

# CIP Ethernet/IP Driver

<b>File Name</b>	CIP.dll
<b>Manufacturer</b>	Open DeviceNet Vendors Association
<b>Devices</b>	Devices compatible with the CIP encapsulated in EtherNetIP protocol
<b>Protocol</b>	CIP encapsulated in EtherNetIP
<b>Version</b>	2.0.5
<b>Last Update</b>	09/02/2025
<b>Platform</b>	Win32
<b>Dependencies</b>	IOKit version 2.0
<b>Superblock Readings</b>	No
<b>Level</b>	0

## Introduction

This Driver implements the CIP encapsulated in EtherNetIP protocol, allowing an application developed by **Eclipse Software** to communicate with devices compatible with the CIP encapsulated in EtherNetIP protocol by Open DeviceNet Vendors Association.

## Driver Configuration

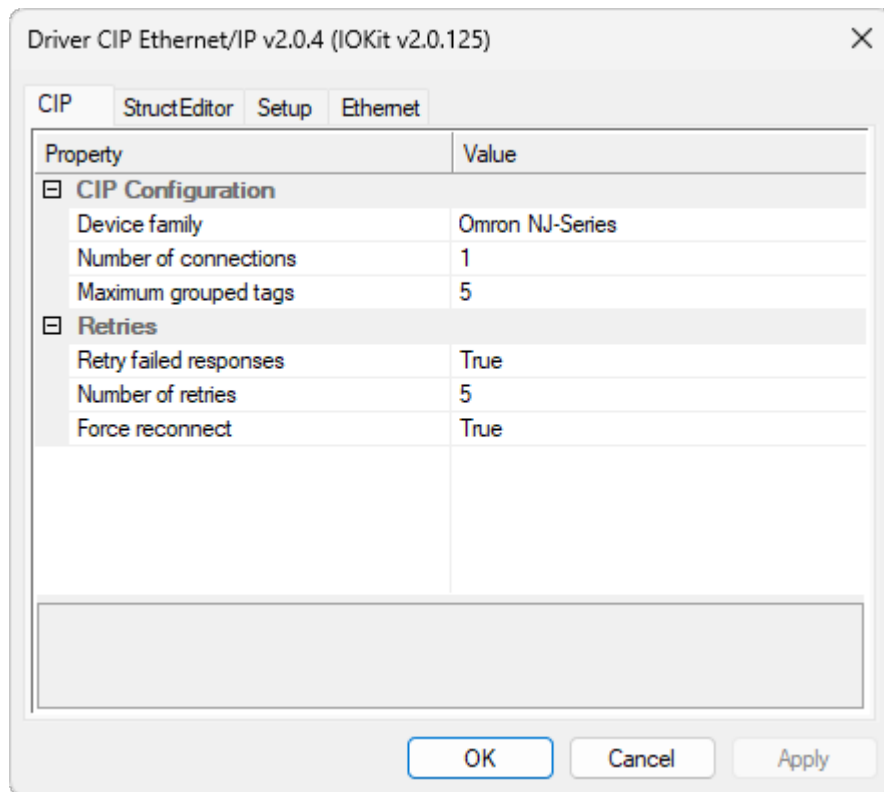
This section contains information about the configuration of this Driver.

### [P] Parameters

This Driver does not use [P] parameters. All configurations are performed on the **Configuration Window**.

## Configuration Window

On this Driver's configuration window, users can select a type of device. This option defines which Tags and Tag Browser's functionality are available.

**CIP tab**

The available options on this tab are described on the next table.

#### Available options on the CIP tab

OPTION	DESCRIPTION
<b>Device family</b>	Family of devices to which this Driver communicates
<b>Number of connections</b>	Number of parallel connections on a remote device
<b>Maximum grouped tags</b>	Number of Tags in advise that can be grouped into a single request
<b>Retry failed responses</b>	Option to enable or disable the internal retries of this Driver to recover a response not yet received from a device (time-out)
<b>Number of retries</b>	Defines the number of internal retries this Driver must perform before considering a reading error
<b>Force reconnect</b>	Option to enable or disable the communication layer's disconnection and reconnection procedure with a device, after all internal attempts to recover responses by time-out have failed

## Tag Grouping

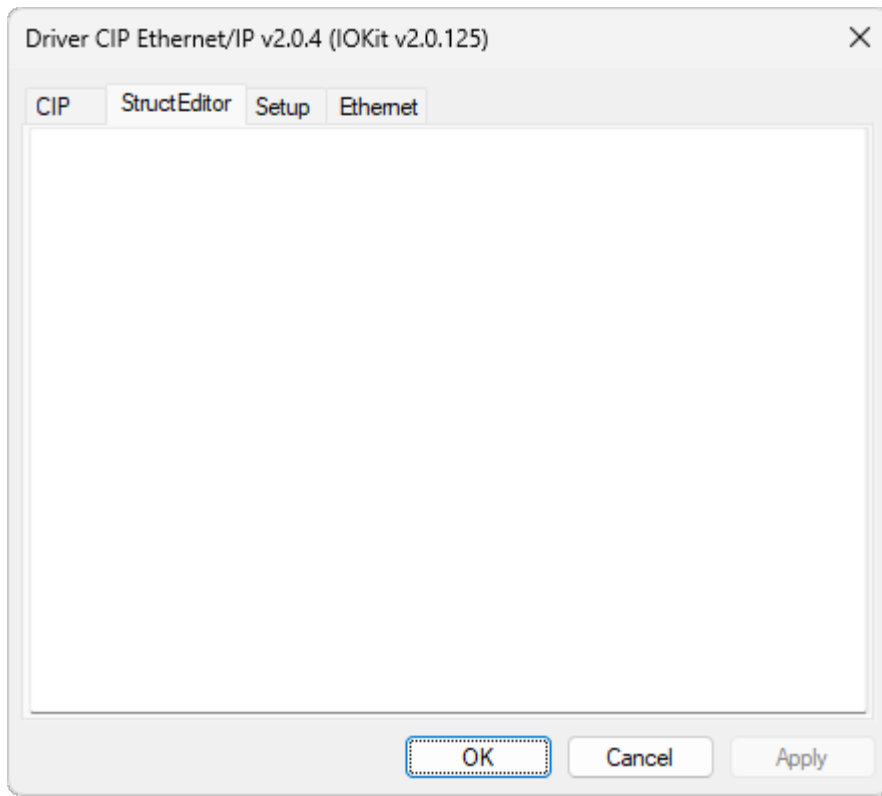
Users can activate in this Driver a grouping of Tags in **Advise** mode, so that communication can be more efficient.

