



*EIP4CCPU EtherNet/IP Quick Start Guide
– Class 3 Explicit Messaging To and From
a Rockwell CPU*



EtherNet/IP™
conformance tested

Quick Start Guide

A graphic illustration of a person in silhouette running towards the right. A dotted line follows the path of the runner, ending in an arrow that points to a button labeled "START". A mouse cursor icon is positioned over the "START" button.

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FURTHER READING REFERENCE LIST

EIP4CCPU User's Manual (October 2012) <http://www.iccdesigns.com/eip4ccpu.html>

Explicit Messaging Function Block Manual

ATTACHMENTS

OPTION 1 (iQ CPU/EIP4CCPU to Rockwell CPU)

EIP4CCPU Scanner Configuration Explicit Message ONLY.escp – EIP4CCPU Scanner Configuration Utility File

EIP4CCPU Explicit MSG Demo.gxw – GXW2 File

EIP4CCPU_EM_Test.ACD – RSLogix 5000 File

SLC 5_05 Explicit Message From EIP4CCPU Test.RSS – RSLogix 500 File

OPTION 2 (Rockwell CPU to iQ CPU/EIP4CCPU)

EIP4CCPU Scanner Configuration Default.escp – EIP4CCPU Scanner Configuration Utility File

EIP4CCPU Explicit MSG From RW.gxw – GXW2 File

Explicit_Message_to_EIP4CCPU.ACD – RSLogix 5000 File

Manuals

EIP4CCPU User's Manual.pdf

Explicit Messaging Function Block V1.5.pdf

Chapter 1 Introduction

This Quick Start Guide (QSG) provides instructions on how to configure an iQCPU and an EIP4CCPU Master Module using EtherNet/IP to communicate to a Rockwell Logix CPU.

The objective of this QSG is to assist the users to quickly setup the GXW2 program, the EIP4CCPU configuration and Rockwell CPU program to have it send/receive commands to and from each other over EtherNet/IP using **Class 3 Explicit Messaging**. This QSG contains the necessary configuration information for the iQ CPU, the EIP4CCPU Master Module and the Rockwell CPU.



Figure 1 Q38DB Rack with an iQCPU and an EIP4CCPU Master Module Installed

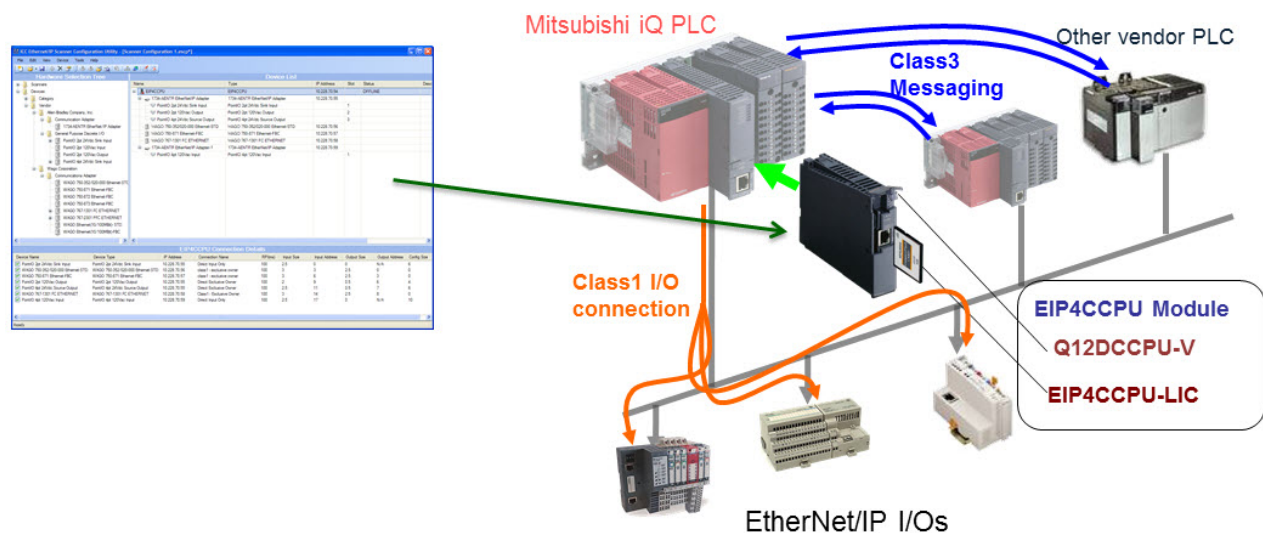


Figure 1.1 EIP4CCPU EtherNet/IP Overview

Chapter 2 System Overview

This QSG was setup using the following test system. The Mitsubishi PLC Programming software is GX Works2 V1.73B or Greater. The Rockwell PLC Programming software is RSLogix 5000 V20.01.00. The EIP4CCPU Scanner Configuration Utility software is Version 1.2.3.1 (Oct 2012) or Greater. The latest EIP4CCPU software can be downloaded from: <http://www.iccdesigns.com/downloads/software/eip4ccpu-scanner-configuration-utility.html>. The EIP4CCPU Core OS is Version 1.120 (Oct 2012) or Greater.

The iQ CPU is PLC#1 and the EIP4CCPU is PLC#2 in the Q38DB Rack. Data is shared between the two CPUs using the Multiple CPU High Speed Transmission memory areas as defined in EIP4CCPU and PLC Parameters.

The EIP4CCPU can be setup to use Client Class 1 Implicit (I/O) Messaging and Client/Server Class 3 Explicit Messaging. Up to 128 CIP connections can be used for Implicit Messaging and 16 CIP Connections can be used for Explicit Messaging. Explicit Messaging Server only sends and receives 16-bit Data Words. For further details see Chapter 8 of the EIP4CCPU User's Manual.

This QSG details the use of Class 3 Explicit Messaging ONLY. Class 1 Implicit (I/O) Messaging is detailed in a separate QSG.

The Rockwell CPU is a 1769-L32E CompactLogix 5332E Controller, Firmware Revision 20.12.

There are TWO OPTIONS for using Explicit Messaging with this configuration.

- **OPTION 1: iQ CPU/EIP4CCPU Initiating the Explicit Message and Rockwell CPU responding**
- **OPTION 2: Rockwell CPU Initiating the Explicit Message and the iQ CPU/EIP4CCPU responding**



EIP4CCPU EtherNet/IP Connection to Rockwell Logix CPU

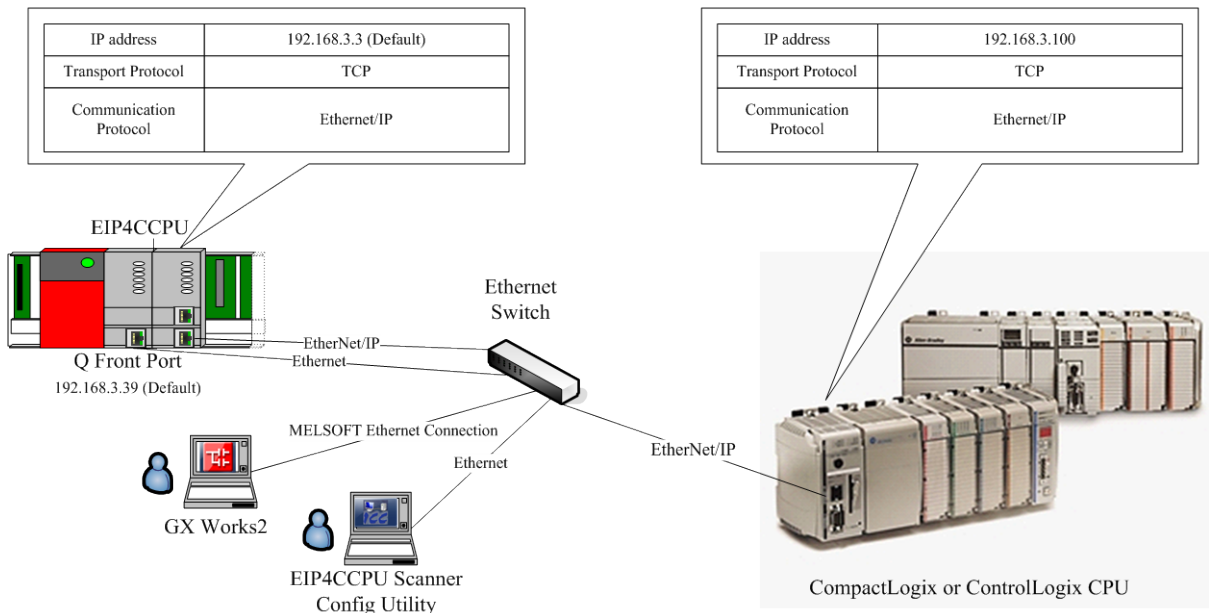


Figure 2.1 Architecture of Test System

Chapter 3 Rockwell CPU Setup Using RSLogix 5000 Software

3.1 Ethernet IP Address Setup (OPTION 1 and OPTION 2)

Under I/O Configuration, Select Module Properties of the Ethernet Port on Module in the Rack. Offline the IP Address can be setup under the General Tab, Online the IP Address can be setup under the Port Configuration Tab. Set it to 192.168.3.100 in this QSG example.

