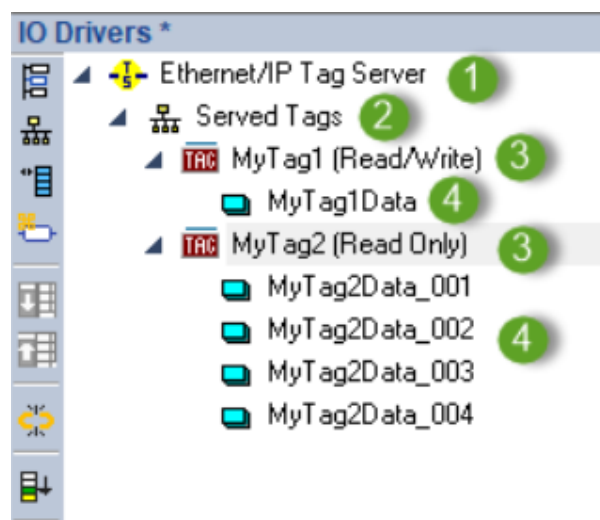# Ethernet/IP Tag Client

The **Ethernet/IP Tag Client** allows you to read and write data with in Allen-Bradley^{TM} Logix controllers. The data must be contained in Controller Tags of global scope. Program (local) Tags cannot be accessed using this interface.

The **Ethernet/IP Tag Client** uses the CIP Data Table Read and CIP Data Table Write services. The Tag Client also implements the CIP Multiple Service Packet service, which improves performance by can embedding multiple Read Tag or Write Tag requests into one CIP message. In order to successfully configure the Tag Client, you must be knowledgeable of Allen-Bradley^{TM} Logix data access facilities and the tags contained in the specific controller you wish to access.

The Ethernet/IP Tag Client is configured in the Fieldbus editing window. To open this window, click on the `Open Fieldbus` 🖧 button on the Main Toolbar.

The Ethernet/IP Tag Client configuration objects are presented in a tree structure as illustrated below.

1. **Ethernet/IP Tag Client** This configuration object represents the protocol operation. If the Ethernet/IP Tag Client protocol does not appear in the Fieldbus window, you can add it by clicking on the `Insert Configuration` toolbar button 🖹 and selecting the protocol from the dialog box that is displayed.

2. **Server:** This object specifies a connection to a device that can service requests to read or write tags, such as an Allen-Bradley^{TM} Logix controller.

3. **Tag Request:** This configuration object specifies the properties of a Tag Read or Tag Write request that will be transmitted to the device.

4. **Variables:** These objects specify the variables assigned to the data elements of the Tag.

Inserting the EIP Tag Client

To add the configuration to the IO Drivers pane, click on the `Insert Configuration` icon 🖹, which will open the **Add Configuration** dialog box. Click on the `CTI 2500P-ACP1`or `CTI Janus Controllers` item, depending on the CTI product your application is going to run on, then select the `Ethernet/IP Tag Client`configuration, and click on the `OK` button.

Configuring a Connection to a Tag Server (usually an RSLogix^{TM} Controller)

To specify a connection to a Tag Server, select the **Ethernet/IP Tag Client** object and click on `Insert Master Port` button 🖧 on the local toolbar.

This action displays the dialog box shown below.
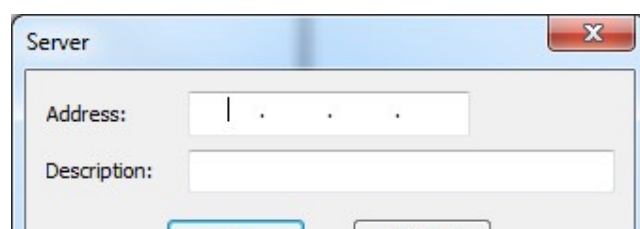
Address: Enter the IP Address of the Tag Server (usually A-B Logix controller)