Although it may seem convenient, it is not recommended to set this parameter to higher values. Packets grouping lots of Tags may become very large for communication to happen normally, causing transmission errors due to limitations in CIP encapsulated in EtherNet/IP protocol.

Therefore, it is recommended to configure this parameter in an application-by-application basis. If an application uses only Tags that read atomic values, or whose return contains a few bytes, this value can be high. But if an application uses Block Tags, a higher value on this configuration may lead to many communication problems.

## Structure Editor Window

On the **StructEditor** tab, users can manually specify data structures described on a remote device. On some devices, these structures can be defined manually.



**StructEditor tab**

## Syntax to Describe Structures

This Driver accepts describing structures according to CIP standard, described on the next examples.

```
TestStruct ::= SEQUENCE OF {
  UINT uint1;
  USINT usint1;
  BOOL bool1;
  ARRAY[0..2] of USINT array1
}

NamelessMembers ::= SEQUENCE OF { BOOL, UINT, DINT }
SubStructure ::= SEQUENCE OF { TestStruct, UINT }
ArrayNamelessStruct ::= SEQUENCE OF { ARRAY[0..2] of USINT, BOOL }
SemicolonNameless ::= SEQUENCE OF { UINT; BOOL; SHORTSTRING }
```

For more information, please check CIP standard *specification*.

## Supported Devices

This section contains the description of specific functionality for each device supported by this Driver.

### Allen-Bradley Logix5000

#### Compatibility

Devices 1756 ControlLogix, 1756 GuardLogix, 1768 CompactLogix, 1769 CompactLogix, 1789 SoftLogix, and 1794 FlexLogix.

## Supported Tags

- Reading and writing variables
- User-defined structures at run time

## Tag Browser

Tag Browser allows viewing **User Variables** Tag available on a device.

# Omron NJ-Series

## Supported Tags

- Reading and writing variables
- Reading instances

## Tag Browser

Tag Browser allows viewing **User Variables** and **System Variables** Tags available on a device.

# Tag Reference

This section contains information about the configuration of **Device** and **Item** Tags of this Driver.

## List of Instances

### Read-Only

<b>Device</b>	InstanceList
<b>Item</b>	"system", "user", or "all"
<b>Size</b>	Undefined

Retrieves accessible variables on a device. Returns a list with an undefined size, in which each element is a pair of **Strings** composed by the name of a variable's parent object and the name of that variable.

# Variables

## Reading and Writing

<b>Device</b>	Variable
<b>Item</b>	Variable's name
<b>Size</b>	Undefined

Retrieves a variable in the **Item** field on a device. This name must be in the format described next.

```
<(type_specification)>variable_name<[access_index]><.member_name<[member_index]>>
```

The format of the **Item** field obeys the following restrictions:

- The **variable\_name** and **member\_name** elements must contain only alphanumeric ASCII characters without symbols, except for the underscore character
- The **access\_index** and **member\_index** elements must be positive integers greater than 0 (zero)
- Elements inside less than (<) and greater than (>) characters are optional
- When the **type\_specification** element is available, this variable is a structure
- The **type\_specification** element must contain data types separated by commas and optionally followed by their array sizes

## Restrictions on the Size of Strings

- If a variable is not a structure, using a Block Tag allows this Driver to access that variable as an array the size of a Block Tag. Using a PLC Tag allows this Driver to access that variable as a simple data type
- If a variable is a structure, the Tag's type must be **Block** with a size equal to the number of members, including array elements

## Examples

Examples for the Item field of a Variable Tag

VARIABLE	BLOCK SIZE	INTERPRETATION
<b>simpleVariable</b>	0 (zero, PLC Tag)	Simple data type
<b>arrayVariable</b>	10	Array with ten positions of simple data types
<b>arrayVariable[9]</b>	0 (zero)	Simple data type (element of an array)
<b>structVariable.simpleMember</b>	0 (zero)	Simple data type (element of a structure)
<b>arrayStructVariable[5].simpleMember</b>	0 (zero)	Simple data type (element of an array of structures)
<b>structVariable.arrayMember[10]</b>	0 (zero)	Simple data type (element of an array in a structure)
<b>arrayStructVariable[5].arrayMember[1]</b>	0 (zero)	Simple data type (element of an array in an array of structures)
<b>arrayStructVariable[5].arrayMember</b>	2 (two)	Array with 2 (two) positions of simple data types (elements of an array of structures)
<b>(int, sint)structVariable</b>	2 (two)	Structure with 2 (two) members
<b>(word, int)structVariable</b>	3 (three)	Error in Tag configuration
<b>(word, int[10])structVariable</b>	11	Structure with 2 (two) members and one of them is an array

VARIABLE	BLOCK SIZE	INTERPRETATION
(word, int[10])structVariable	2 (two)	Error in Tag configuration

## Documentation of I/O Interfaces

This section contains the documentation of I/O Interfaces referring to the **CIP** Driver.

