC program in the PC3 contains the desired address. For example, to read data register D10 from program 2 in the PC3, use the following address syntax: P2-D10. If the device is in PC2 Interchange mode, use "P1-" to reference data.

Note: The extended addresses do not use the "P1-", "P2-", or "P3-" program indicator. If that is done, an error message will be generated in the OPC server message window. Extended addresses must be entered without any program number. For example, to request Extended I/O Relay (EX) 6FF, use the following syntax: EX6FF.

**Low/High Byte Modifier

An optional Low (L) or High (H) byte modifier can be appended to any address. This modifier instructs the driver that the low or high byte of the address word is requested. *For more information, refer to* ***Addressing Examples***.

Note: When adding a static tag with a low / high byte modifier, the data type must be set to Byte. For more information on static vs. dynamic tags, consult the OPC Server online help.

*** String Length and Byte Order

Strings require that a length and byte order be specified as part of the address syntax. The syntax is as follows:

```
<Base Addr>.<Length><Byte Modifier>
```

Base Addr: This is the base address to specify for any other data type. Examples are Y01FF or L00FF.

Length: The length is the length of the string, not including the null terminator. Unlike the base address, the length is specified in decimal (base-10).

Byte Modifier: Specify either High or Low byte order with a 'H' for High Byte Order (Big Endian) or 'L' for Low Byte Order (Little Endian).

Examples:
Y01FF.10H – A 10 character string at Y01FF stored in High Byte Order.
L00FF.32L – A 32 character string at L00FF stored in Low Byte Order.

Multi-Point Read Support

Multi-point read support allows the Toyopuc Ethernet driver to read data from multiple memory types (based on program number) in a single request. The multi-point read function is available for both the PC3 and PC2 models and can be used across HPC Link or FL-net modules using relay routing. *For more information, refer to* ***Multi-Point Read Support***.

Diagnostics Tags

The Diagnostics Tags provide information on how the Toyopuc PC3/PC2 Ethernet Driver is performing. *For more information, refer to* ***Diagnostic Tags***.

Array Support

All memory types support arrays, which can be of any data type. Only the following exceptions apply:

- Byte arrays are not supported (this also means that low/high byte modifiers cannot be used with array syntax).
- Boolean arrays are not supported for bit within word type addresses. For example, addresses like 'S0000.0' cannot be used with array notation. Discrete types support Boolean arrays.
- Multi-point read is not supported for arrays.

The array size cannot exceed the internal block size of 512 bytes. Array syntax is specified by adding '[r]' (rows) or '[r][c]' at the end of the address string. [r]: rows, [c]: columns.

Addressing Examples

1. Request 'Specific Relay FF' from program 1 --> P1-VFF.
2. Request High Byte of 'Data Register 10' from program 2 --> P2-D10H.
3. Request Data Register 1000 from program 3 --> P3-D1000.
4. Request Extended I/O Relay 6FF --> EX6FF.

5. Request Long value (2 consecutive 16 bit registers) starting at 'Link Register 7E' in program 1 --> P1-L7E@LONG (set data type to Long for static tags, or append '@LONG' to address for dynamic tags. For more information on static vs. dynamic tags consult the OPC Server online Help.
6. Request 20 bits starting at 'I/O Relay 256' from program 2 --> P2-X0256[20] (set data type to BOOLEAN for static tags, or append '@BOOLEAN' to address for dynamic tags).
7. Request 24 bits starting at 'Edge Relay 100' from program 1 --> P1-P0100[4][6] (set data type to BOOLEAN for static tags, or append '@BOOLEAN' to address for dynamic tags).
8. Request 16 words starting at 'Specific Register 64' from program 3 --> P3-S0064[4][4].
9. Request 50 LBCDs starting at 'File Register 6' from program 1 --> P1-B0006[50](set data type to LBCD for static tags, or append '@LBCD' to address for dynamic tags).
10. Request a 64-character string; 65 characters including the null terminator, starting at 'Data Register 32' in Low Byte Order --> D0032.64L (set data type to String, or append '@STRING' to address for dynamic tags).

PC10G Address Descriptions

When the PC10G model has been selected, the Toyopuc Computer Link Protocol supports the following addresses. These address types are only available when using a PC10G PLC. For more information, refer to **Addressing Examples**.

Notes:

1. The PC10G model also accepts arrays. For example, U0000[2][2].
2. The valid address range of each memory type depends on the data type being accessed. Please refer to the Syntax and Data Types columns below. The valid range (syntax) is shown on the same line as the data type(s). For example, the valid range for Edge Relay is P0000-P01FF if the data type being accessed is Boolean. If the data type being accessed is byte, word, short or BCD, the valid range is P000-P01F. If the data type is DWord, Long or LBCD, the valid range is P000-P01E. The default data types for dynamically defined tags are shown in **bold**.

Memory Type	Syntax*	Data Type	Access
Edge Relay (P)	P000-P1FF P00-P1F P00-P1E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Edge Relay (P)	P1000-P17FF P100-P17F P100-P17E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Keeping Relay (K)	K000-K2FF K00-K0F K00-K0E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Specific Relay (V)	V00-VFF V0-VF	**Boolean** Byte**, Word, Short, BCD	Read/Write

Memory Type	Syntax*	Data Type	Access
	V0-VE	DWord, Long, LBCD, Float String***	
Specific Relay (V)	V1000-V17FF V100-V17F V100-V17E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Timer Bits (T)	T000-T1FF T00-T1F T00-T1E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Timer Bits (T)	T1000-T17FF T100-T17F T100-T17E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Count Bits (C)	C000-C1FF C00-C1F C00-C1E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Count Bits (C)	C1000-C17FF C100-C17F C100-C17E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Link Relay (L)	L000-L7FF L00-L7F L00-L7E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Link Relay (L)	L1000-L2FFF L100-L2FF L100-L2FE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
I/O Relay (X)	X000-X7FF X00-X7F X00-X7E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
I/O Relay (Y)	Y000-Y7FF Y00-Y7F Y00-Y7E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Internal Relay (M)	M000-M7FF M00-M7F M00-M7E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Internal Relay (M)	M1000-M17FF M100-M17F M100-M17E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write

Memory Type	Syntax*	Data Type	Access
Specific Register (S)	S000.0-S3FF.F S000-S3FF S000-S3FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Specific Register (S)	S1000.0-S13FF.F S1000-S13FF S1000-S13FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Present Value Register (N)	N000.0-N1FF.F N000-N1FF N000-N1FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Present Value Register (N)	N1000.0-N17FF.F N1000-N17FF N1000-N17FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Link Register (R)	R000.0-R7FF.F R000-R7FF R000-R7FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Data Register (D)	D0000.0-D2FFF.F D0000-D2FFF D0000-D2FFE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
FB Escape Area (JL)	JL0000.0-JL1FFF.F JL0000-JL1FFF JL0000-JL1FFE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
SFC (JS)	JS0000.0-JSFFF.F JS0000-JSFFF JS0000-JSFFE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended I/O Relay (EX)	EX000-EX7FF EX00-EX7F EX00-EX7E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended I/O Relay (EY)	EY000-EY7FF EY00-EY7F EY00-EY7E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Internal Relay (EM)	EM0000-EM1FFF EM000-EM1FF EM000-EM1FE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Keep Relay (EK)	EK000-EKFFF EK00-EKFF	**Boolean** Byte**, Word, Short, BCD	Read/Write