Description: A short description, such as the device name/type, may be entered in this open text field.
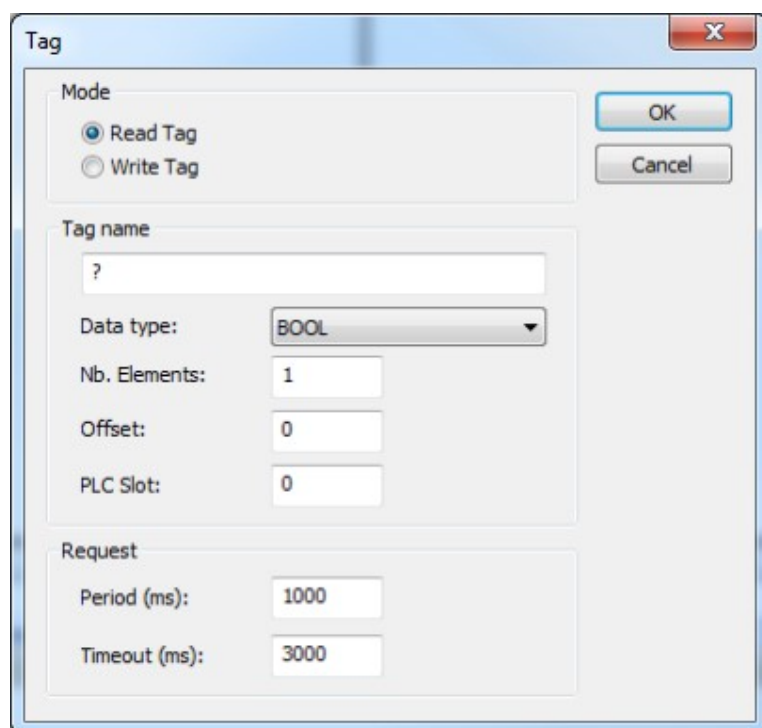
Configuring a Tag Request

The configuration of a Tag Request consists of specifying the Server Tag information, mapping of application variable(s) to the data transferred to/from the Tag Server, and (optionally) mapping of diagnostic and /control data to application variables.

The CTI Tag Client provides several methods for configuring a Tag Request as shown below.

- One method allows the Tag Request configuration and variable mapping operations to be done separately. It is typically used when individual application variables (as opposed to elements of a single array variable) are mapped to the Server Tag data. *This method does not allow mapping of arrays*. It is explained in the following sections two sections.

- A second method, which applies only to mapping array variables, allows the Tag Request configuration, variable declaration and variable mapping to be performed in a single operation. It creates a new array variable and automatically maps the tag data to array elements. This method is explained in the Add Array Tag section.

- An alternative method, which is required when mapping existing array variables, allows you to map variables by dragging and dropping, after you have configured a tag request. This method is described in the Mapping Variables by Dragging and Dropping section..

Tag Request Data Block

To create a Tag Request data block, select the corresponding Tag Server connection object and click on the *Insert Slave/ Data Block* button on the local toolbar. This action will display the dialog box shown below.

Mode: Select the request mode (Read Tag or Write Tag)

Tag Name: Enter the name of the Controller (Server) Tag to be read or written. *The Tag name entered must exactly match the Tag name in the Server device*.

Data Type: Select the Tag data type from the drop-down menu. The available data types match those supported by AB Logix controllers. *The data type must exactly match the data type in the Server device*.

Nb. Elements: An RSLogix^{TM} tag used for data exchange is usually structured as a single dimension array of a given data type. Enter the number of Tag elements you wish to read or write. You can access any number of Controller Tag elements (at least one) up to the number of elements in the array. *If 'Number of Elements' results in a request to read non-existing element(s) in the Server Tag, an error response will be returned*.

Note

If the RSLogix tag data type is BOOL, the 'Number of Elements' must be 1 (to indicate a single BOOL variable). RS Logix controllers store Boolean arrays as bits packed into a 32-bit DWORD. Boolean arrays can be accessed by choosing DWORD as the data type and 'Number of Elements' as a multiple of 32 (i.e. 32,64, 96, etc.).

> ⚠ **Attention**
>
> *The maximum number of elements depends on the data type of the tag and the CTI product. For the CTI Janus controller and CTI JACP module, the maximum number of bytes that can be read or written for a tag is 2000 bytes. For tags with 32-bit data types (DINT or REAL), which require 4 bytes per element, this allows a tag with of 500 elements to be read or written. For the 2500P-ACP1, the maximum number of bytes is 500 bytes.*

Offset: Byte offset to the first element.