### Configuration of a Driver

I/O Interface configuration is performed on a Driver's configuration dialog box. To access the configuration of this dialog box in **Eclipse E3** in version 1.0, follow these steps:

1. Right-click a Driver object (IODriver).
2. Select the **Properties** item on the contextual menu.
3. Select the **Driver** tab.
4. Click **Other parameters**.

In **Eclipse E3** version 2.0 or later, click **Configure driver**  on a Driver's toolbar. In **Eclipse SCADA**, follow these steps:

1. Open the Organizer.
2. Select a Driver on Organizer's tree.
3. Click **Extras** on the **Driver** tab.

Currently, an I/O Interface allows opening only one connection for each Driver. This means that, if users want to access two serial ports, they must add two Drivers to an application and then configure each one of these Drivers for each serial port.

### Configuration Dialog Box

The dialog box of I/O Interfaces allows configuring the I/O connection used by a Driver. This dialog box contains the **Setup**, **Serial**, **Ethernet**, **Modem**, and **RAS** tabs, described on the next topics. If a Driver does not implement a specific I/O connection, its corresponding tab is not available for configuration. Some Drivers may contain additional tabs, specific for that Driver, on the configuration dialog box.

### Setup Tab

The **Setup** tab contains general configurations of a Driver. This tab is divided into the following groups:

- **General configurations:** Configurations of a Driver's physical layer, time-out, and initialization mode
- **Connection management:** Configurations on how the I/O Interface keeps a connection and which recovery policy is used on failure
- **Logging options:** Controls the generation of log files

Setup

Physical Layer: Ethernet  Start driver OFFLINE

Timeout: 1000 ms      Communication check time: 5000 ms

Connection management

Mode: Automatic (managed by the driver)

Retry failed connection every 20 seconds

Give up after 1 failed retries

Disconnect if non-responsive for 0 seconds

Logging Options

Log to File: C:\eeLogs\MicrolokII\_%DATE%.log

File size limit (MB): 0 ('0' is unlimited)

**Setup tab**

**General options on the Setup tab**

OPTION	DESCRIPTION
<b>Physical Layer</b>	Select the physical layer on a list. Available options are <b>Serial</b> , <b>Ethernet</b> , <b>Modem</b> , and <b>RAS</b> . The selected interface must be configured on its specific tab
<b>Timeout</b>	Configure a time-out, in milliseconds, for the physical layer. This is the amount of time an I/O interface waits to receive any byte from the reception's buffer
<b>Communication check time</b>	Set the time, in milliseconds, to define the interval at which communication is considered to be in an inactive state. As long as an I/O Driver receives valid data, its communication state is considered active. However, if during operation an I/O Driver does not receive valid data inside this period of time, the state is considered inactive. The communication state is shown in the <b>IO.CommunicationStatus</b> Tag
<b>Start driver OFFLINE</b>	Select this option so that a Driver starts in <b>Offline</b> mode or stopped. This means that the I/O interface is not created until this Driver is configured to <b>Online</b> mode by using a Tag in an application. This mode enables a dynamic configuration of an I/O interface at run time

## Options on the Connection management group

OPTION	DESCRIPTION
<b>Mode</b>	Selects a management mode of a connection. Selecting the <b>Automatic</b> option allows a Driver to manage the connection automatically, as specified in the next options. Selecting the <b>Manual</b> option allows an application to fully manage a connection
<b>Retry failed connection every ... seconds</b>	Select this option to enable a Driver's connection retry in a certain interval, in seconds. If the <b>Give up after failed retries</b> option is not selected, this Driver keeps retrying until a connection is performed, or until the application is stopped
<b>Give up after ... failed retries</b>	Enable this option to define a maximum number of connection retries. When the specified number of consecutive connection retries is reached, a Driver goes to the <b>Offline</b> mode, assuming that a hardware problem was detected. If a Driver establishes a successful connection, the number of unsuccessful retries is cleared. If this new connection is lost, then the retry counter starts at zero
<b>Disconnect if non-responsive for ... seconds</b>	Enable this option to force a Driver to disconnect if no byte was received by the I/O interface during the specified time-out, in seconds. This time-out must be greater than the time-out configured in the <b>Timeout</b> option

## Options on the Logging Options group

OPTION	DESCRIPTION
<b>Log to File</b>	<p>Enable this option and configure the name of a file to write a log. Log files can be large, so use this option for short periods of time, only for testing and debugging purposes. If the <b>%PROCESS%</b> macro is used in the log file name, it is replaced by the identifier of the current process. This option is particularly useful when using several instances of the same Driver in <b>Elipse E3</b>, thus allowing each instance to generate a separate log file. For example, when configuring this option with value "c:\e3logs\drivers\sim_%PROCESS%.log", it generates a file named c:\e3logs\drivers\sim_00000FDA.log for process <b>OFDAh</b>. Users can also use the <b>%DATE%</b> macro in the file name. In this case a log file is generated every day, in the format <b>aaaa_mm_dd</b>. For example, when configuring this option with value "c:\e3logs\drivers\sim_%DATE%.log", it generates a file named c:\e3logs\drivers\sim_2005_12_31.log in 12/31/2005 and a file named c:\e3logs\drivers\sim_2006_01_01.log in 01/01/2006. Similarly, the <b>%DATE_HOUR%</b> macro generates one log file per hour, in the format <b>aaaa_mm_dd_hh</b>.</p>
<b>File size limit (MB)</b>	<p>Configure the log file size limit, in megabytes. A value equal to 0 (zero) means that there is no size limit for the log file.</p>

## Ethernet Tab

Use this tab to configure parameters of an **Ethernet** Interface. These parameters, except port configurations, must also be configured for use in the **RAS** Interface.