Memory Type	Syntax*	Data Type	Access
	EK00-EKFE	DWord, Long, LBCD, Float String***	
Extended Special Relay (EV)	EV000-... EV00-EVFF EV00-EVFE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Timer Bits (ET)	ET000-ET7FF ET00-ET7F ET00-ET7E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Counter Bits (EC)	EC000-EC7FF EC00-EC7F EC00-EC7E	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Link Relay (EL)	EL0000-EK1FFF EL000-EK1FF EL000-EK1FE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Edge Direction (EP)	EP000-EPFFF EP00-EPFF EP00-EPFE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Data Register (U)	U000000-U1FFFF.F U00000-U1FFFF U00000-U1FFFE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Timer/Counter Value (EN)	EN0000-EN7FFF EN000-EN7FF EN000-EN7FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Setup Value Register (H)	H0000-H7FFF H000-H7FF H000-H7FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Special Register (ES)	ES0000-ES7FFF ES000-ES7FF ES000-ES7FE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Input Relay (GX)	GX0000-GXFFFF GX000-GXFFF GX000-GXFFE	**Boolean** Byte***, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Output Relay (GY)	GY0000-GYFFFF GY000-GYFFF GY000-GYFFE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write

Memory Type	Syntax*	Data Type	Access
Extended Internal Relay (GM)	GM0000-GMFFFF GM000-GMFFF GM000-GMFFE	**Boolean** Byte**, Word, Short, BCD DWord, Long, LBCD, Float String***	Read/Write
Extended Buffer Register (EB)	EB00000.0EB3FFFF.F EB00000-EB3FFFF EB00000-EB3FFFE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write
Extended Flash Register (FR)	FR000000.0FR1FFFFF.F FR000000-FR1FFFFF FR000000-FR1FFFFE	**Boolean** Byte**, **Word**, Short, BCD DWord, Long, LBCD String***	Read/Write

*Syntax

Addresses should be prefixed with "P1-", "P2-" or "P3-" to denote which PLC program in the PC3 contains the desired address. For example, to read data register D10 from program 2 in the PC3, use the following address syntax: P2-D10. If the device is in PC2 Interchange mode, use "P1-" to reference data.

Note: The extended addresses do not use the "P1-", "P2-", or "P3-" program indicator. If that is done, an error message will be generated in the OPC server message window. Extended addresses must be entered without any program number. For example, to request Extended I/O Relay (EX) 6FF, use the following syntax: EX6FF.

**Low/High Byte Modifier

An optional Low (L) or High (H) byte modifier can be appended to any address. This modifier instructs the driver that the low or high byte of the address word is requested. *For more information, refer to* ***Addressing Examples***.

Note: When adding a static tag with a low / high byte modifier, the data type must be set to Byte. For more information on static vs. dynamic tags, consult the OPC Server's online documentation.

*** String Length and Byte Order

Strings require that a length and byte order be specified as part of the address syntax. The syntax is as follows:

```
<Base Addr>.<Length><Byte Modifier>
```

Base Addr: This is the base address to specify for any other data type. Examples are Y01FF or L00FF.

Length: The length is the length of the string, not including the null terminator. Unlike the base address, the length is specified in decimal (base-10).

Byte Modifier: Specify either High or Low byte order with a 'H' for High Byte Order (Big Endian) or 'L' for Low Byte Order (Little Endian).

Examples:
Y01FF.10H – A 10 character string at Y01FF stored in High Byte Order.
L00FF.32L – A 32 character string at L00FF stored in Low Byte Order.

Multi-Point Read Support

Multi-point read support allows the Toyopuc Ethernet driver to read data from multiple memory types (based on program number) in a single request. The multi-point read function is available for the PC10G model and can be used across HPC Link or FL-net modules using relay routing. *For more information, refer to* ***Multi-Point Read Support****.*

Diagnostics Tags

Diagnostics tags provide information on how the Toyopuc PC3/PC2 Ethernet Driver is performing. *For more information, refer to Diagnostic Tags.*

Array Support

All memory types support arrays, which can be of any data type. The following exceptions apply:

- Byte arrays are not supported (this also means that low/high byte modifiers cannot be used with array syntax).
- Boolean arrays are not supported for bit-within-word type addresses. For example, 'S0000.0' cannot be used with array notation. Discrete types support Boolean arrays.
- Multi-point read is not supported for arrays.

The array size cannot exceed the internal block size of 512 bytes. Array syntax is specified by adding '[r]' (rows) or '[r][c]' at the end of the address string. [r]: rows, [c]: columns.

Addressing Examples

1. Request 'Specific Relay 100' from program 1 --> P1-V100.
2. Request 'Edge Relay 1000' from program 2 --> P2-P1000.
3. Request High Byte of 'Data Register 10' from program 2 --> P2-D10H.
4. Request Data Register 1000 from program 3 --> P3-D1000.
5. Request Extended I/O Relay 6FF --> EX6FF.
6. Request Extended Buffer Register 17FFF --> EB17FFF.
7. Request Long Value (2 consecutive 16 bit registers) starting at 'Link Register 7F' in program 1 --> P1-L7F@LONG (set data type to Long for static tags or append '@LONG' to address for dynamic tags).
8. Request 16-character, 17 characters including the null terminator; starting at 'Specific Register 10' in High Byte Order --> S010.16H (set data type to String, or append '@STRING' to address for dynamic tags).

For more information on static vs. dynamic tags, refer to the OPC Server's help documentation.

Error Descriptions

The following categories of messages may be generated. Click on a link for a list of messages.

Address Validation

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

Missing address.

Error Type:

Warning

Possible Cause:

A tag address that has been specified dynamically has no length.

Solution:

Re-enter the address in the client application.

Device address <address> contains a syntax error.

Error Type:

Warning

Possible Cause:

A tag address that has been specified dynamically contains one or more invalid characters.

Solution:

Re-enter the address in the client application.

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

Error Type:

Warning

Possible Cause:

A tag address that has been specified dynamically references a location that is beyond the range of supported locations for the device.

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

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

Error Type:
Warning

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

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

Device address <address> is read only.

Error Type:
Warning

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

Solution:
Change the access mode in the client application.

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

Error Type:
Warning

Possible Cause:
A tag address that has been specified statically is requesting an array size that is too large for the address type or block size of the driver.

Solution:
Re-enter the address in the client application to specify either a smaller value for the array or a different starting point.

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

Error Type:
Warning

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

Solution:

Either re-enter the address in the client application to remove the array reference or correct the address type.

Device Status Messages

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

Device <device name> is not responding.
Unable to write to <address> on device <device name>.

Device <device name> is not responding.