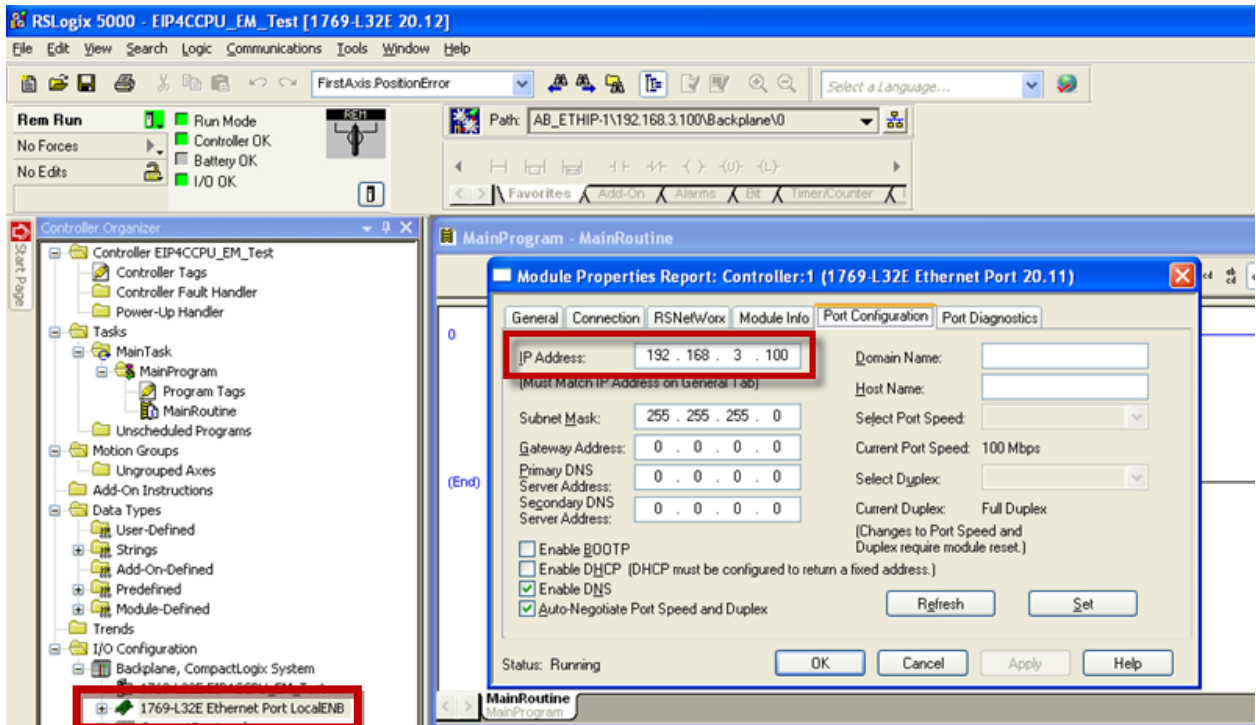


Figure 3.1 Ethernet IP Address Setup

3.2 EIP4CCPU Ethernet Device Setup (OPTION 2 ONLY)

Under I/O Configuration, right click on the Ethernet Module and Select “New Module...”

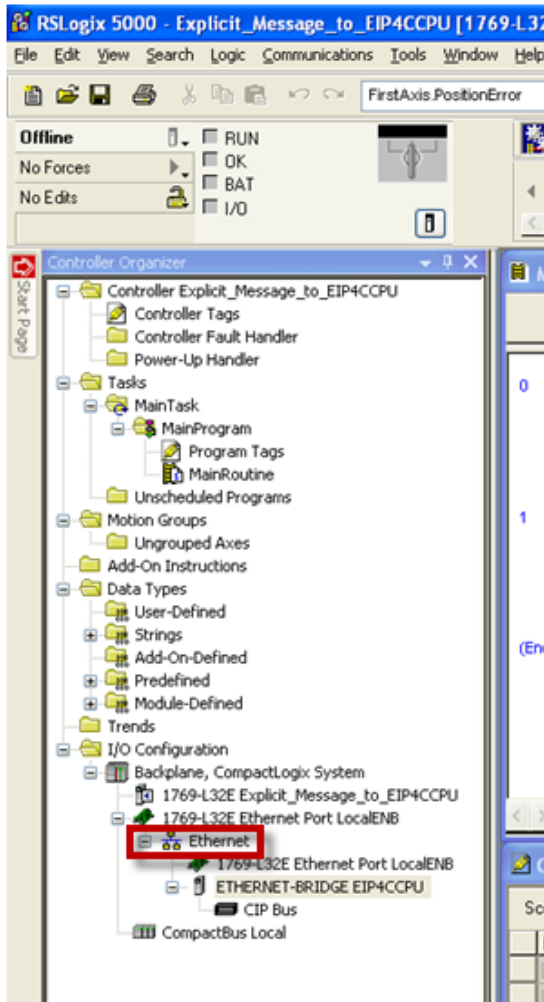


Figure 3.2 Ethernet Device – New Module Creation

Select “ETHERNET-BRIDGE” from Select Module Type, then “Create”.

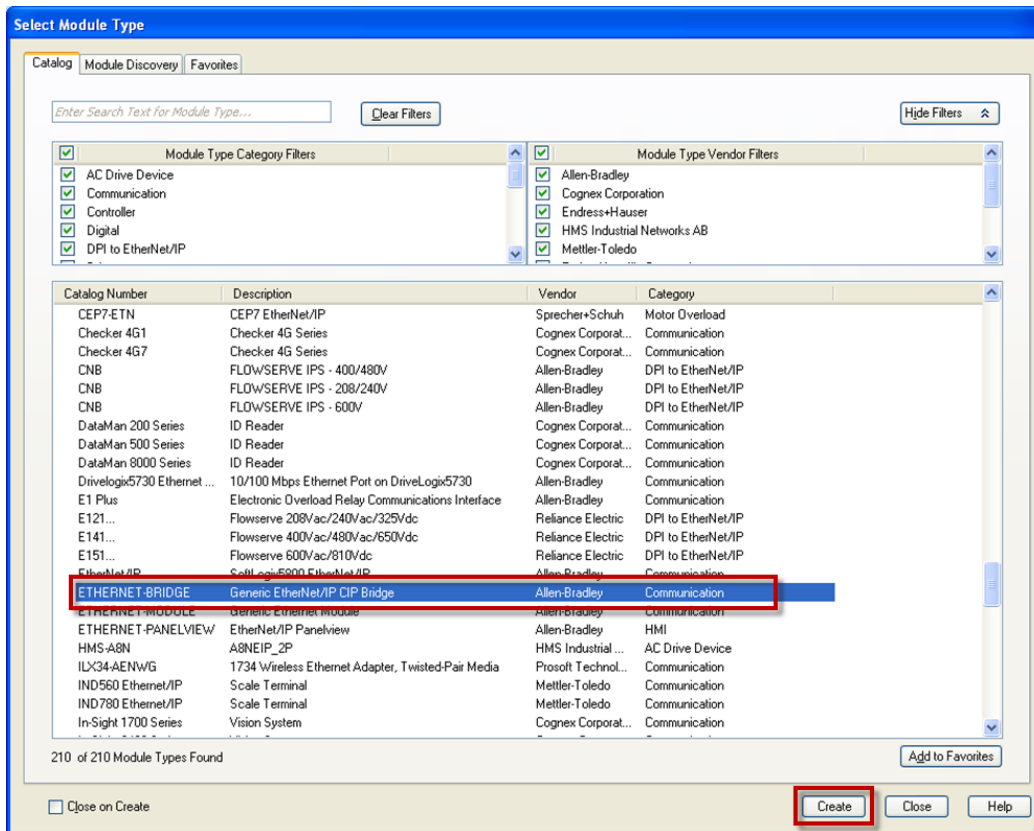


Figure 3.2.1 Select Module Type Window

Enter Name of “EIP4CCPU”, Description and IP Address of “192.168.3.3” of the EIP4CCPU Module. Select “OK” to finish Module Configuration. It will now appear under your Ethernet Module as a Device.