Ethernet

Transport: TCP/IP ▼

PING before connecting  
 Timeout: 4000 ms  
 Retries: 1

Listen for connections on port: 0

Share listen port with other processes

Interface: (All Interfaces) ▼

Use IPv6  Use SSL SSL Settings

Enable 'ECHO' supression

IP Filter:

Connect to

<input type="checkbox"/> Main IP:	<input style="width: 90%;" type="text"/>	Port:	<input style="width: 80%;" type="text" value="502"/>	<input type="checkbox"/> Local port:	<input style="width: 80%;" type="text" value="0"/>
<input type="checkbox"/> Backup IP 1:	<input style="width: 90%;" type="text"/>	Port:	<input style="width: 80%;" type="text" value="0"/>	<input type="checkbox"/> Local port:	<input style="width: 80%;" type="text" value="0"/>
<input type="checkbox"/> Backup IP 2:	<input style="width: 90%;" type="text"/>	Port:	<input style="width: 80%;" type="text" value="0"/>	<input type="checkbox"/> Local port:	<input style="width: 80%;" type="text" value="0"/>
<input type="checkbox"/> Backup IP 3:	<input style="width: 90%;" type="text"/>	Port:	<input style="width: 80%;" type="text" value="0"/>	<input type="checkbox"/> Local port:	<input style="width: 80%;" type="text" value="0"/>

**Ethernet tab**

**Available options on the Ethernet tab**

OPTION	DESCRIPTION
<b>Transport</b>	Select the value <b>TCP/IP</b> for a TCP socket ( <i>stream</i> ) or select the value <b>UDP/IP</b> to use a UDP socket ( <i>connectionless datagram</i> )
<b>Listen for connections on port</b>	Use this option to wait for new connections in a specific IP port, common in Slave Drivers. If this option remains unselected, a Driver connects to the address and port specified in the <b>Connect to</b> option
<b>Share listen port with other processes</b>	Select this option to share the listening port with other Drivers and processes
<b>Interface</b>	Select the local network interface, identified by its IP address, that a Driver uses to establish and receive connections, or select the value <b>(All Interfaces)</b> to allow connection in any network interface
<b>Use IPv6</b>	Select this option to force a Driver to use addresses in <b>IPv6</b> format on all Ethernet connections. Leave this option deselected to use the <b>IPv4</b> format
<b>Enable 'ECHO' supression</b>	Enable this option to remove the echo from received data. An echo is a copy of sent data, which can be returned before a reply message
<b>IP Filter</b>	List of restricted or allowed IP addresses from where a Driver accepts connections ( <i>Firewall</i> ). Please check the <b>IO.Ethernet.IPFilter</b> property for more information
<b>PING before connecting</b>	Enable this option to execute a <b>ping</b> command, that is, to check whether a device can be reached on a network, for a device before trying a socket connection. This is a quick way

OPTION	DESCRIPTION
	<p>of determining a successful connection before trying to open a socket with a device. The time-out of a connection with a socket can be very high. The available options are:</p> <ul style="list-style-type: none"> <li>• <b>Timeout:</b> Specify the number of milliseconds to wait for a reply from a <b>ping</b> command. Users must use a <b>ping</b> command to check the normal reply time, configuring this option for a value above that average. Usually this value can be configured between 1000 and 4000 milliseconds, that is, between 1 (one) and 4 (four) seconds</li> <li>• <b>Retries:</b> Number of retries of a <b>ping</b> command, not counting the first attempt. If all attempts fail, then the socket connection is aborted</li> </ul>

**Available options on the Connect to group**

OPTION	DESCRIPTION
<b>Main IP</b>	Type the IP address of a remote device. Users can use an IP address separated by dots, as well as a URL. In case of a URL, a Driver uses the available DNS service to map that URL to an IP address, such as "192.168.0.13" or "Server1"
<b>Port</b>	Type the IP port of a remote device, between 0 (zero) and 65535
<b>Local port</b>	Select this option to use a fixed local IP port when connecting to a remote device
<b>Backup IP 1, 2, and 3</b>	Indicate the IP address, the IP port, and the fixed local IP port of up to 3 (three) backup addresses of a remote device

## General Configurations

This section contains information about the configuration of general **I/O Tags** and **Properties** of I/O Interfaces.

### I/O Tags

#### General I/O Interfaces Tags (N2/B2 = 0)

The Tags described next are provided for all supported I/O Interfaces.

#### IO.CommunicationStatus

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Reading
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	6 (six)
<b>String Configuration</b>	IO.CommunicationStatus

This Tag informs the communication status of a Driver. It indicates how communication works relative to receiving valid data within a time period arbitrated in the configuration. For more information, please check topic **Setup Tab**. Possible values are **0 - Inactive communication**: The Driver did not receive valid data or stopped receiving data after *n* milliseconds, as configured in the properties window, or **1 - Active communication**: The Driver is receiving valid data.