Error Type:

Serious

Possible Cause:

1. The driver cannot create a socket connection between the device and the Host PC.
2. The response from the device took longer to receive than the amount of time specified in the "Request Timeout" device setting.
3. The IP address for the device is incorrect.
4. The TCP/IP Port specified in device settings is incorrect.

Solution:

1. Verify that the Ethernet connections between the PC and the network are functional.
2. Increase the Request Timeout setting so that the entire response can be handled.
3. Verify that the Ethernet connections between the device and the network are functional.
4. Verify that the specified IP address matches the Device IP.
5. Verify that the specified TCP/IP Port matches the port used by the device.

Unable to write to <address> on device <device name>.

Error Type:

Serious

Possible Cause:

1. The driver cannot create a socket connection between the device and the Host PC.
2. The IP address for the device is incorrect.
3. The TCP/IP Port specified in device settings is incorrect.

Solution:

1. Verify that the Ethernet connections between the PC and the network are functional.
2. Verify that the Ethernet connections between the device and the network are functional.

3. Verify that the specified IP address matches the Device IP.
4. Verify that the specified TCP/IP Port matches the port used by the device.

Device Error Codes

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

Device Error Codes

Error Response Data: Error Code Table

Error Response Data: Error Code Table

Error Code	Error Description
11	Inability to process data because of faulty CPU Module Hardware.
20	Fixed Data (ENQ) within relay command is not "05."
21	Faulty transfer number (there is erroneous transfer byte number within the relay command).
23	Erroneous command code.
24	Erroneous subcommand code.
25	Erroneous command-format data byte.
26	Erroneous function-call operand number.
31	Attempting to write data into the field where any writing is prohibited during a sequence operation or to use the function call (which is protected from any execution) during a sequence operation.
32	A command that is defeated during a stop continuity is activated during a stop continuity.
33	Attempting to execute a debug function call despite non-debug mode.
34	Access prohibited owing to access-prohibited configuration.
35	Non-executable owing to execution-priority limiting configuration.
36	Non-executable owing to execution-priority limiting configuration by another device.
39	Attempting to start scanning without any reset after writing I/O point-number parameters or I/O allocation point-number parameters.
3C	During a fatal failure, a command has issued that is not executable during a fatal failure.
3D	Non-executable due to competing process while a different-factor command is executed.
3E	Non-executable command due to reset existence.
3F	Non-executable command due to stop duration.
40	Address of a reading/writing command or of "address+data number" of a command is out of range.
41	Word/byte number is out of range.
42	Non-designated data is sent.
43	Erroneous function/call operand.
52	Though any timer or counter is employed, a command for reading/writing the set/recent values

Error Code	Error Description
	is issued.
66	No reply is sent from link module with the link exchange No. specified by a relay command (owing to no existence of specified link module, power OFF, faulty circuit, or etc.).
70	Non-executable module with the link exchange No. specified by a relay command (owing to erroneous link No. designation or faulty link module).
72	No reply is sent from link module with the link exchange No. specified by relay command (owing to no existence of specified link module, power OFF, faulty circuit, or etc.).
73	Multiple relay commands were issued to the same link module from the CPU module and the link module could not process the commands. Send commands again.

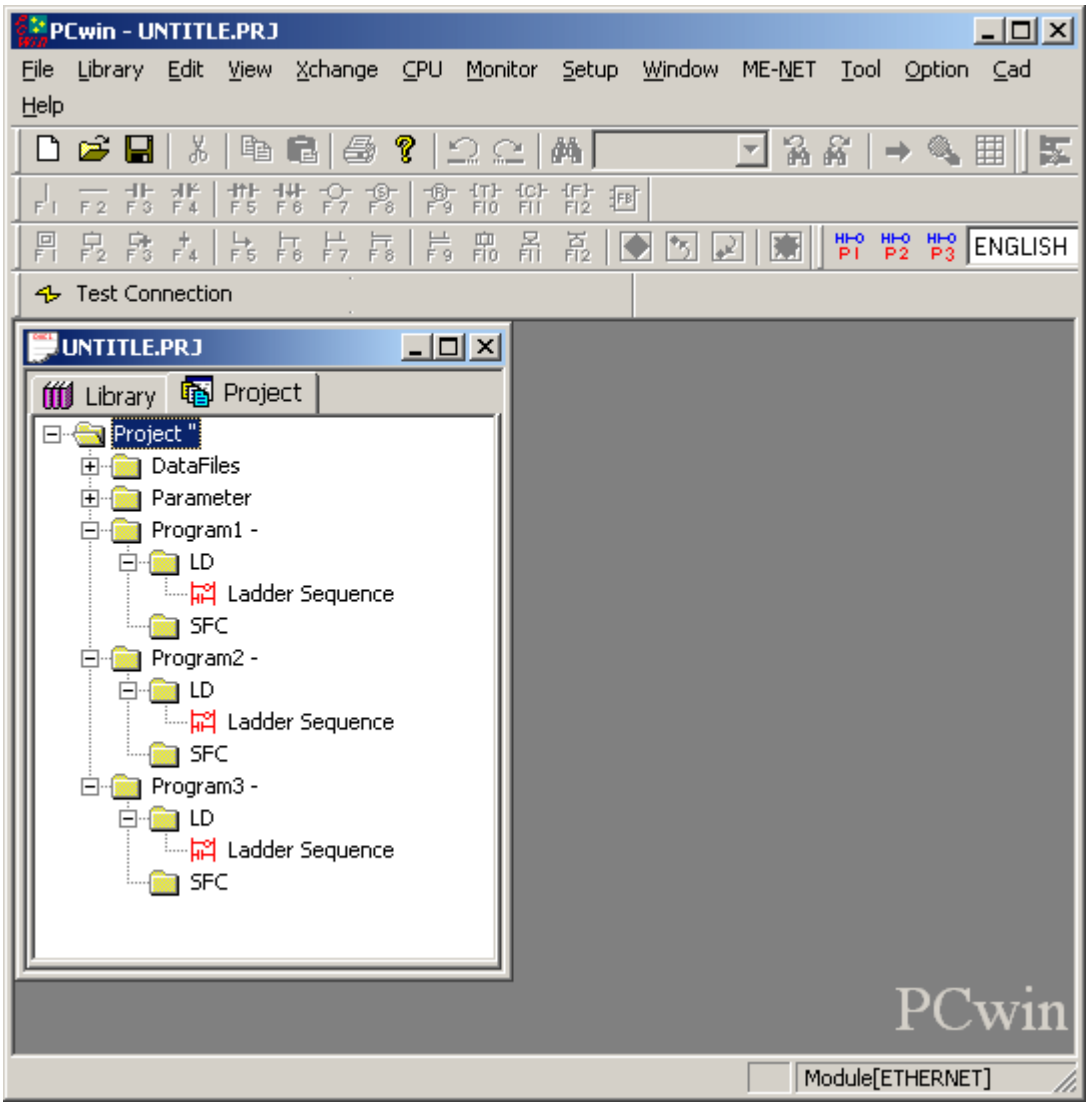
Note: Codes taken from Toyopuc document: TOYOPUC PC3J/PC2J FL/ET-T-V2 Instruction Manual.