PLC Slot: This item specifies the location of the Ethernet port on the RSLogix controller. When accessing the PLC via a communications adapter module, the slot location where the communications adapter is located should be entered. This information is used to route the request between the communications module and the controller via the backplane. When accessing the PLC via a local Ethernet port on the CPU, set this value to '0'.
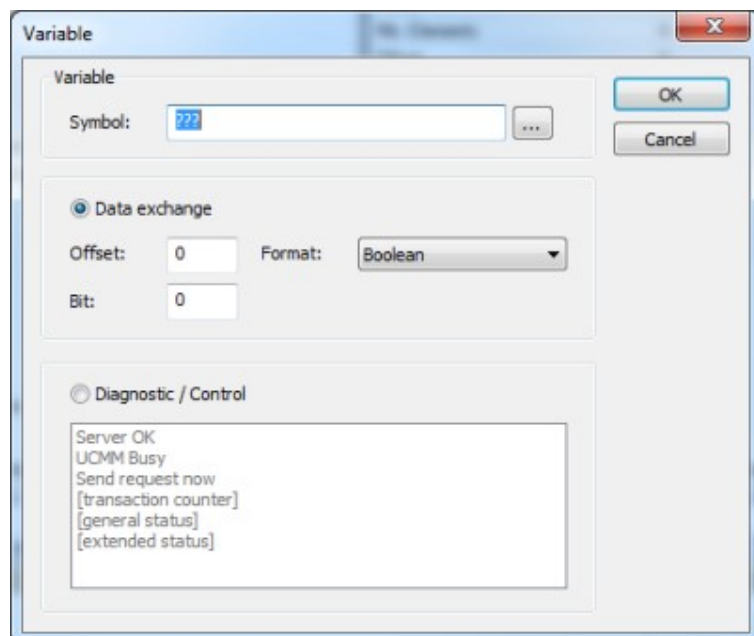
Request Period: Enter the time interval (in milliseconds) between successive requests. A value of 0 indicates that the request will be initiated using program logic using the `Send Request Now` trigger described in the Diagnostic/Control Variables section below.

Timeout: Enter the time interval (in milliseconds) to wait for a response from the Tag Server before declaring a timeout error.

NOTE: If the RSLogix tag data type is BOOL, the 'Number of Elements' must be 1 (to indicate a single BOOL variable). RS Logix controllers store Boolean arrays as bits packed into a 32-bit DWORD. Boolean arrays can be accessed by choosing DWORD as the data type and 'Number of Elements' as a multiple of 32 (i.e. 32,64, 96, etc.).

Mapping Variables to Server Tag Data

To map an application variable to the Server Tag data block, select the **Tag Request** object and click on the `Insert Variable` button [icon] on the local toolbar. The following dialog box is displayed. This operation may be repeated as necessary to map the entire data block.

Data Exchange

Select this option to map an application variable to Sever Tag data position(s). When selected, you can specify the following:

Symbol: This specifies the name of the variable to be mapped to one or more data elements that comprise data field sent to (or received from) the Controller Tag specified above. You can create a new variable by entering an unused variable name or select an existing application variable using the browse button. **Note: Only single dimension variables can be mapped using this method.** To create and map new array variables, use an Array Tag.

Offset: This specifies the starting **Byte** offset within the data field. The first byte in the data block is Offset 0. This value represents the offset position within the Tag array- not the array element number.

For example, the first element of an "Integer" Controller Tag array occupies offset positions 0-1. The second "Integer" element is stored in offset positions 2-3. Therefore, the first element can be ignored by entering "2" as the Offset value. Offsets for all elements can be automatically calculated via the Renumber Offsets facility described later in this document.

Format: Select the data format used to map the designated positions in the I/O block data to the variable from the drop-down list: ***Boolean***, ***Bit***, ***8-bit Signed (SINT)***, ***16-bit Signed (INT)***, ***32-bit Signed (DINT)***, ***16-bit Unsigned (UINT)***, ***32-bit Unsigned (UDINT)***, ***32-bit Float (REAL)***, or ***64-bit Float (LREAL***).

For instance, a segment of T->O I/O data of type DINT can be mapped to a REAL variable type by specifying the Offset position, Format of '32 bit – signed', and IEC variable of type REAL. The driver then automatically handles the data conversion from DINT to REAL before updating the variable value.