## IO.IOKitEvent

<b>Type of Tag</b>	Block Tag
<b>Type of Access</b>	Read-Only
<b>B1 Parameter</b>	-1 (minus one)
<b>B2 Parameter</b>	0 (zero)
<b>B3 Parameter</b>	0 (zero)
<b>B4 Parameter</b>	1 (one)
<b>Size Property</b>	4 (four)
<b>ParamItem Property</b>	IO.IOKitEvent

This Block returns Driver events generated by several sources in I/O Interfaces. The **TimeStamp** property of this Block represents the moment this event occurred. The Block Elements are the following:

- **Element 0**: Type of event. Possible values are **0**: Information, **1**: Warning, or **2**: Error
- **Element 1**: Source of an event. Possible values are **0**: Driver (specific of a Driver), **-1**: IOKit (generic events of I/O Interfaces), **-2**: **Serial** Interface, **-3**: **Modem** Interface, **-4**: **Ethernet** Interface, or **-5**: **RAS** Interface
- **Element 2**: Error number, specific for each source of event
- **Element 3**: Message of an event, a **String** specific for each event

### NOTE

A Driver keeps a maximum number of 100 events internally. If additional events are reported, older events are discarded.

## IO.PhysicalLayerStatus

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	2 (two)
<b>String Configuration</b>	IO.PhysicalLayerStatus

This Tag indicates the status of a physical layer. Possible values are the following:

- **0**: Physical layer stopped, that is, a Driver is in **Offline** mode, the physical layer failed when initializing, or exceeded the maximum number of reconnection attempts
- **1**: Physical layer started but not connected, that is, a Driver is in **Online** mode but the physical layer is not connected. If the **Connection management** option is configured with the value **Automatic**, the physical layer can be connecting, disconnecting, or waiting for a reconnection attempt. If the **Connection management** option is configured with the value **Manual**, then the physical layer remains in this status until forced to connect
- **2**: Physical layer connected, that is, the physical layer is ready for use. This **DOES NOT** mean a device is connected, only that the access layer is working

## IO.SetConfigurationParameters

<b>Type of Tag</b>	Block Tag
<b>Type of Access</b>	Read-Only
<b>B1 Parameter</b>	-1 (minus one)
<b>B2 Parameter</b>	0 (zero)
<b>B3 Parameter</b>	0 (zero)
<b>B4 Parameter</b>	3 (three)
<b>Size Property</b>	2 (two)
<b>ParamItem Property</b>	IO.SetConfigurationParameters

Use this Tag to change any property of a Driver's configuration dialog box at run time.

This Tag works only while a Driver is in **Offline** mode. To start a Driver in **Offline** mode, select the **Start driver OFFLINE** option on that Driver's configuration dialog box. Users can write to a PLC Tag or to a Block Tag containing the parameters to change. Writing individual Block Elements is not supported, the whole Block must be written at once.

In **Eclipse SCADA**, users must use a Block Tag. Every parameter to configure uses two Block Elements. For example, if users want to configure 3 (three) parameters, then the size of the Block must be 6 (six,  $3 \times 2$ ). The first Element is the property's name, as a **String**, and the second Element is the property's value, according to the next example.

```
// 'Block' must be a Block Tag with automatic reading,
// scan reading, and automatic writings disabled.
// Configure all parameters
Block.element001 = "IO.Type" // Parameter 1
Block.element002 = "Serial"
Block.element003 = "IO.Serial.Port" // Parameter 2
Block.element004 = 1
Block.element005 = "IO.Serial.BaudRate" // Parameter 3
Block.element006 = 19200
// Writes the whole Block
Block.Write()
```

When using **Eclipse E3**, the ability to create arrays at run time allows using an I/O Tag as well as a Block Tag. Users can use the **Write** method of a Driver to send the parameters directly to that Driver, without creating a Tag, according to the next example.

```
Dim arr(6)
' Configure all array elements
arr(1) = "IO.Type"
arr(2) = "Serial"
arr(3) = "IO.Serial.Port"
arr(4) = 1
arr(5) = "IO.Serial.BaudRate"
arr(6) = 19200
' There are two methods to send parameters
' Method 1: Using an I/O Tag
tag.WriteEx arr
' Method 2: Without using a Tag
Driver.Write -1, 0, 0, 3, arr
```

A variation of the previous example uses a bidimensional array.

```
Dim arr(10)
' Configure all array elements. Notice the array was resized
' to 10 elements. Empty array elements are ignored by a Driver
arr(1) = Array("IO.Type", "Serial")
arr(2) = Array("IO.Serial.Port", 1)
arr(3) = Array("IO.Serial.BaudRate", 19200)
Driver.Write -1, 0, 0, 3, arr
```

A Driver does not validate parameter names or passed values, therefore be careful when writing parameters and values. The **Write** method fails if the configuration array is incorrectly created. Users can check the log of a Driver or use the *writeStatus* parameter of the **WriteEx** method to find out the exact cause of an error.

```
Dim arr(10), strError
arr(1) = Array("IO.Type", "Serial")
arr(2) = Array("IO.Serial.Port", 1)
arr(3) = Array("IO.Serial.BaudRate", 19200)
If Not Driver.WriteEx -1, 0, 0, 3, arr, , , strError Then
    MsgBox "Failed configuring Driver parameters: " + strError
End If
```

## IO.WorkOnline

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Reading or Writing
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	4 (four)
<b>String Configuration</b>	IO.WorkOnline

This Tag informs the current status of a Driver and allows starting or stopping the physical layer. Possible values are the following:

- **0 - Driver Offline:** Physical layer is closed or stopped. This mode allows a dynamic configuration of a Driver's parameters using the **IO.SetConfigurationParameters** Tag
- **1 - Driver Online:** Physical layer is open or executing. While in **Online** mode, the physical layer can be connected or disconnected and its current status can be checked using the **IO.PhysicalLayerStatus** Tag