Appendix: Configuring Modules

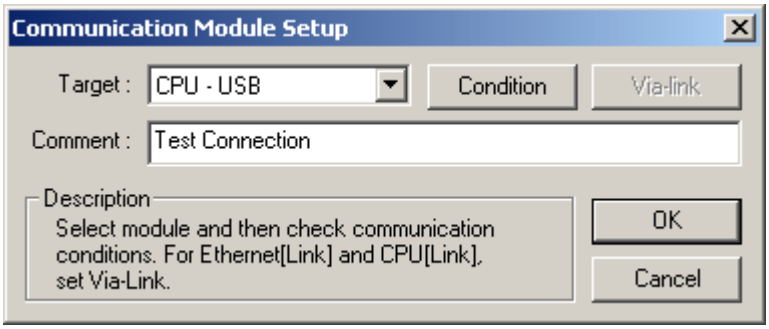
Configuring the PC10G-CPU for Ethernet Communications

Before the PC10G-CPU can be used for Ethernet communications, it must be configured using PCWin version 10 or above. The following example first shows how to configure the built-in Ethernet port L2 and then shows how to connect to the PC with PCWin to the PC10G-CPU using a USB connection.

1. To start, open PCWIN.

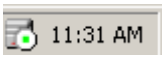


2. To setup the communication between PCWin and PC10G-CPU, click **Setup** | **Setup Communication Module**. If it is the first time configuring PCWin, select **Addition** and then make the selections as shown below.

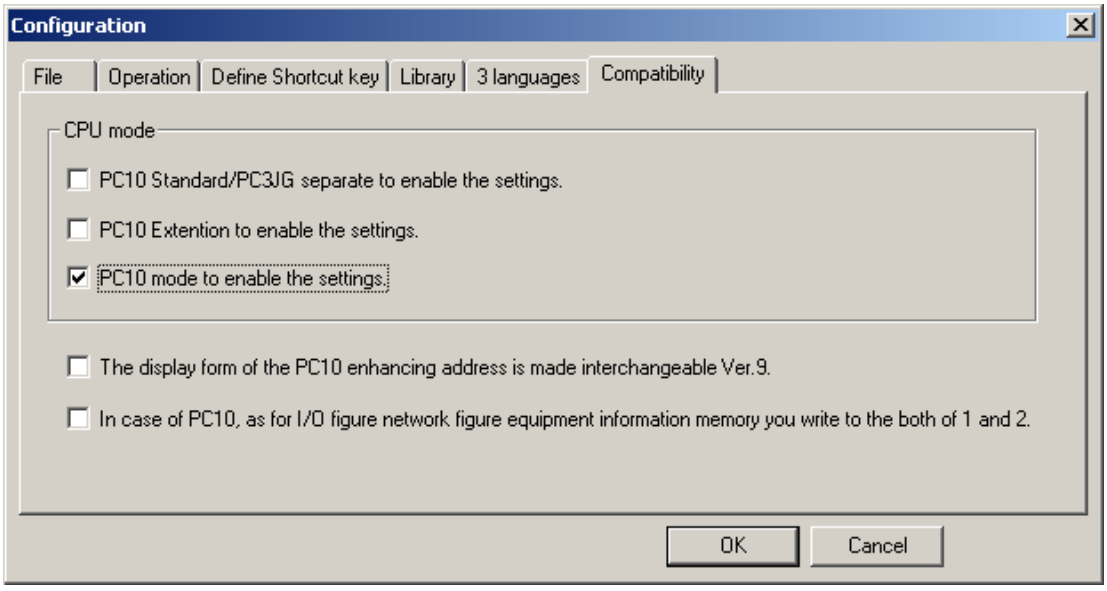


3. Next, make sure that the COM_SERV icon (shown on the bottom right side of the screen) appears as shown below. The red icon indicates that the connection between PCWin and PC10G-CPU hasn't been established yet. There are two possible solutions:

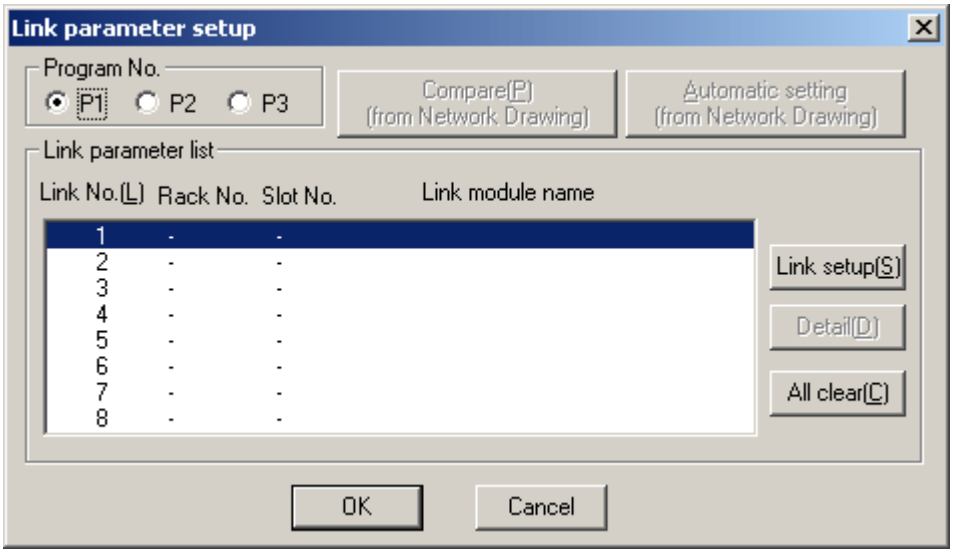
   - Check the cable connections.
   - Reinstall the USB driver that came with the PCWin setup.



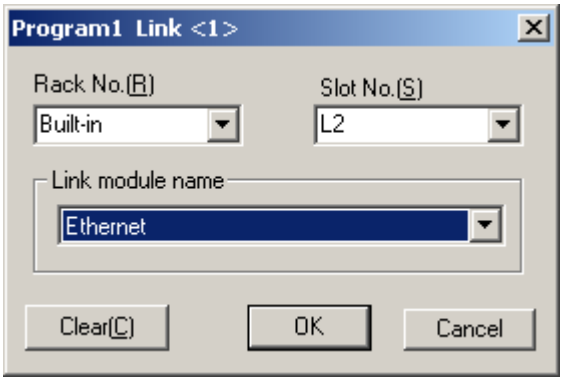
4. **Optional:** To monitor PC10G data from PCWin, go to the menu bar and click **Option** | **Configuration**. Then, select **Compatibility** and make the selections as shown in the image below.