When ***Bit*** is selected, you must specify the ***Offset*** byte and ***Bit*** number to map to the variable. In this case, that bit position is associated with an application variable such as a Boolean or Integer. All other data formats require that only the ***Offset*** byte be specified.

Diagnostic/Control Variables

Select this button to map connection status or diagnostic data to an application variable. Each desired function must be mapped to a separate variable. The following table lists the status data and control functions associated with the Ethernet/IP Tag Client.

This selection is optional and in addition to mapping of data variables. However, it is highly recommended as a means to monitoring, debugging, and tracking the operational status of the Ethernet/IP connection between the Tag Client and Server device.

Information	Description
Server OK	This is a Boolean value that reports the state of the TCP connection to the server. It is TRUE when the connection is OK.
UCMM Busy	This is a Boolean value that indicates the availability of the UCMM (UnConnected Message Manager) service. The UCMM services Explicit messages that have no CIP connection. The Tag Client uses Unconnected Explicit Messages for CIP Tag Read and Write requests. A value of TRUE indicates the UCMM is busy and unable to complete the request. If this should occur, the request should be retried.
Send Request Now	This control is used to initiate a CIP Tag Read or Write request when the Request Period field in the Tag Request dialog box is set to 0 . The request is initiated when the Boolean variable that is mapped to it transitions from FALSE to TRUE. This transition is treated as a "one-shot" and triggers a single request.
Transaction Counter	This counter is incremented each time a Tag Request message is generated by the application.
General Status	After a request completes successfully, a value of 0 will be written to the **General Status** variable. When an error is detected, an error code is written to the **General Status** variable, See CIP Error Status Codes section for a list of error codes.
Extended Status	Some errors also return an associated **Extended Status Error** code to provide more detailed reporting. See CIP Error Status Codes section for a list of error codes.

NOTE: *CTI strongly recommends that variables be mapped to the 'General Status' and 'Extended Status' attributes of every Tag request. This is the ONLY method available for determining the cause of errors that might occur.* The **Server OK** and **UCMM Busy** attributes are global and need to be mapped only once per Server and these variables may be mapped into any Tag Request for the Server. The **Transaction Counter** is useful for confirming that Tag Requests are occurring as expected. The **Send Request Now** attribute is needed only if you are using logic to initiate a request.

Add Array Tag

This option can be used to create a new Global application array variable and map its elements directly to the Server Tag data block. Right click on the corresponding **Server** object and choose the `Add Array Tag` option from the drop-down menu to select this option. The following dialog box is displayed:

Mode: Select the request mode (Read Tag or Write Tag)

Tag Name: Enter the name of the Tag to be accessed. *The Tag name entered must exactly match the Tag name in the Tag Server (or Controller).*

Data Type: Select the data type from the drop down list. *This data type must exactly match the Server Tag and will also be assigned to the newly created application array variable .*

Nb. Elements: RSLogix^{TM} tags used for data exchange are often structured as single dimension arrays of a given data type. Enter the number of Tag elements you wish to read or write. You can access any number of Controller Tag elements from one up to the number of elements in the array. The starting point can be set for any element position (see Offset below). The application array variable must be sized to contain at least the number of elements specified in this field. *If 'Number Elements' results in a request to read non-existing element(s) in the Server Tag or application variable, an error response will be returned.*.

Offset The Offset parameter is not supported by the EIP Tag Client Driver.

PLC Slot: This item specifies the location of the Ethernet port on the RSLogix controller. When accessing the PLC via a communications adapter module, the slot location where the comm adapter is located should be entered. This information is used to route the request between the communications module and the controller via the backplane. When accessing the PLC via a local Ethernet port, set this value to 0.

IEC61131-3 variable: Enter the name for the new Global application array variable to be created. You cannot use the name of an existing variable with this dialog window.

Request Period: Enter the time interval (in milliseconds) between successive requests. A value of 0 indicates that the request will be initiated using program logic. You must use the `Send Request Now` trigger described in the Diagnostic/Control Variables section above to initiate the request.

Timeout: Enter the time interval (in milliseconds) to wait for a response from the Tag Server before declaring a timeout error.