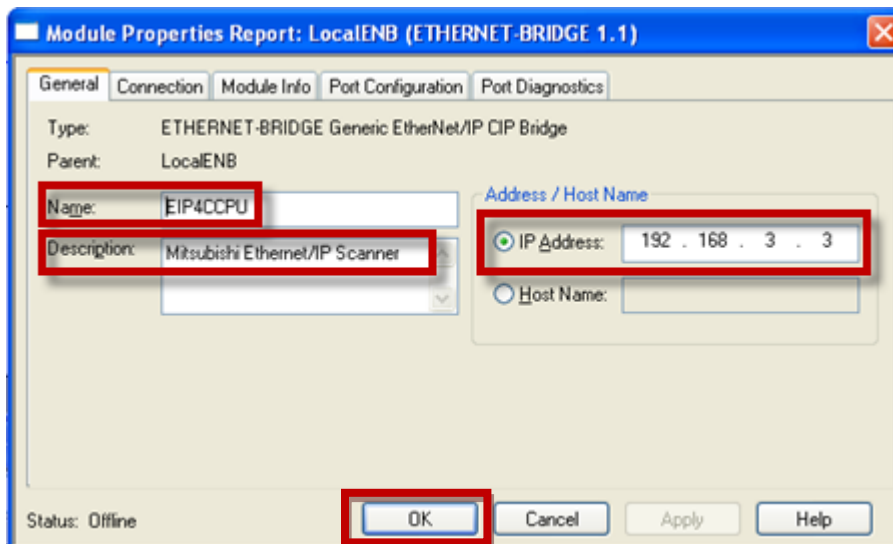


Figure 3.2.2 Module Properties Window

3.3 Read and Write Tag Creation (OPTION 1 ONLY)

The user must define at least one Read Tag and one Write Tag. The EIP4CCPU will Read Data from “TestTag” and the EIP4CCPU will Write Data to “TestTag2” in this QSG example.

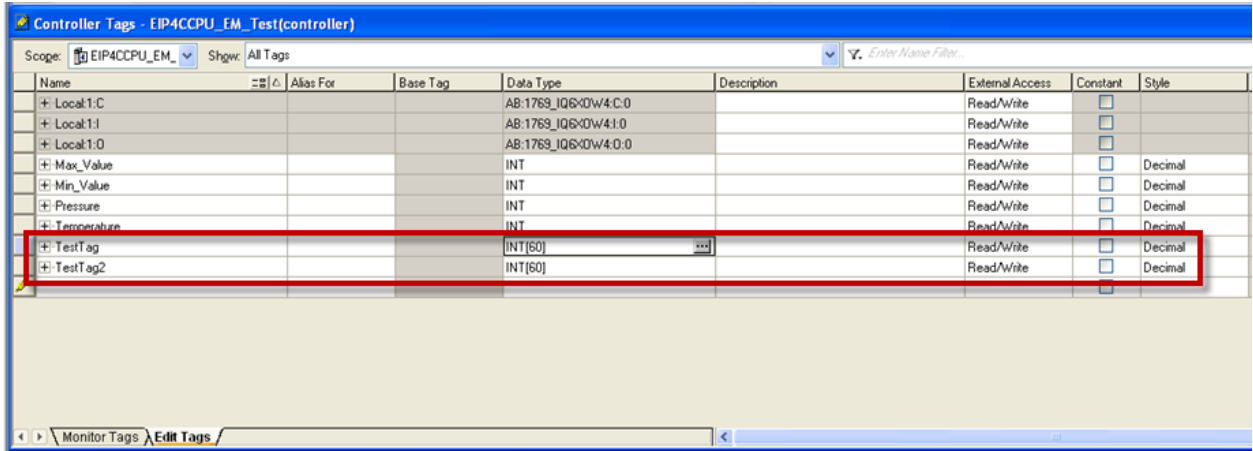


Figure 3.3 Tag Editor

The Tags need to be defined as INT Type with Array Dim 0 equal to 60 in this QSG example.

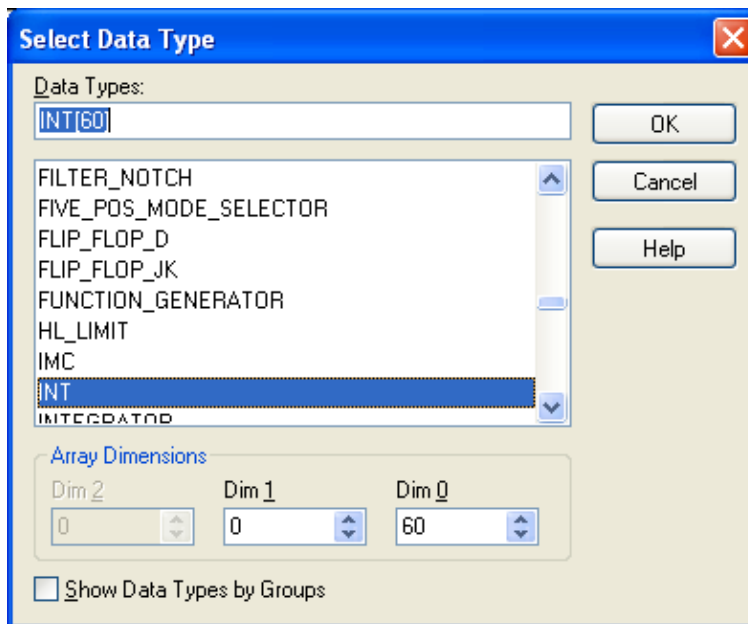


Figure 3.3.1 Tag Data Type

3.4 Message Tags and Code Creation (OPTION 2 ONLY)

The user must define at least one Read Message Tag and one Write Message Tag. These Message Tags will use the Ethernet/IP Server Function of the EIP4CCPU Module as defined in Section 9.1.3 of the manual.

9.1.3 EtherNet/IP Server

The EtherNet/IP server supports only explicit messaging. Class 3 (explicit messaging) can serve as a direct method of accessing the sequencing PLC's devices by reference to "tag names". Tags are read via the EtherNet/IP "Data Table Read" service, and tags are written via the EtherNet/IP "Data Table Write" service. Data is read and written as 16-bit values.

Figure 3.4 EtherNet/IP Server Definitions

Create Controller Tags called "EIP4CCPU_Read" and "EIP4CCPU_Write" both of Data Type "MESSAGE".

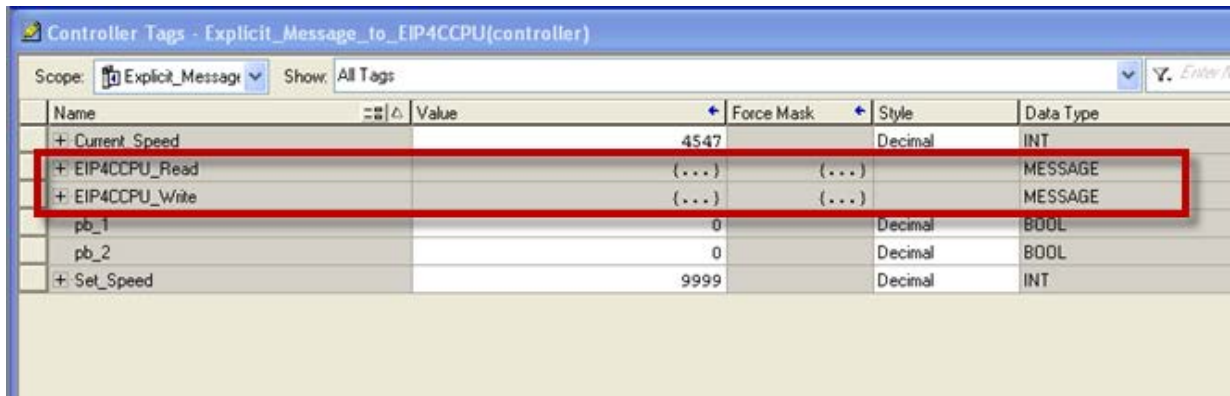


Figure 3.4.1 MESSAGE Tag Creation

Other Tags, such as "Current_Speed" and "Set_Speed" can be created to be used for the data to be Read to and Written from in the MSG Block. These Tags must be Data Type of INT (16-bit Word) ONLY.

The Data Registers in the iQ CPU will be defined in the following manner in the Message Command Block in the Rockwell PLC Code.

9.1.3.1 Device Tag Reference:

The supported device types can be accessed with their own unique tag names with one PLC instruction. Note that an underscore (" _ ") is used to separate fields in the tag names. Tag names are generated according to the following equation:

$$[\text{device type prefix}]_ [\text{address}]$$

The address is a 32-bit unsigned value. Note that the address may take the form of a decimal or hexadecimal value depending on the device type. The supported device types and address formats are listed in the following table:

Device Type	Format (d = decimal, h = hexadecimal)
Data Register	D_<d>
Special Register	SD_<d>
File Register	ZR_<d>
Link Register	W_<h>

Examples

Access data starting at Data Register 100.....D_100
 Access data starting at Link Register 1000.....W_3E8

Figure 3.4.2 iQ CPU Register References

In PLC Code create two MSG Command Blocks. One for Write and one for Read.