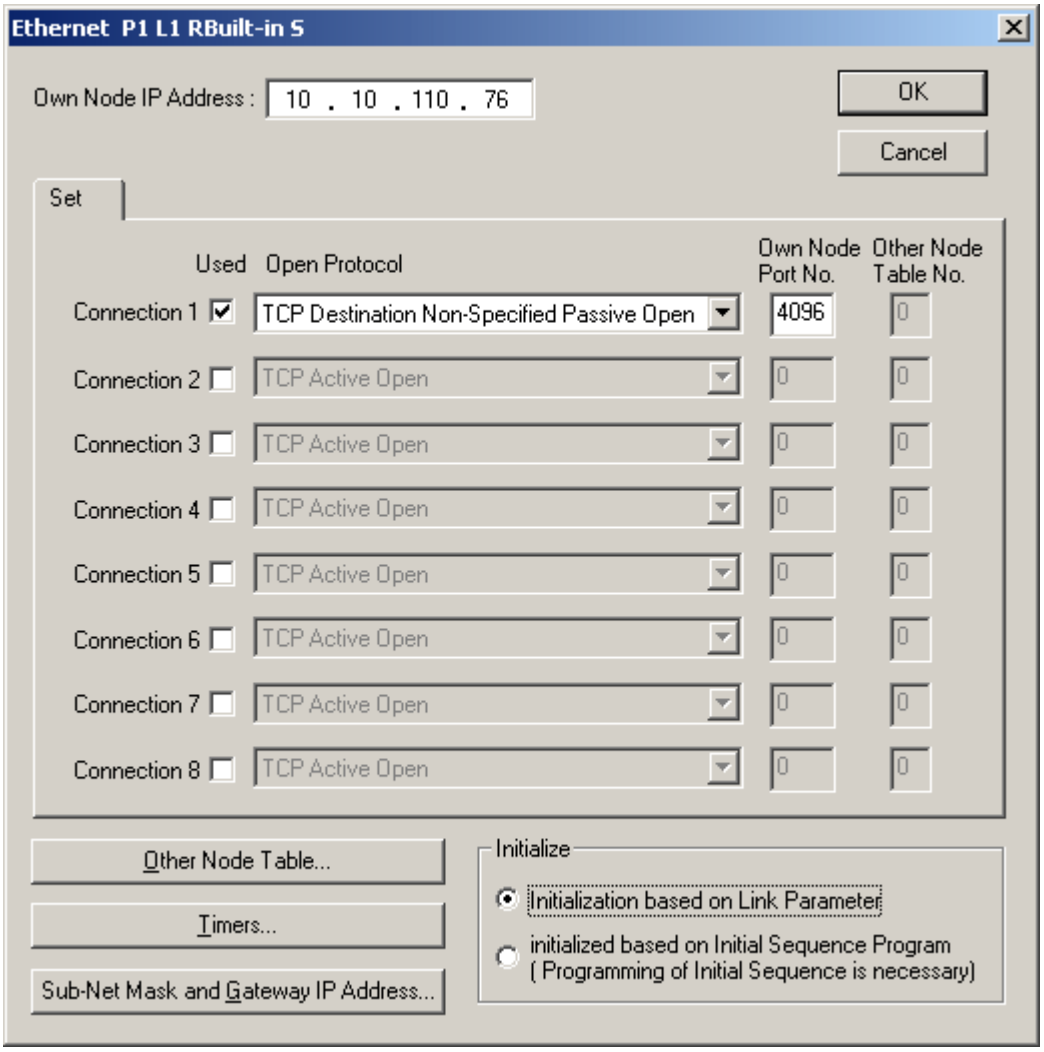
5. Back in the Project Window, select the **Project** tab. Then, click **Parameters** | **Link Parameter**.



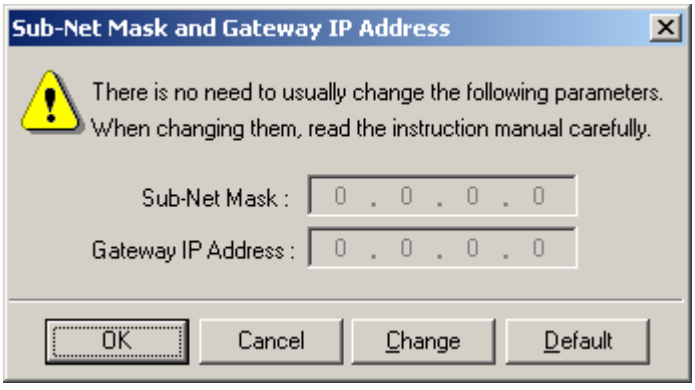
6. Click **Link setup(S)** and make the following selections:
    - Rack No.(R) - Built-in
    - Slot No. (S) - L2 Link
    - Module Name - Ethernet
7. Click **OK**.



8. Click **Detail(D)**. In this dialog, the following parameters may be specified:
    - In **Own Node IP Address**, set the desired IP address of the Ethernet Port.
    - In **Own Node Port No.**, set the desired Port Number. In this example, 4096 is used.



9. Click **Sub-Net Mask and Gateway IP Address** and specify the desired subnet and gateway settings.



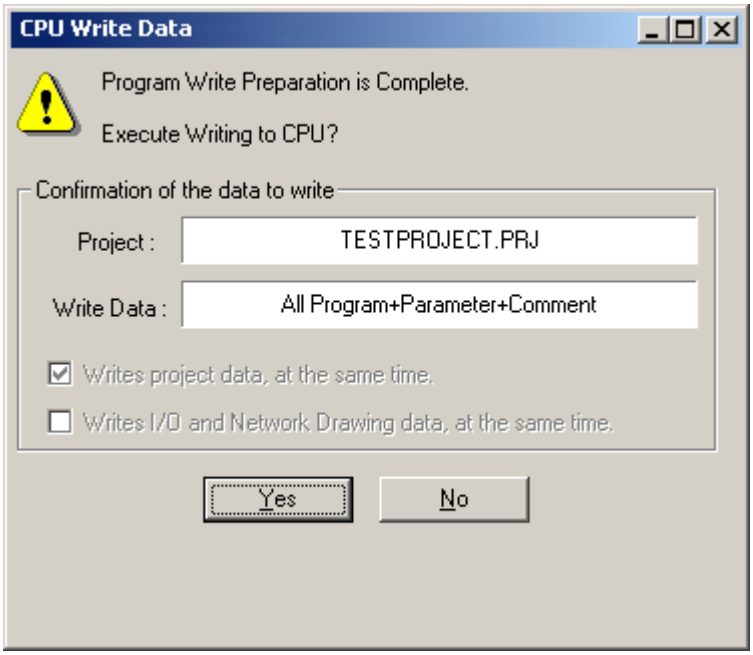
10. Once finished, click **OK**.
11. Click **OK** again. Then, click **Yes**.

12. Save the project. In this example, the name "TestProject" is used.

Transferring Configuration Settings to the PC10G-CPU

1. Click **CPU** | **Write Data** | **All Program+Parameter+Comment**. Alternatively, click **CPU** | **Write Data** | **Parameter**. The invoked window should appear as shown below.

   Note: If the CPU is in Run Mode, it will need to be stopped. To do so, click **CPU** | **Stop / Release Stop**.