In the next example, using **Eclipse E3**, a Driver is configured to **Offline** mode, its COM port is changed, and then configured to **Online** mode again.

```
'Configure to Offline mode
Driver.Write -1, 0, 0, 4, 0
'Change port to COM2
Driver.Write -1, 0, 0, 3, Array("IO.Serial.Port", 2)
'Configure to Online mode
Driver.Write -1, 0, 0, 4, 1
```

The **Write** method may fail when configuring a Driver to **Online** mode, that is, writing the value 1 (one). In this case, this Driver remains in **Offline** mode. The cause of failure can be:

- Type of physical layer incorrectly configured, probably an invalid value was configured in the **IO.Type** property
- This Driver may have run out of memory
- Physical layer probably did not create its working thread. Search the log file for a message "Failed to create physical layer thread!"
- Physical layer could not start. The cause of this failure depends on the type of physical layer. It can be an invalid serial port number, a failure when starting Windows Sockets, or a failure when starting TAPI (modem), among others. This cause is recorded on the log file

#### IMPORTANT

Even if the configuration of a Driver to **Online** mode is successful, this does not necessarily mean the physical layer is ready to use, that is, ready to execute input and output operations with an external device. The **IO.PhysicalLayerStatus** Tag must be checked to ensure the physical layer is connected and ready for communication.

## Properties

These are general properties of all supported I/O Interfaces.

### IO.ConnectionMode

**9** Controls the management mode of a Connection. Possible values are **0**: Automatic mode, in which a Driver manages the connection or **1**: Manual mode, in which an application manages the connection.

### IO.GiveUpEnable

When configured to True, defines a maximum number of reconnection attempts. If all reconnection attempts fail, a Driver enters the **Offline** mode. When configured to False, a Driver tries until a reconnection is successful.

### IO.GiveUpTries

**9** Number of reconnection attempts before this one is aborted. For example, if the value of this property is equal to 1 (one), a Driver tries only one reconnection when the connection is lost. If this one fails, this Driver enters the **Offline** mode.

### IO.InactivityEnable

Configure to True to enable and to False to disable inactivity detection. The physical layer is disconnected if inactive for a certain period of time. The physical layer is considered inactive only if it is capable of sending data but not capable of receiving it back.

### IO.InactivityPeriodSec

**9** Number of seconds to check for inactivity. If the physical layer is inactive for this period of time, it is then disconnected.

## IO.RecoverEnable

☑ Configure to True to enable a Driver to recover lost connections and to False to leave a Driver in **Offline** mode when a connection is lost.

## IO.RecoverPeriodSec

9 Delay time between two connection attempts, in seconds.

### NOTE

The first reconnection is executed immediately after a connection is lost.

## IO.StartOffline

☑ Configure to True to start a Driver in **Offline** mode and to False to start a Driver in **Online** mode.

### NOTE

It is pointless to change this property at run time, as it can only be changed when a Driver is already in **Offline** mode. To configure a Driver in **Online** mode at run time, write the value 1 (one) to the **IO.WorkOnline** Tag.

## IO.TimeoutMs

9 Defines a time-out for the physical layer, in milliseconds. One second is equal to 1000 milliseconds.

## IO.Type

A Defines the type of physical interface used by a Driver. Possible values are the following:

- **N or None:** Does not use a physical interface, that is, a Driver must provide a customized interface
- **S or Serial:** Uses a local serial port (COM $n$ )
- **M or Modem:** Uses a local modem, internal or external, accessed via TAPI (*Telephony Application Programming Interface*)
- **E or Ethernet:** Uses a TCP/IP or UDP/IP socket
- **R or RAS:** Uses a **RAS** (*Remote Access Server*) Interface. A Driver connects to a RAS device using the **Ethernet** Interface and then sends an **AT** (*dial*) command

## Statistical Configuration

This section contains information about the configuration of **I/O Tags** and **Properties** of I/O Interfaces statistics.

### I/O Tags

#### Tags of I/O Interface Statistics (N2/B2 = 0)

The Tags described next display statistics for all I/O Interfaces.

## IO.Stats.Partial.BytesRecv

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1101
<b>Configuration by String</b>	IO.Stats.Partial.BytesRecv

This Tag returns the number of bytes received in the current connection.

## IO.Stats.Partial.BytesSent

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1100
<b>Configuration by String</b>	IO.Stats.Partial.BytesSent

This Tag returns the number of bytes sent through the current connection.

## IO.Stats.Partial.TimeConnectedSeconds

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1102
<b>Configuration by String</b>	IO.Stats.Partial.TimeConnectedSeconds

This Tag returns the number of seconds a Driver is connected in the current connection or 0 (zero) if a Driver is disconnected.

## IO.Stats.Partial.TimeDisconnectedSeconds

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1103
<b>Configuration by String</b>	IO.Stats.Partial.TimeDisconnectedSeconds

This Tag returns the number of seconds a Driver is disconnected since the last connection ended or 0 (zero) if a Driver is connected.

## IO.Stats.Total.BytesRecv

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1001
<b>Configuration by String</b>	IO.Stats.Total.BytesRecv

This Tag returns the number of bytes received since a Driver was loaded.

## IO.Stats.Total.BytesSent

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1000
<b>Configuration by String</b>	IO.Stats.Total.BytesSent

This Tag returns the number of bytes sent since a Driver was loaded.

## IO.Stats.Total.ConnectionCount

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1004
<b>Configuration by String</b>	IO.Stats.Total.ConnectionCount

This Tag returns the number of connections a Driver already established, successfully, since it was loaded.