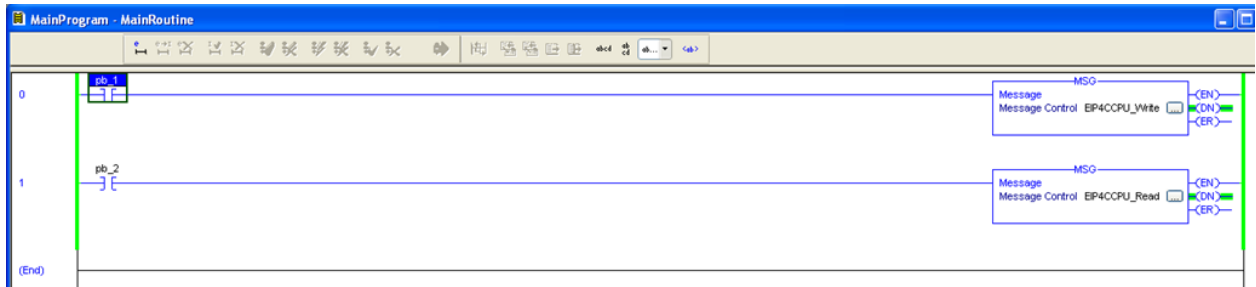


Figure 3.4.3 MSG Command Blocks

In the MSG Block, click on the “?” and from the pull down menu select one of the two Message Tags that were previously created.



Figure 3.4.4 MSG Command Block Tag Selection

Enter Name Filter...		Show: MESSAGE
Name	Data Type	Description
+ EIP4CCPU_Read	MESSAGE	
+ EIP4CCPU_Write	MESSAGE	

Figure 3.4.5 Message Tag Selection

The first MSG Block to create will be the EIP4CCPU_Write Block, therefore select the “EIP4CCPU_Write” Tag from the pull down menu.

Next Click on the “...” Box in the MSG Block to enter the Message Configuration Window.

In the Configuration Tab, for Message Type select “CIP Data Table Write”, for Source Element select “Set_Speed” Tag, for Number of Elements enter “1” and For Destination Element enter “D_100”. This is D100 in the iQ CPU that will be Written to by the Rockwell CPU.

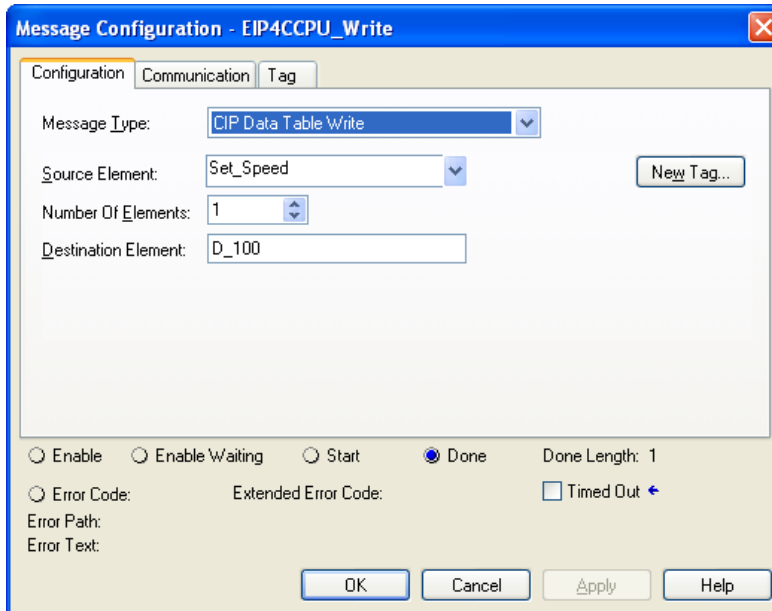


Figure 3.4.6 Message Configuration – Configuration Tab

In the Communication Tab, select “EIP4CCPU” for the Path.

Leave everything else at default.

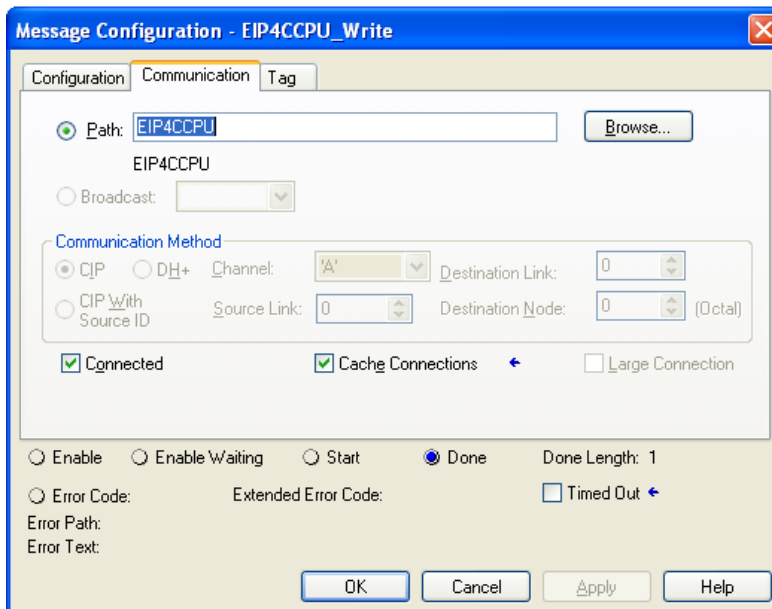


Figure 3.4.7 Message Configuration – Communication Tab

In the Tag Tab, for Name, verify that the Tag “EIP4CCPU_Write” has been selected. Leave everything else at default.

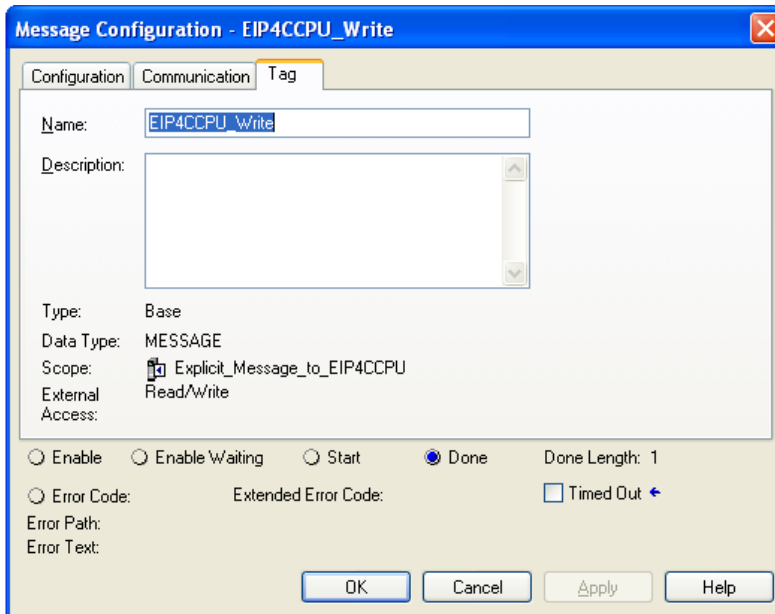


Figure 3.4.8 Message Configuration – Tag Tab

The Second MSG Block to create will be the EIP4CCPU_Read Block, therefore select the “EIP4CCPU_Read” Tag from the pull down menu.

Next Click on the “...” Box in the MSG Block to enter the Message Configuration Window.

In the Configuration Tab, for Message Type select “CIP Data Table Read”, for Source Element enter “D_300”, for Number of Elements enter “1” and For Destination Element select the “Current_Speed” Tag.

This is D300 in the iQ CPU that will be Read from by the Rockwell CPU.

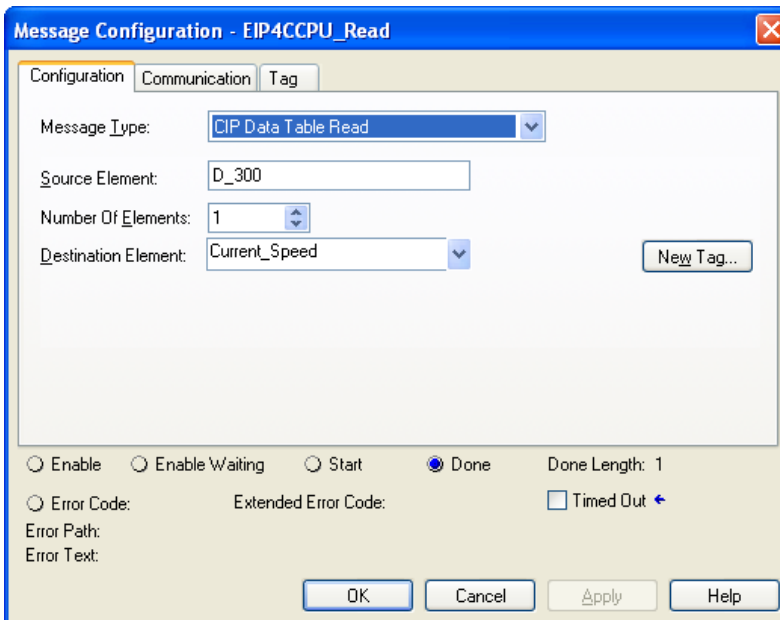


Figure 3.4.8 Message Configuration – Configuration Tab

In the Communication Tab, select “EIP4CCPU” for the Path.
Leave everything else at default.