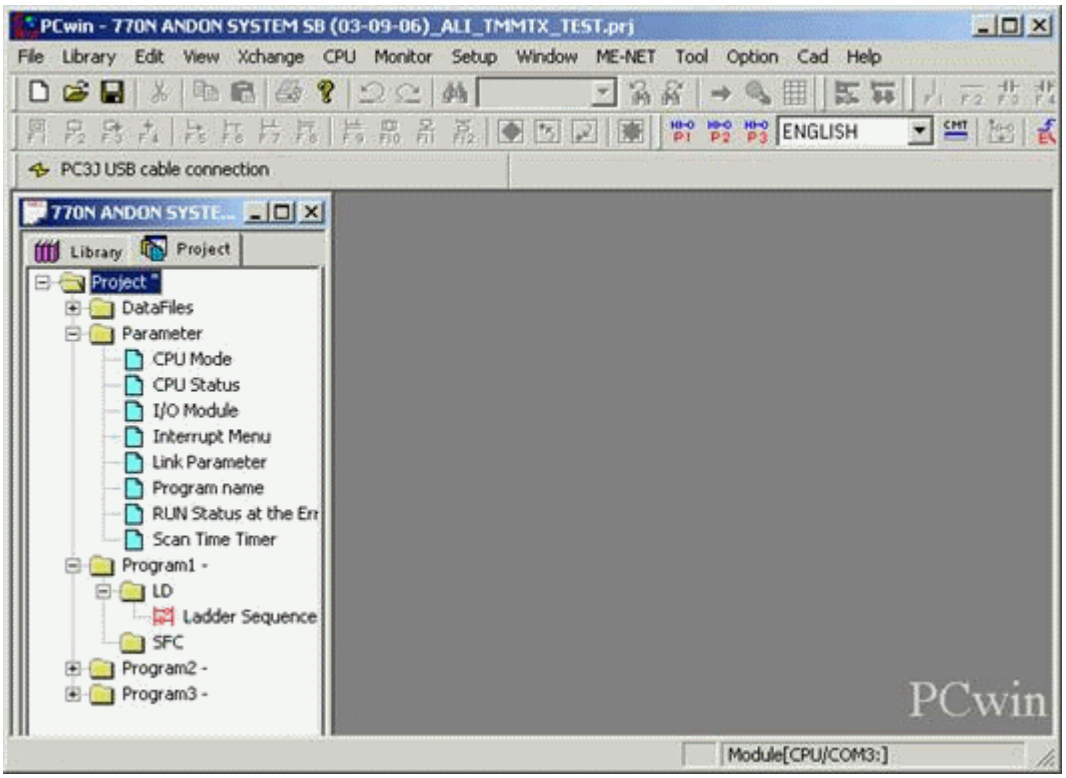
2. Once the download is complete, the following window should appear.

3. Power cycle the PC10G-CPU for the new settings to take effect.

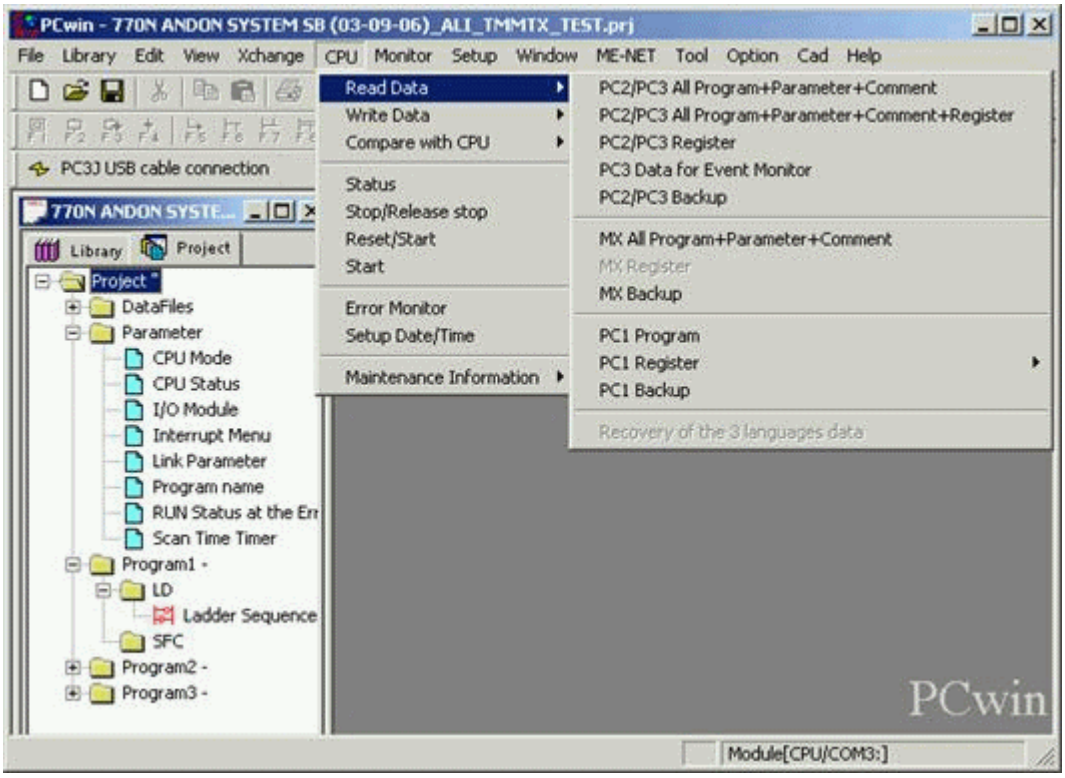
Configuring the FL/ET-T-V2 Ethernet Module

Before the FL/ET-T-V2 card can be used for communications, it needs to be configured to use PCWIN. At this point, users should know how to configure PCWIN to connect to the PLC. For more information, refer to the *Toyopuc FL/ET-T-V2 Ethernet Module Users Manual*.

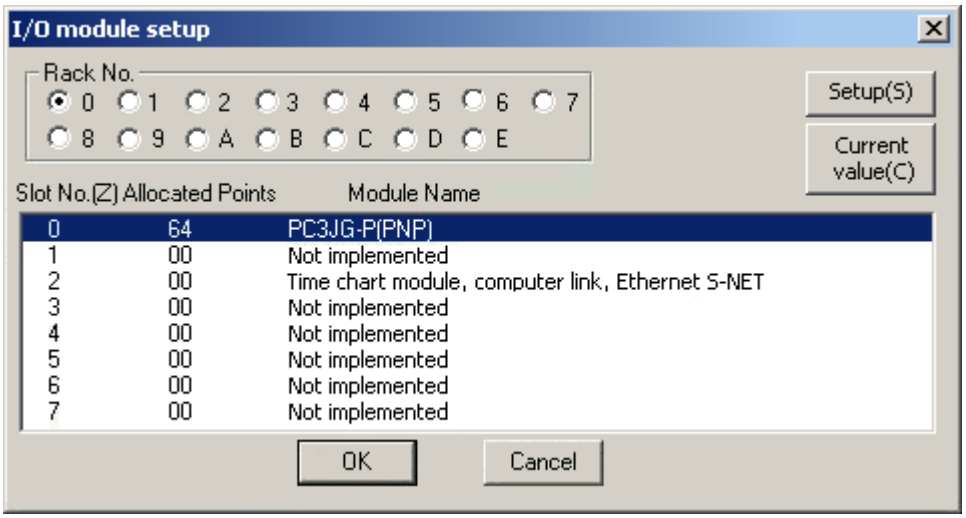
1. To start, open PCWIN.