## IO.Stats.Total.TimeConnectedSeconds

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1002
<b>Configuration by String</b>	IO.Stats.Total.TimeConnectedSeconds

This Tag returns the number of seconds a Driver remained connected since it was loaded.

## IO.Stats.Total.TimeDisconnectedSeconds

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	0 (zero)
<b>N4 Parameter</b>	1003
<b>Configuration by String</b>	IO.Stats.Total.TimeDisconnectedSeconds

This Tag returns the number of seconds a Driver remained disconnected since it was loaded.

## Properties

Currently, there are no properties defined specifically to display I/O Interface statistics at run time.

# Ethernet Interface Configuration

This section contains information about the configuration of **I/O Tags** and **Properties** of an **Ethernet** Interface.

## I/O Tags

### Tags of an Ethernet Interface (N2/B2 = 4)

The Tags described next allow controlling and identifying an **Ethernet** Interface at run time and they are also valid when the **RAS** Interface is selected.

#### IMPORTANT

These Tags are available **ONLY** while a Driver is in **Online** mode.

### IO.Ethernet.IPSelect

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Reading or Writing
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	4 (four)
<b>N4 Parameter</b>	0 (zero)
<b>String Configuration</b>	IO.Ethernet.IPSelect

Indicates the active IP address. Possible values are **0**: The main IP address is selected, **1**: The first alternative or backup IP address is selected, **2**: The second alternative or backup IP address is selected, or **3**: The third alternative or backup IP address is selected.

If the **Ethernet** or **RAS** Interface is connected, this Tag indicates which one of the four configured IP addresses is in use. If the Interface is disconnected, this Tag indicates which IP address is used first on the next attempt to connect.

During the connection process, if the active IP address is not available, the I/O Interface tries to connect using the other IP address. If the connection with the alternative IP address works, it is configured as the active IP address (automatic switchover).

To force a manual switchover, write values from 0 (zero) to 3 (three) to this Tag. This forces a reconnection with the specified IP address (**0**: Main address or **1, 2, 3**: Alternative address) if a Driver is currently connected. If a Driver is disconnected, this Tag configures the active IP address for the next attempt to connect.

## IO.Ethernet.IPSwitch

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Write-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	4 (four)
<b>N4 Parameter</b>	1 (one)
<b>String Configuration</b>	IO.Ethernet.IPSwitch

Any value written to this Tag forces a manual switchover. If the main IP address is active, then the first alternative or backup IP address is activated, and so on for all alternative IP addresses and returning to the main address until a connection is established.

If a Driver is disconnected, this Tag configures the active IP address for the next attempt to connect.

## IO.Ethernet.SocketState

<b>Type of Tag</b>	I/O Tag
<b>Type of Access</b>	Read-Only
<b>N1 Parameter</b>	-1 (minus one)
<b>N2 Parameter</b>	0 (zero)
<b>N3 Parameter</b>	4 (four)
<b>N4 Parameter</b>	2 (two)
<b>String Configuration</b>	IO.Ethernet.SocketState

The Value property of this Tag corresponds to socket states as a map of bits:

- **Bit 0:** 0 (zero, not listening) or 1 (one, listening)
- **Bit 1:** 0 (zero, disconnected) or 1 (one, connected)

## Properties

These properties control the configuration of an **Ethernet** Interface.

### NOTE

The **Ethernet** Interface is also used by the **RAS** Interface.

## IO.Ethernet.AcceptConnection

Configure to False if a Driver must not accept external connections, that is, if a Driver behaves as a master, or configure to True to enable the reception of connections, that is, if a Driver behaves as a slave.

## IO.Ethernet.BackupEnable[2,3]

■ Configure to True to enable an alternative or backup IP address. If the reconnection attempt with the main IP address fails, a Driver tries to use an alternative IP address. Configure to False to disable its usage.

## IO.Ethernet.BackupIP[2,3]

▲ Alternative or backup IP address of a remote device. Users can use a numerical address, as well as a device's host name, such as "192.168.0.7" or "SERVER2".

## IO.Ethernet.BackupLocalPort[2,3]

9 Local port number to be used when connecting to an alternative IP address of a remote device. Used only if **IO.Ethernet.BackupLocalPortEnable** is equal to True.

## IO.Ethernet.BackupLocalPortEnable[2,3]

■ Configure to True to force the use of a specific local port when connecting to an alternative or backup IP address or configure to False to use any available local port.

## IO.Ethernet.BackupPort[2,3]

9 Port number of an alternative or backup IP address of a remote device, used with the **IO.Ethernet.BackupIP** property.

## IO.Ethernet.IPFilter

▲ List with a comma-separated IPv4 or IPv6 addresses, which defines from which addresses a Driver accepts or blocks connections. Users can use asterisks, such as "192.168.\*.\*", or intervals, such as "192.168.0.41-50", in any part of IP addresses. To block an IP address or a range of IP addresses, use the tilde ("~") character at the beginning of the address, according to the next examples:

- **192.168.0.24**: Accepts only connections from IPv4 address 192.168.0.24
- **192.168.0.41-50**: Accepts connections from IPv4 addresses in the interval between 192.168.0.41 and 192.168.0.50
- **192.168.0.\***: Accepts connections from IPv4 addresses in the interval between 192.168.0.0 and 192.168.0.255
- **fe80:3bf:877::\*\* (expands to fe80:03bf:0877:0000:0000:0000:0000:0000:\*\*\*\*)**: Accepts connections from IPv6 addresses in the interval between fe80:03bf:0877:0000:0000:0000:0000:0000 and fe80:03bf:0877:0000:0000:0000:ffff:ffff
- **192.168.0.10, 192.168.0.15, 192.168.0.20**: Accepts connections from IPv4 addresses 192.168.0.10, 192.168.0.15, and 192.168.0.20
- **~192.168.0.95, 192.168.0.\***: Accepts connections from IPv4 addresses in the interval between 192.168.0.0 and 192.168.0.255, except the IPv4 address 192.168.0.95