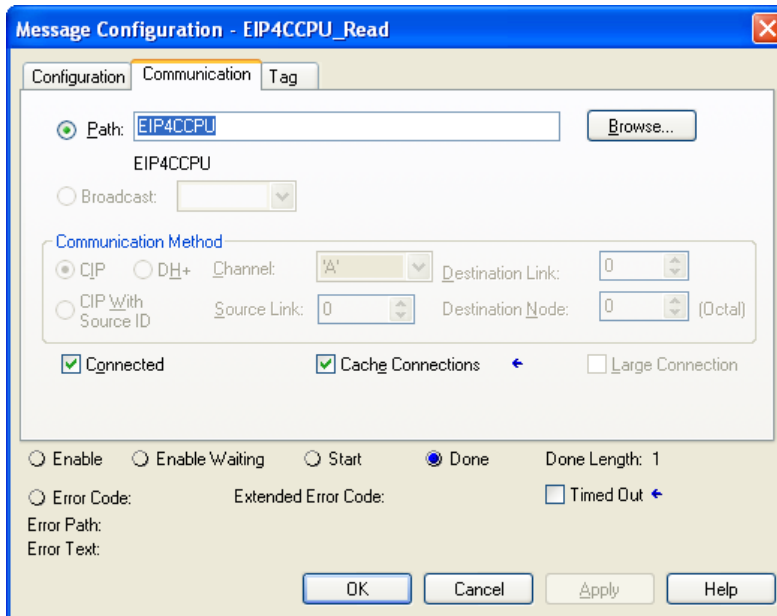


Figure 3.4.10 Message Configuration – Communication Tab

In the Tag Tab, for Name, verify that the Tag “EIP4CCPU_Read” has been selected.
Leave everything else at default.

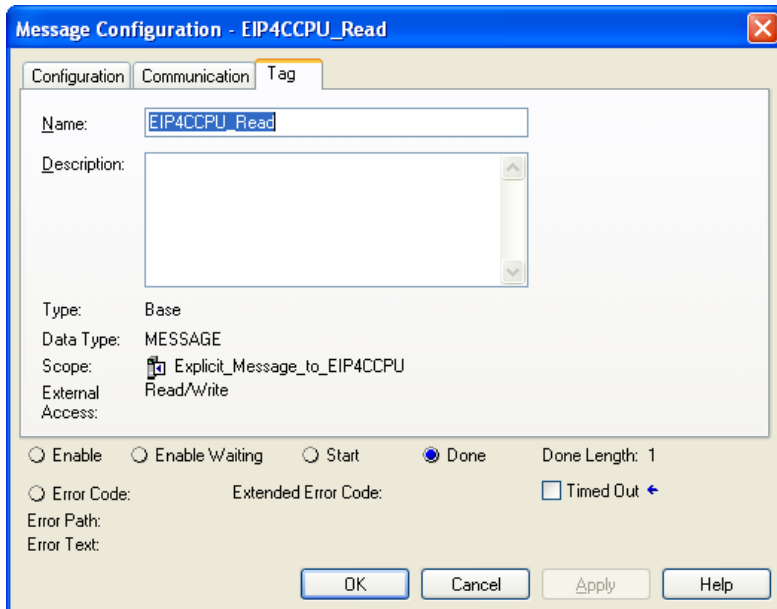


Figure 3.4.11 Message Configuration – Tag Tab

Chapter 4 EIP4CCPU Configuration

4.1 Scanner Setup and Monitoring (OPTION 1 and OPTION 2)

To setup and configure the EIP4CCPU under the Hardware Selection Tree either right click on the EIP4CCPU under Scanners and select "Add Device" or click on EIP4CCPU and drag to the Device List.

Enter Device Details as needed.

The Default IP Address is 192.168.3.3 and used in this QSG. Select OK when finished with this Window.

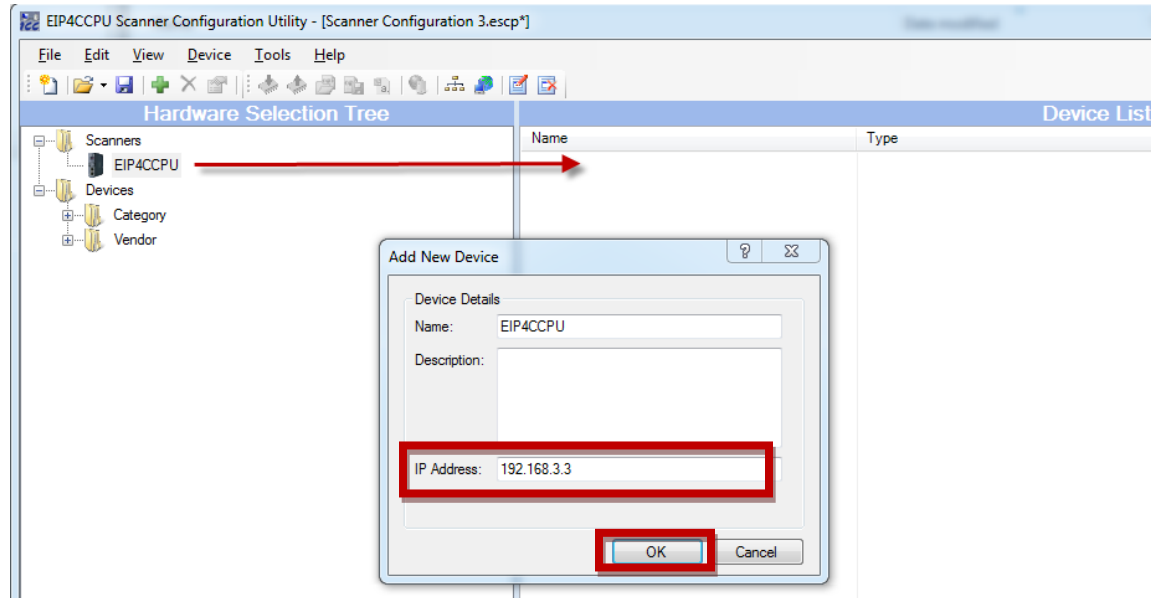


Figure 4.2 Add Scanner Device Details Window

Now the EIP4CCPU will appear under the Device List with the Name and IP Address assigned to it.

Right Click on the EIP4CCPU in the Device List and select Properties....

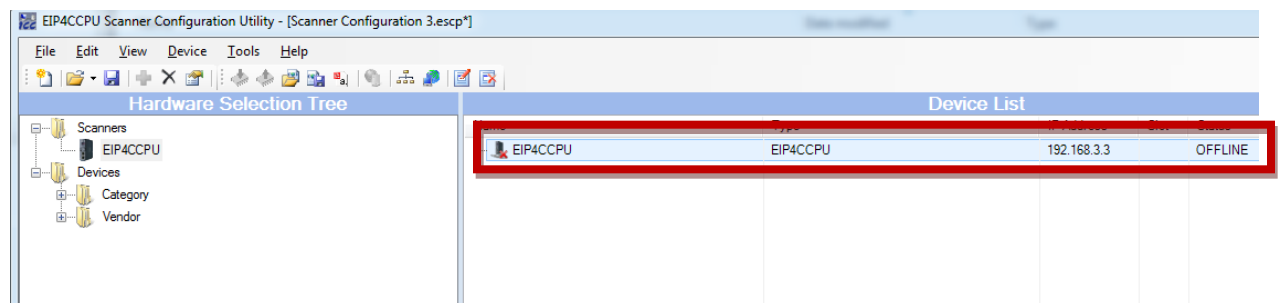


Figure 4.2.1 EIP4CCPU in Device List

The Device Properties Window has 5 Tabs (Offline), 6 Tabs (Online).

The **General Tab** is where the initial information can be changed as needed such as IP Address. All other information can be left at default.