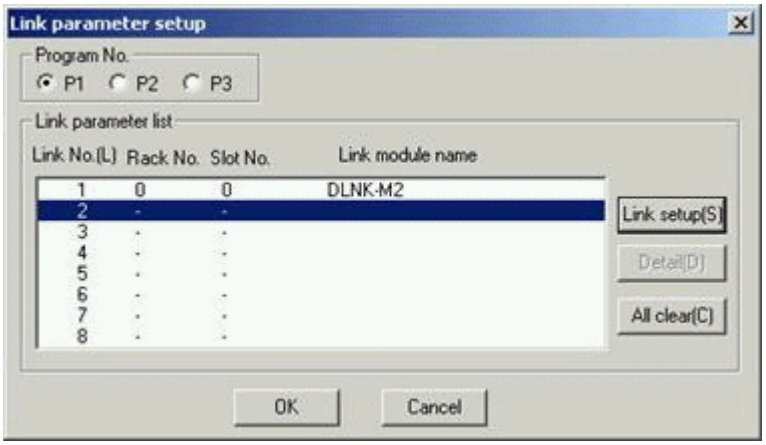
2. Read the existing program and parameters from the PLC by clicking on **CPU** | **Read Data**. Select the proper option.



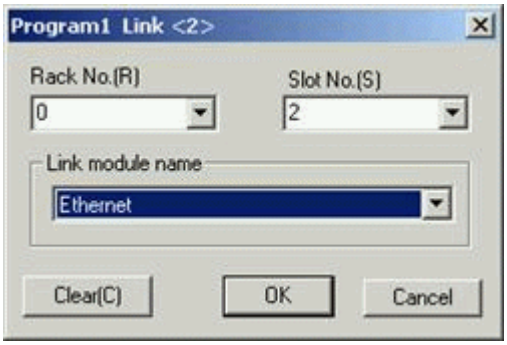
3. Once the ladder is loaded, click on **Project** | **Parameter** and then select **I/O Module**.
4. Verify that the Ethernet Card is configured in the PLC.



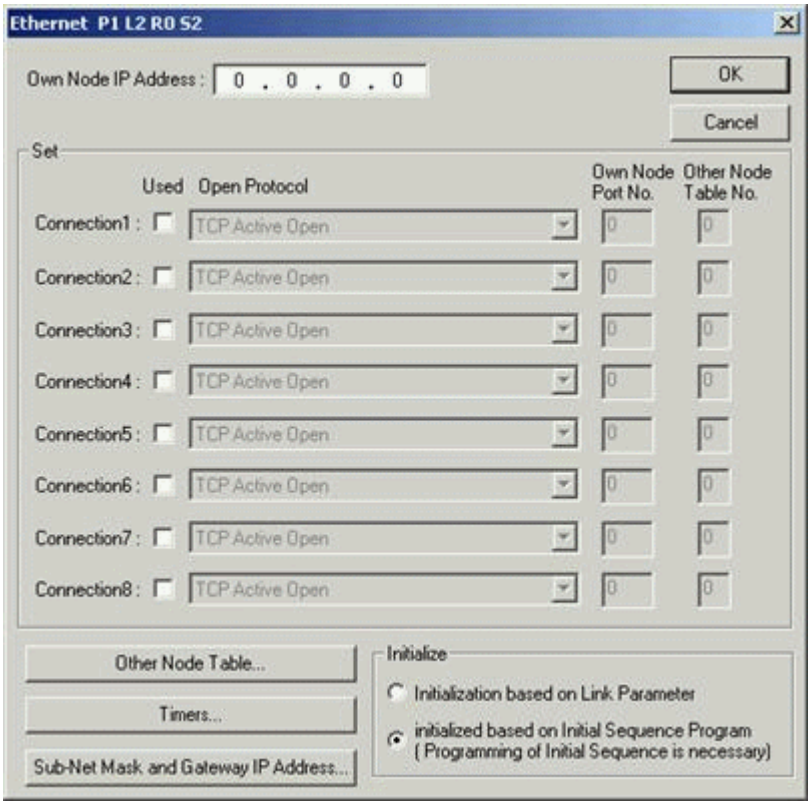
5. Click **OK** to close.
6. Click **Project** | **Parameter** and then double-click on **Link Parameter**.



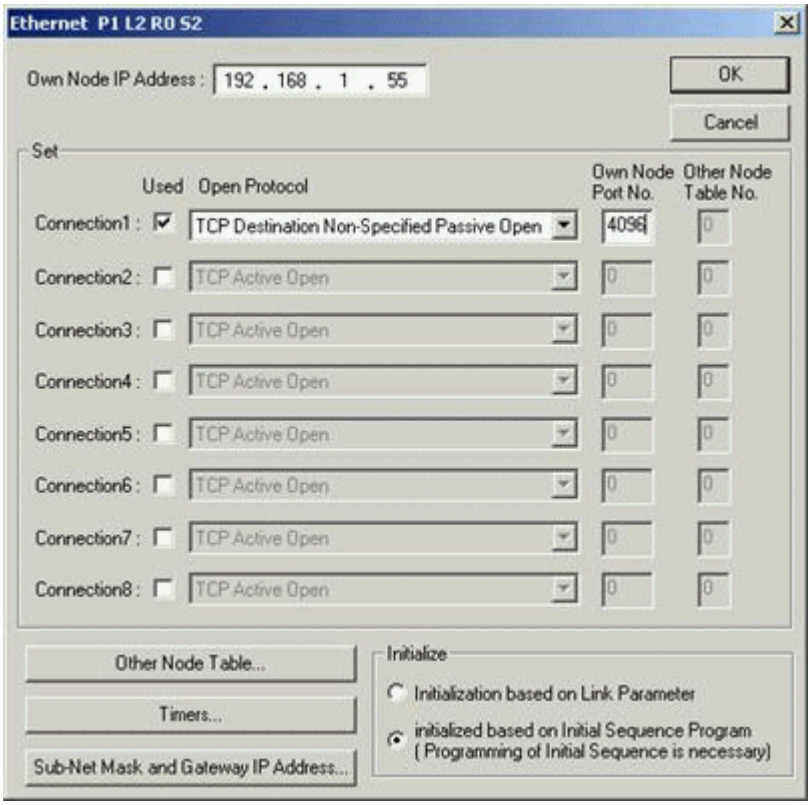
7. In the **Program No.** field, select the program that the configuration will be placed in. Click **Link Setup**.