NOTE: Diagnostic/Control functions can also be added to Array Tags as described in the Diagnostic/Control Variables section. Variables must be individually mapped to each desired function by selecting the corresponding function and clicking on the `Insert Variable` button 🔾 the local toolbar. Mapping Variables to Server Tag Data .

Two additional facilities are provided to assist in the Tag Client configuration:

- **Sort**: Order in which variables are displayed may be sorted by offset byte position. Select Server Tag and click on the `Sort Variables` button 🔾
- **Renumber Offsets**: This facility automatically calculates offsets based on variable data type. Right-click on Server Tag and select `Renumber offsets`.

Mapping Variables by Dragging and Dropping

The following method can be used to map existing application variables to an existing Server Tag. **It is the only available method when mapping an existing array variable to a server tag.** The following steps explain how to map an array variable.

1. Select the desired server tag and drag an array variable or group of non- array variables to the grid pane. *An array variable is shown in the illustration below.*
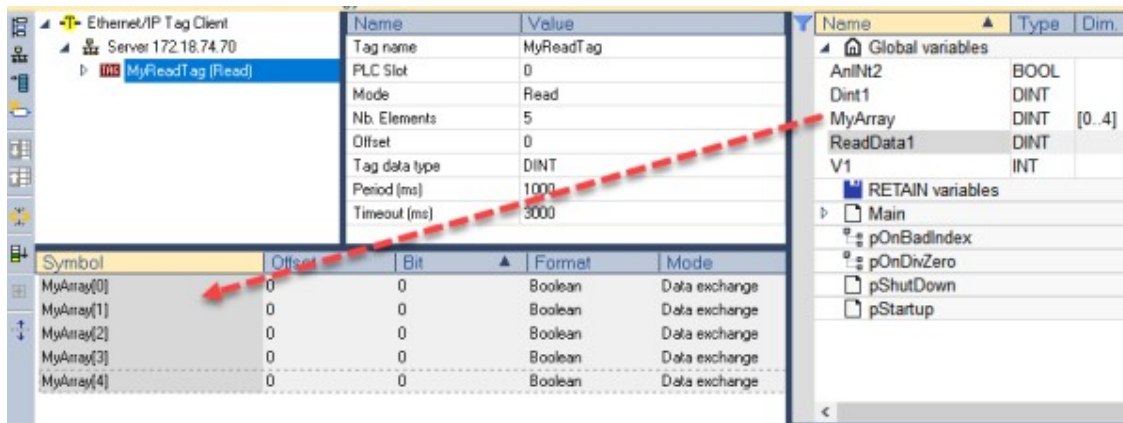
2. Select the Format grid column and press the Enter key. Select the desired format from the drop down menu.
   NOTE: An array of BOOLs cannot be used, since it is not supported by Logix PLCs.
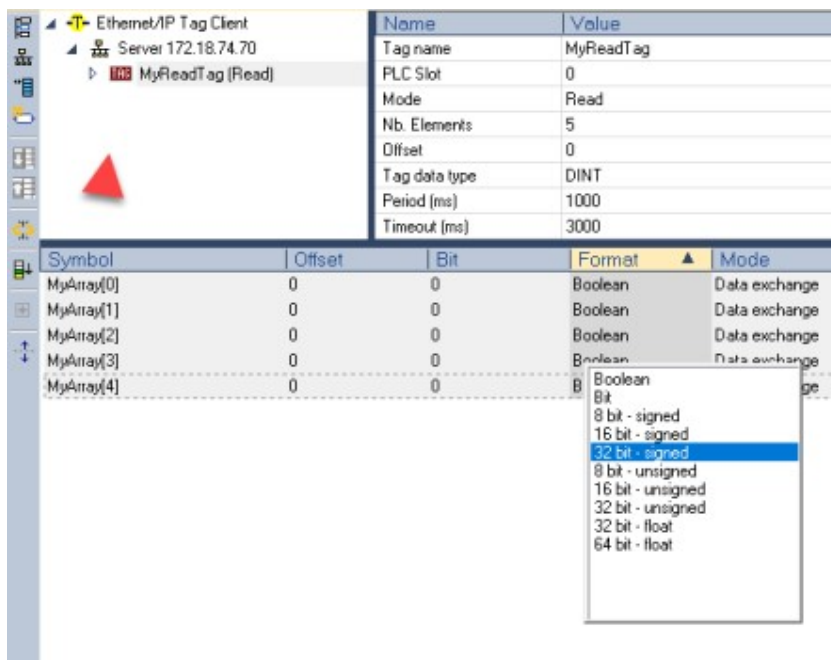
3. Right-Click on the tag object and select `Renumber Offsets` from the drop down menu to calculate the byte offsets.
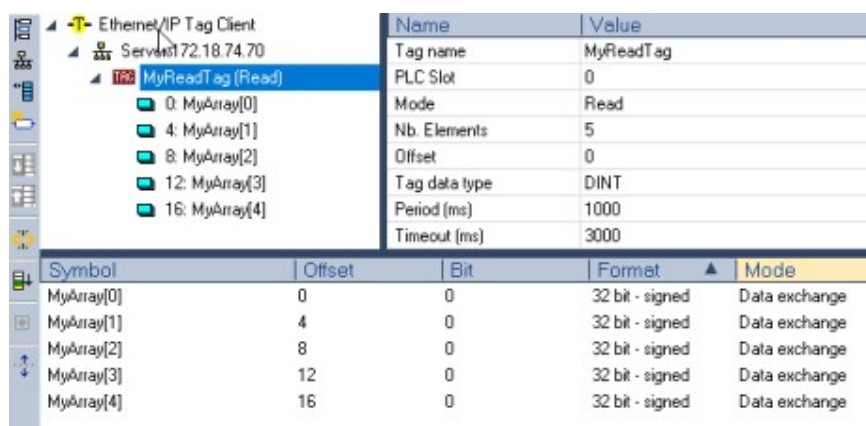
CIP Error Status Codes