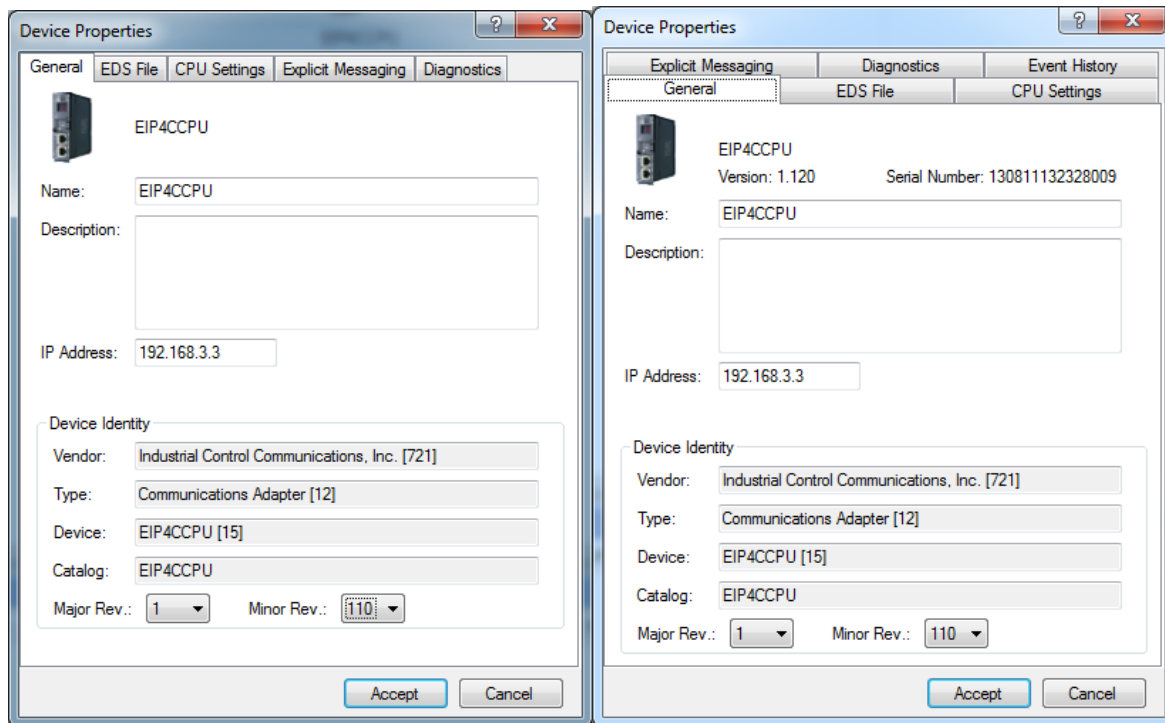


Figure 4.2.2 General Tab (Offline and Online)

The **CPU Settings Tab** is where the PLC CPU Number and Shared Memory Base Address and Size can be selected. Leave these at DEFAULT.

These settings must match the Multiple CPU Settings in GXD2 as detailed in Chapter 5.

When ONLINE with the EIP4CCPU this tab will display ONLINE Status, current Error Codes and EIP4CCPU Time Setting.

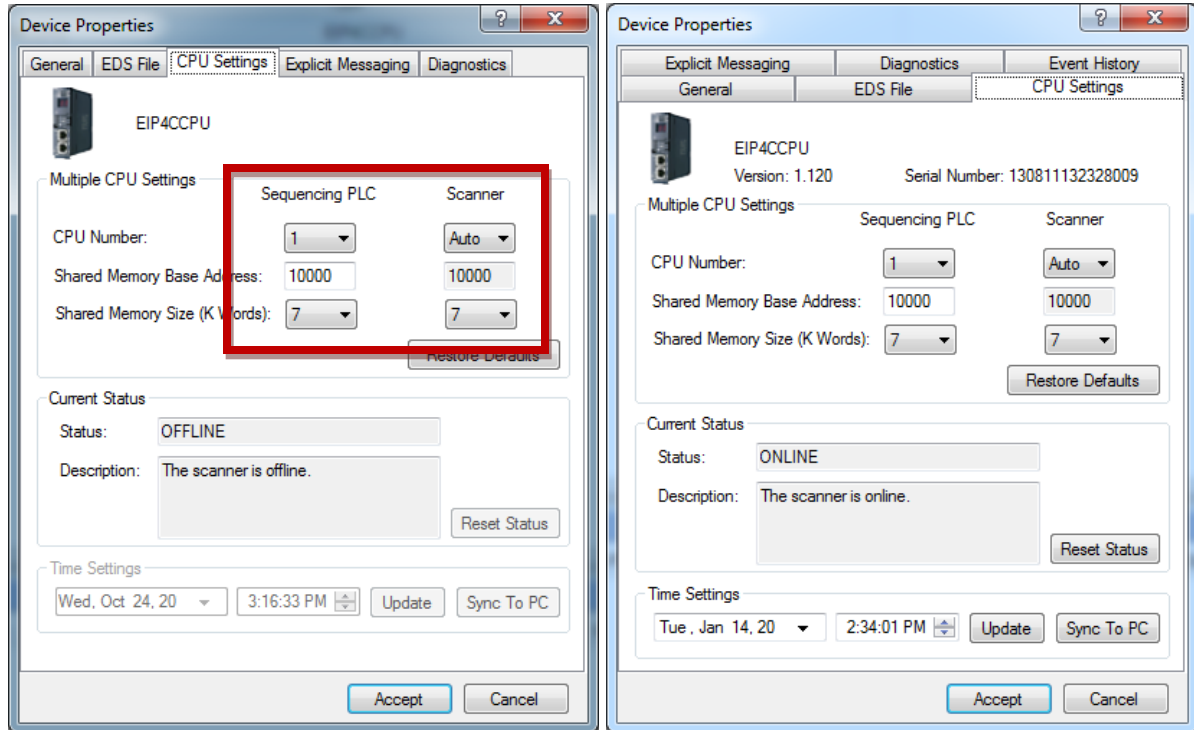


Figure 4.2.3 CPU Settings Tab (Offline and Online)

The **Diagnostics Tab** is where you need to set a PLC Data Register (D500 as an example) where all EIP4CCPU error message numbers will be stored in the PLC CPU. **When the error is cleared the PLC code then can write a zero (0) to this register to clear the LED display on the EIP4CCPU module.**

When ONLINE with the EIP4CCPU this tab will display the Core Firmware and Serial Number of the EIP4CCPU module.

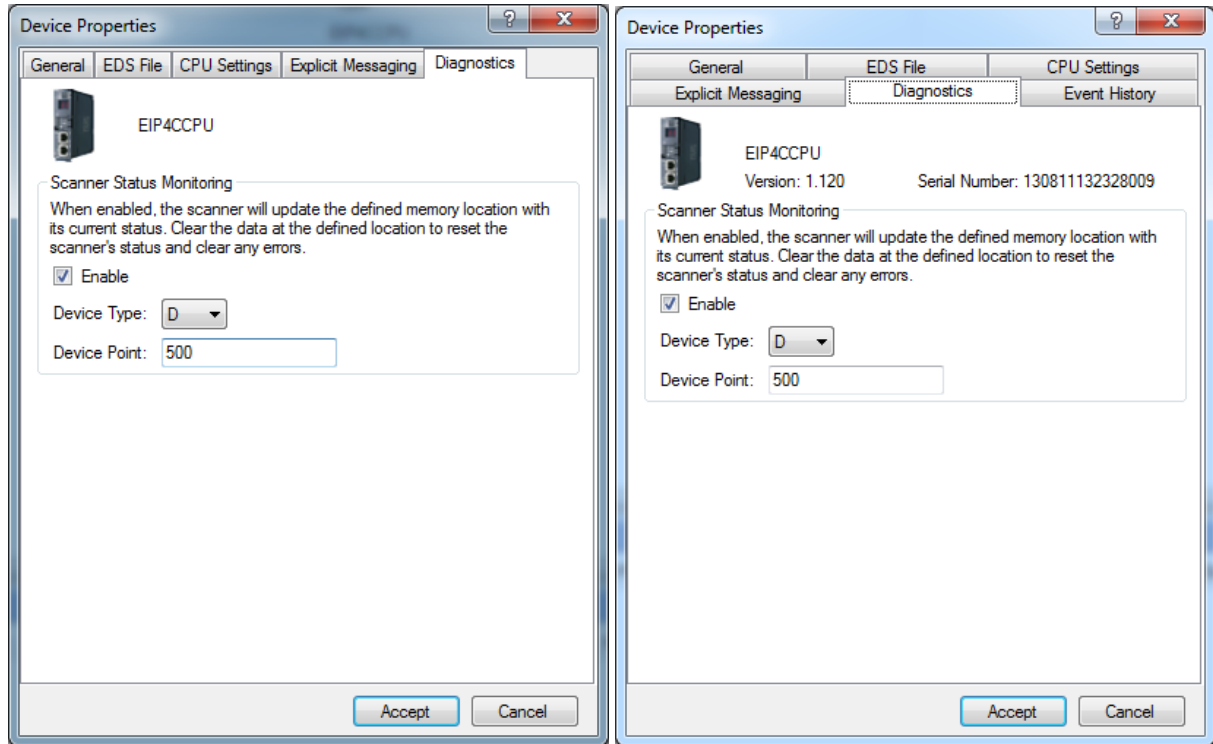


Figure 4.2.3 Diagnostics Settings Tab (Offline and Online)

The **Explicit Messaging Tab (OPTION 1 ONLY, this Step can be skipped for OPTION 2)** is where you need to set how many Instances of Explicit Messages you want to use (16 is the maximum at one time). This is where the Data Register Type, Starting Device Point and Size in Bytes are defined for this Explicit Message Instance. Explicit Message Instance “0”, Device Type and Starting point of “D0” and Size in Bytes of “128” (64 Words) are used in this QSG. Each Instance must use a different Data Register Range of 128 Bytes (64 Words) each.