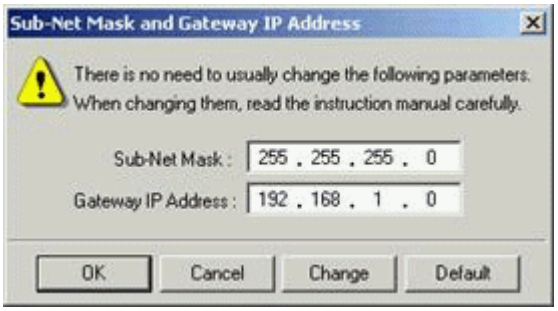
8. In the **ProgramName Link** dialog, select the **Rack No.** and **Slot No.** where the module is located.
9. In the **Link** module name field, select **Ethernet** from the drop-down list. Click **OK**.
10. In the **Link Parameter Setup** dialog, select the new link. Next, click the **Detail** button.
11. Enter the card's IP address in the **Own Node IP Address** field.



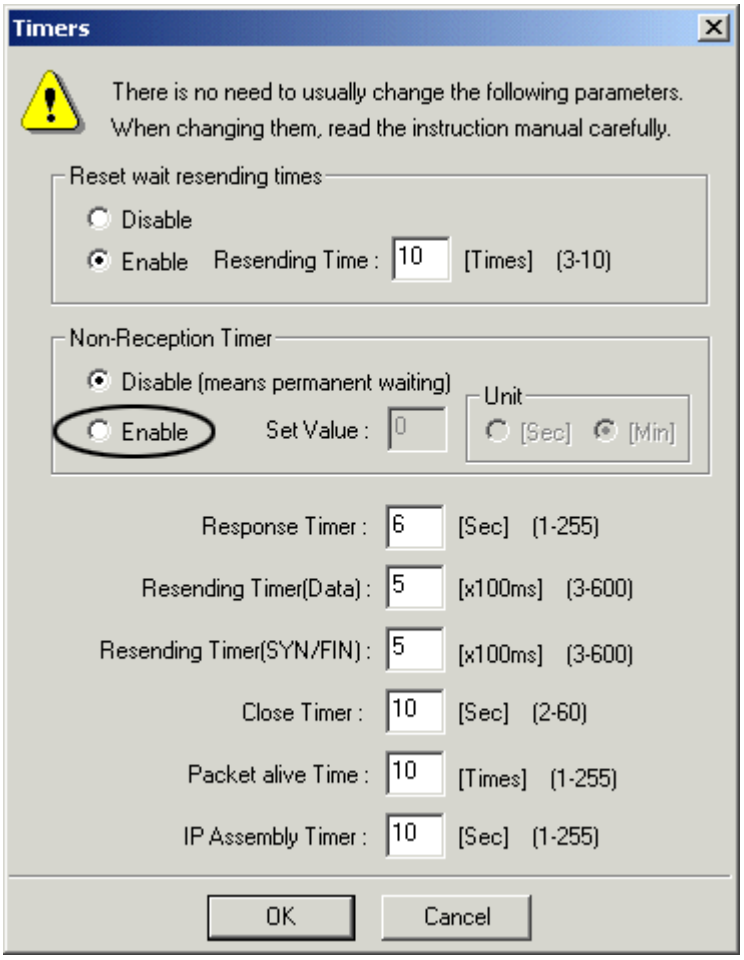
12. Check the **Used** checkbox for Connection1. Up to 8 connections can be configured.
13. In the **Open Protocol** field, select **TCP Destination Non-Specified Passive Open** from the drop-down list.
14. Enter the appropriate value in the **Own Node Port No**. field. In the example shown below, the number 4096 has been entered.



15. Now that the connection is configured, click **Sub-Net Mask and Gateway IP Address**. These values should be set by the IT Manager. For less complex networks, match the sub-net mask and gateway IP address that are configured in the PC's network configuration.
16. Click **OK** when finished.



17. Click on **Timers**. This dialog allows the Ethernet connection to reset if a network error forces a dropped connection between the server and the device. By default, the Non-Reception Timer is set to Disable (which means permanent waiting).



18. Under **Non-Reception Timer**, click **Enable**.
19. To set the timer resolution, enter a value in the **Set Value** field. Under **Unit**, select seconds or minutes. A value of less than a minute is recommended. This setting should not be faster than the poll rate.
20. Click **OK** to finish.

Configuration Ladder for EN-I/F Ethernet Module

To make multiple connections to the Toyopuc PLC PC2/PC3, users must connect with different Port IDs in each client connection. To do this, the ports in the ladder program must be initialized. The example below shows how to initialize the Ethernet card for one connection port. The following properties are assumed:

1. The Ethernet module link number is 3.
2. The PC IP address is being set to 192.168.1.1 (C0,A8,01,01).
3. The module allows 8 connections. This example specifies 1.
4. The port will be opened as "TCP," "passive partner unspecified."
5. The port number for the first connection is 1000h (4096).

6. The file memory 0th operand corresponds with data register D000.
7. Data Registers D0100–D0105 are used for writing file memory.

Ladder for Initializing the Ethernet Card

```
├──────────────────[ Start ]
│
│ Value is 1/on
│ first scan
├┤V06├──────┬──────[ FIL1 00 → D0000L      →D0009H ] Clear Data
│            ├──────[ WMOV   0001h      →  D0000 ] Initial Request On
│            ├──────[ DMOV   C0A80101   →  D0004 ] IP Address Assigned to the PLC
│            ├──────[ WMOV   0001h      →  D0006 ] Connection Used
│            ├──────[ WMOV   0200h      →  D0008 ] Indicates Unspecified TCP Partner Connection
│            └──────[ WMOV   1000h      →  D0009 ] Port Number for connection
│
│
│Flag to show
│link availability
├┤V94├┤P00↑├──────[ WMOV   300Ch       → D0100  ] Link 3 0Ch byte designation
│            ├──────[ WMOV   2008h       → D0101  ] D0004 designated
│            ├──────[ WMOV   0008h       → D0102  ] File memory address 8 designated
│            ├──────[ SPW    D0100 D0101 → D0102  ] Writing into file memory
│            ├──────[ WMOV   0001h       → D0106  ] Non-reception timer value (1 Minute)
│            ├──────[ WMOV   3002h       → D0107  ] Link 3 2 bytes designated
│            ├──────[ WMOV   220Ch       → D0108  ] D0106 designated
│            ├──────[ WMOV   00E2h       → D0109  ] File memory E2 operand designated
│            ├──────[ SPW    D0107 D0108 → D0109  ] Writing non-reception timer value into the file memory
│            ├──────[ WMOV   3001h       → D0103  ] Link 3 1 byte designated
│            ├──────[ WMOV   2000h       → D0104  ] D0000 designated
│            ├──────[ WMOV   0000h       → D0105  ] File memory address 0 designated
│            └──────[ SPW    D0103 D0104 → D0105  ] Writing into file memory
```

For more information, refer to the Toyopuc PC2 or PC3 EN-1/F Users Manual.

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