When a Driver receives a connection attempt, the list of filters is scanned sequentially from left to right, searching for a specific authorization or block for the IP address where the connection comes from. If no element on the list corresponds to the IP address, the authorization or block are dictated by the last element of that list:

- If the last element on the list is an authorization, such as "192.168.0.24", then all IP addresses not found on the list are blocked
- If the last element on the list is a block, such as "~192.168.0.24", then all IP addresses not found on the list are authorized

If an IP address appears on more than one filter on the list, the leftmost filter has precedence. For example, in case of "~192.168.0.95, 192.168.0.\*", the IP address 192.168.0.95 fits both rules, but the rule that wins is the leftmost one, "~192.168.0.95", and therefore this IP address is blocked.

When **IOKit** blocks a connection, it logs a message "Blocked incoming socket connection from {IP}!".

In case of UDP connections in broadcast listening mode, in which a Driver can receive packets from different IP addresses, blocks or permissions are performed at each packet received. If a packet is received from a blocked IP address, it logs a message "Blocked incoming packet from {IP} (discarding {N} bytes)!".

## IO.Ethernet.ListenIP

**A** IP address of the local network interface that a Driver uses to establish and accept connections. Leave this property empty to establish and accepts connections using any local network interface.

## IO.Ethernet.ListenPort

**9** Number of the IP port used by a Driver to listen to connections.

## IO.Ethernet.MainIP

**A** IP address of a remote device. Users can use a numerical address, as well as a device's host name, such as "192.168.0.7" or "SERVER2".

## IO.Ethernet.MainLocalPort

**9** Local port number to use when connecting to the main IP address of a remote device. This value is only used if the **IO.Ethernet.MainLocalPortEnable** property is equal to True.

## IO.Ethernet.MainLocalPortEnable

**☑** Configure to True to force the use of a specific local port when connecting to the main IP address of a remote device or configure to False to use any available local port.

## IO.Ethernet.MainPort

**9** Number of the IP port of a remote device, used with the **IO.Ethernet.MainIP** property.

## IO.Ethernet.PingEnable

**☑** Configure to True to enable sending a **ping** command to the IP address of a remote device, before trying to connect to the socket. This socket's connection time-out cannot be controlled, therefore sending a **ping** command before connecting is a fast way to detect if the connection is going to fail. Configure to False to disable a **ping** command.

## IO.Ethernet.PingTimeoutMs

**9** Delay time to wait for a response from a **ping** command, in milliseconds.

## IO.Ethernet.PingTries

**9** Maximum number of attempts of a **ping** command. Minimum value is 1 (one), including the first **ping** command.

## IO.Ethernet.ShareListenPort

☑ Configure to True to share a listening port with other Drivers and processes or False to open a listening port in exclusive mode. To successfully share a listening port, all Drivers and processes that use that port must open it in shared mode. When a listening port is shared, each incoming connection is distributed to one of the processes listening. This way, if a Slave Driver only supports one connection at a time, users can use several instances of this Driver listening on the same port, therefore simulating a Driver with support for multiple connections.

## IO.Ethernet.SupressEcho

☑ Configure to True to eliminate echoes in communication. An echo is the unwanted reception of an exact copy of all data packets a Driver sent to a device.

## IO.Ethernet.Transport

⚠ Defines a transport protocol. Possible values are **T or TCP**: Uses the TCP/IP protocol or **U or UDP**: Uses the UDP/IP protocol.

## IO.Ethernet.UseIPv6

☑ Configure to True to use IPv6 addresses on all Ethernet connections or configure to False to use IPv4 addresses (default).

# Driver Revision History

VERSION	DATE	AUTHOR	COMMENTS
2.0.5	09/02/2025	M. Ludwig	<ul style="list-style-type: none"> <li>Driver updated to <b>IOKit</b> library version <b>3.0</b> and Visual Studio 2022 (Case 37949).</li> </ul>
2.0.4	12/23/2021	C. Mello	<ul style="list-style-type: none"> <li>Adjustments to confirm user-defined parameters in this Driver's configuration window (Case 31638).</li> </ul>
2.0.3	09/24/2021	C. Mello	<ul style="list-style-type: none"> <li>Adjustments in handling data in <b>String</b> format (Case 31404).</li> <li>Adjustments in the processing of services for individual values (Case 31243).</li> </ul>
2.0.2	05/03/2021	C. Mello	<ul style="list-style-type: none"> <li>Adjustments in the routine for writing data in <b>Boolean</b> format (Case 30814).</li> </ul>
2.0.1	03/05/2021	C. Mello	<ul style="list-style-type: none"> <li>Added options for trying to retrieve responses not received due to time-out (Case 30090).</li> </ul>
1.0.18	10/03/2017	A. Hertzog	<ul style="list-style-type: none"> <li>Implemented an editor for user-defined structures (Case 22547).</li> </ul>

VERSION	DATE	AUTHOR	COMMENTS
			<ul style="list-style-type: none"><li>Improved communication of Tags in <b>Advise</b> mode when using native I/O protocols with many data and added a configuration for this type of communication (<i>Case 22811</i>).</li></ul>
<b>1.0.2</b>	05/17/2017	A. Hertzog	<ul style="list-style-type: none"><li>Initial version of this Driver.</li></ul>

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Gartner, Cool Vendors in Brazil 2014, April 2014.

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