When ONLINE with the EIP4CCPU this tab will display the Core Firmware and Serial Number of the EIP4CCPU module.

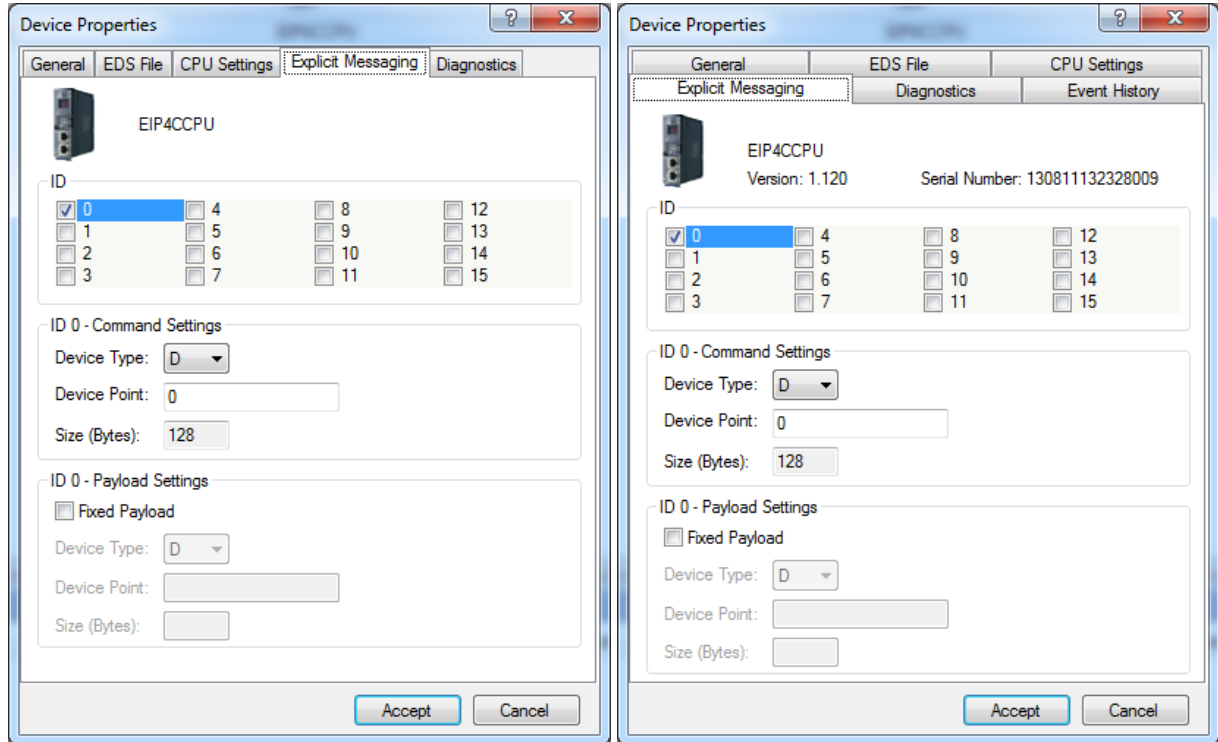


Figure 4.2.4 Explicit Messaging Tab (Offline and Online)

When ONLINE with the EIP4CCPU, the **Event History Tab** is where you can view a complete historical listing of all error messages that have occurred in the module. These error messages can be save to a file as needed.

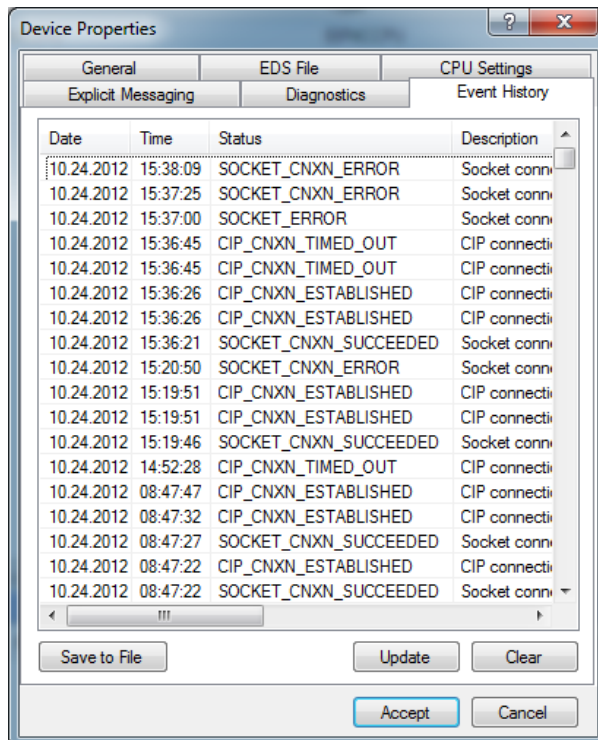


Figure 4.2.5 Event History Settings Tab (Online ONLY)

Chapter 5 iQ CPU Setup Using GXW2 Software

5.1 Multiple CPU Settings (OPTION 1 and OPTION 2)

In PLC Parameters the Multiple CPU Setting must be configured to match the EIP4CCPU Device Properties – CPU Settings Tab configuration. No. of PLC must be set to 2 and under Use Multiple CPU High Speed Transmission Settings the Data size for each CPU must be set to 7 (K). The Data size can be increased or decreased as needed. These changes must also be made in the EIP4CCPU configuration as well as shown in Section 4.1 in the CPU Settings Tab.

Q Parameter Setting

PLC Name | PLC System | PLC File | PLC RAS | Boot File | Program | SFC | Device | I/O Assignment | **Multiple CPU Setting** | Built-in Ethernet Port Setting

No. of PLC (*1)
2 Count

Host Station
No Specification

Operation Mode (*1)
Error Operation Mode at the Stop of PLC
☒ All station stop by stop error of PLC1
☒ All station stop by stop error of PLC2
☒ All station stop by stop error of PLC3
☒ All station stop by stop error of PLC4

Multiple CPU Synchronous Startup Setting(*1)
Target PLC
☒ No. 1
☒ No. 2
☒ No. 3
☒ No. 4

Online Module Change(*1)
☐ Enable Online Module Change with Another PLC.
 When the online module change is enabled with another PLC, I/O status outside the group cannot be taken.

I/O Sharing When Using Multiple CPUs (*1)
☐ All CPUs Can Read All Inputs
☐ All CPUs Can Read All Outputs

Multiple CPU High Speed Transmission Area Setting | Communication Area Setting (Refresh Setting)

☒ Use Multiple CPU High Speed Transmission

PLC	Points(K)	I/O No.	CPU Specific Send Range (*1)			Auto Refresh	
			User Setting Area			Points	Setting
PLC No.1	7	U3E0	7168	G10000	G17167	0	Refresh
PLC No.2	7	U3E1	7168	G10000	G17167	0	Refresh
PLC No.3							
PLC No.4							

Total 14K Points
Set auto refresh setting if it is needed(No Setting / Already Set)
☐ Advanced Setting(*1) Assignment Confirmation

The total number of points is up to 14K.

(*1)Setting should be set as same when using multiple CPU. Import Multiple CPU Parameter

Print Window... | Print Window Preview | Acknowledge XY Assignment | Default | Check | End | Cancel

Figure 5.1 Multiple CPU Setting Window

5.2 Explicit Message Function Block and Labels (OPTION 1 ONLY)

The Explicit Message Function Block, “ExplicitMSG”, was created to use one of the 16 Explicit Message Instances configured in the EIP4CCPU under the Explicit Message Tab. This Explicit Message Instance Label is called “ExplicitMSGChannel”. Here is one of two Function Block Examples in the QSG program. This FB Instance is for Reading from the Rockwell CPU. “ExplicitMSGChannel” Label = 0. “MSGTypeCommand” Label = H4C = Read Command. For all the details on this Function Block and Commands please reference the Explicit Messaging Function Block Manual.