The following errors may be returned by the Tag Client protocol manager. Error codes are in hexadecimal format. Decimal equivalents are shown in parenthesis.

Read Tag Status Codes

General Status	Extended Status	Description
0x00 (0)	0	Success
0x01 (1)	0x0107 (263)	Error connecting to EIP Server
0x01 (1)	0x0312 (786)	Communications Path Error. Usually indicates an invalid 'PLC Slot' value.
0x05 (5)	0x0000 (0)	Request Path Destination Unknown. This usually indicates the Tag Name does not exist or (for RSLogix controllers) is not in the controller scope.
0x06 (6)	0x0000 (0)	Response buffer length is not large enough to hold all the response data.
0x28 (40)	0x0000 (0)	The array element specified in the request exceeds the number of elements in the tag.
0x1E (30)	0x0000 (0)	Embedded Service Error. This will occur if the tag name contains too many characters.
0x1F (31)	0xFFFF (-1)	Parameter error. For example, 'Number of Elements' set to 0.
0xF0 (240)	0	Timeout set to less than 100 msec.
0xF3 (243)	0	Internal logic error. Contact CTI.

Write Tag Status Codes

General Status	Extended Status	Description
0x00 (0)	0	Success
0x01 (1)	0x0107 (263)	Error connecting to EIP Server
0x01 (1)	0x0312 (786)	Communications Path Error. Usually indicates an invalid 'PLC Slot' value.
0x05 (5)	0x0000 (0)	Request Path Destination Unknown. This usually indicates the Tag Name does not exist or (for RSLogix controllers) is not in the controller scope.
0x28 (40)	0x0000 (0)	Array element specified in the request exceeds the number of elements in the tag.
0x1E (30)	0x0000 (0)	Embedded Service Error. For example, this will occur if the tag name contains too many characters.
0x1F (31)	0xFFFF (-1)	Parameter error. For example, 'Number of Elements' set to 0.
0xF0 (240)	0x0000 (0)	Timeout set to less than 100 msec.
0xF2 (242)	0x0000 (0)	Number of bytes exceeds maximum message size. See 'Attention' comment above.
0xF3 (243)	0x0000 (0)	Internal logic error. Contact CTI.
0xFF (255)	0x2107 (8455)	Data type of tag in request does not match data type of tag in the server.

See the CIP Status Codes topic for a complete list of all General Status and Extended Status codes.

CTI Product Support

2500P-ACP1
CTI Janus Controllers
CTI JACP Module