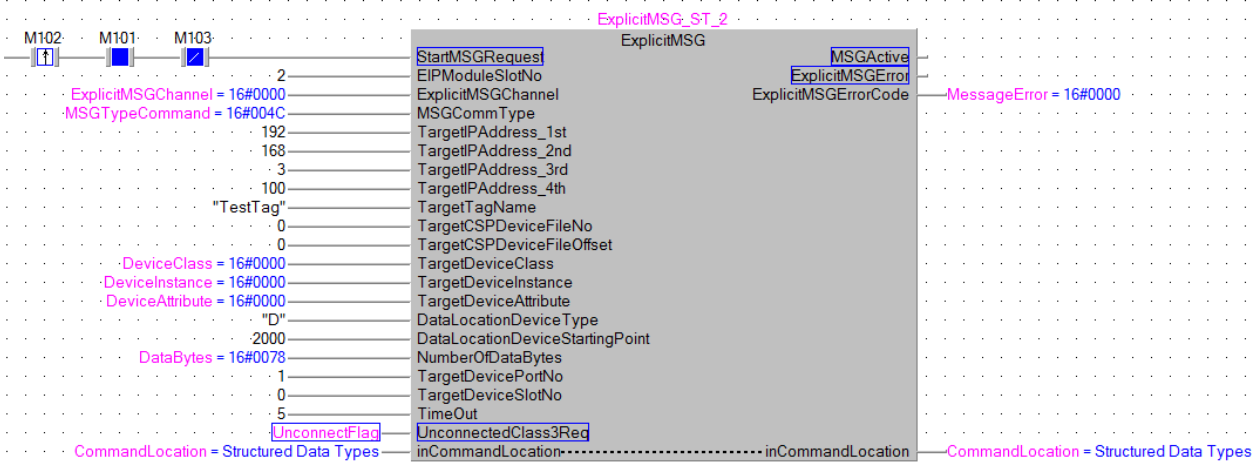


Figure 5.2 “ExplicitMSG” Function Block Example

The EIP Module Slot No. is defined as “2” (2nd Slot next to iQ CPU), the IP Address of the Rockwell CPU is defined as **192.168.3.100**, the Target Tag Name is defined as “**TestTag**”, the Type of Data Register and Starting Point of the Data Register is defined as “**D2000**” and the Target Device Port No. (Rockwell CPU Ethernet Card Slot No.) is defined as “1”. Rockwell CPUs with a Built-in Ethernet Port defaults to “1”.

The Input Labels for this example are configured in the MOV Statements.

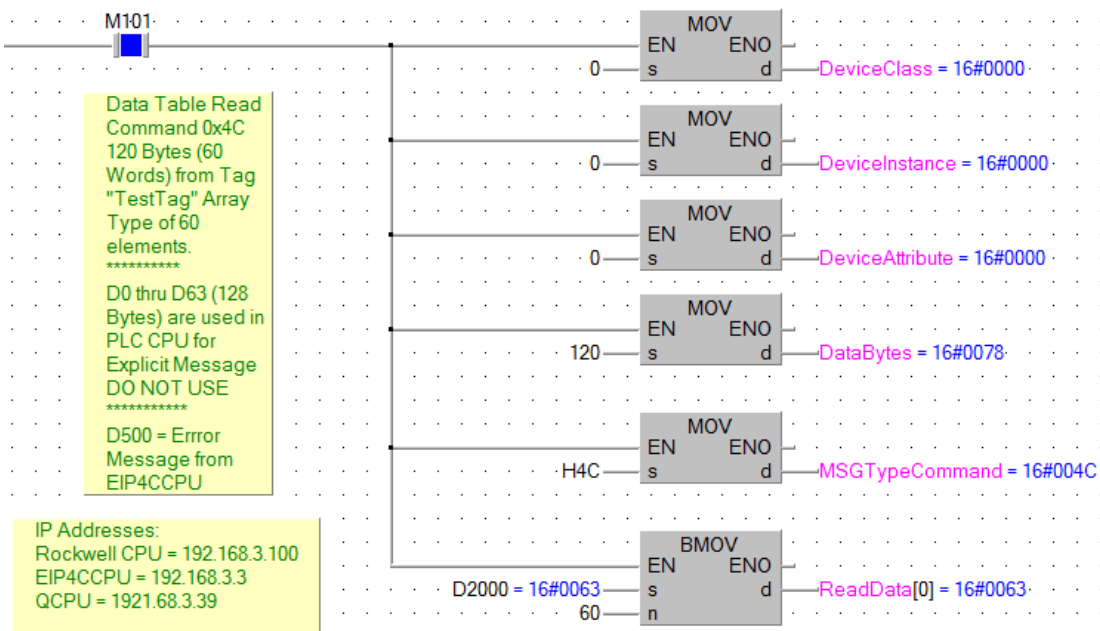


Figure 5.2.1 EtherNet/IP Labels Setup

The Device Class, Instance and Attribute for CPU to CPU Explicit Messaging are all set to zero.

Mode of Operation for this FB Instance is as follows:

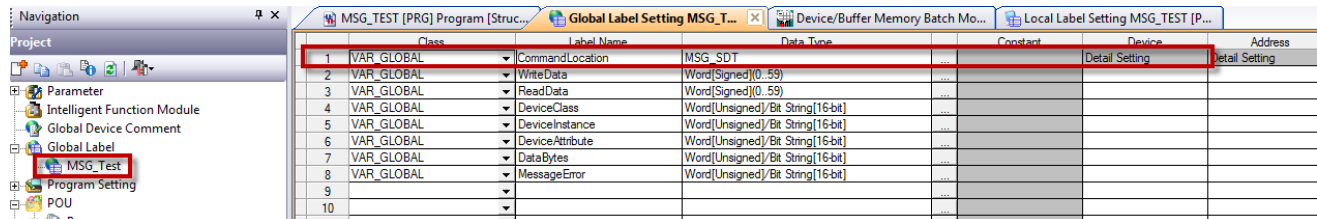
Force M101 ON. Toggle M102 from OFF to ON to execute the Read from the Rockwell CPU.

The Read Vales in D2000 thru D2063 are then MOVED to the Label “ReadData” of Array Type with 60 Elements when the Function Block has finished Reading from the Rockwell CPU.

The Second Function Block and Data is used for Writing Data for the iQ CPU to the Rockwell CPU. Reference the EIP4CCPU Explicit MSG Demo program for the details on the Write Function Block Instance.

5.3 PLC Data Register Label Mapping (OPTION 1 ONLY)

Global Labels have been created to support the Function Block. Specifically Global Label “CommandLocation” of Structured Data Type “MSG_SDT” has to be configured with the proper Starting Data Register that is configured in the EIP4CCPU under the Explicit Message Tab.

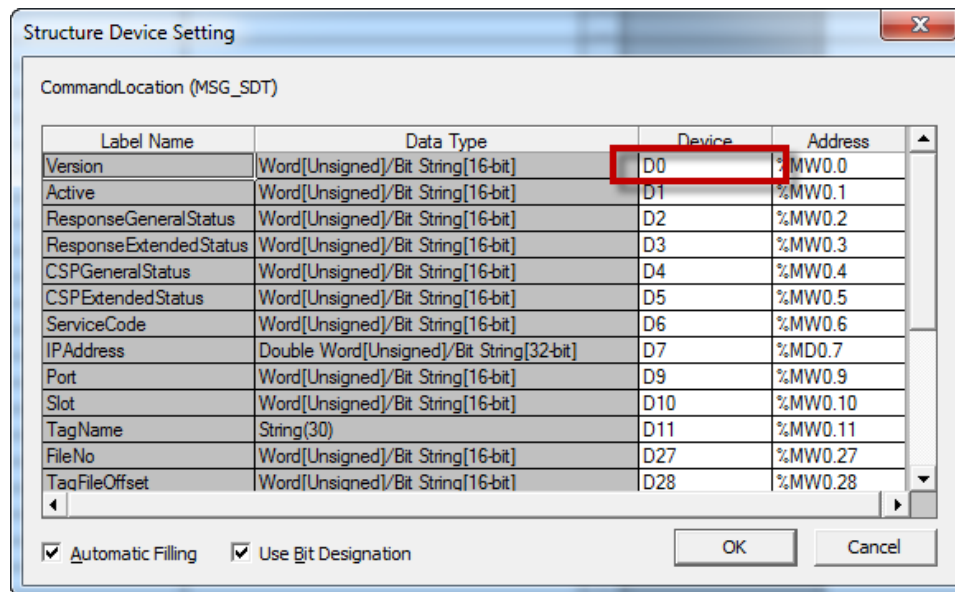


Class	Label Name	Data Type	Constant	Device	Address
VAR_GLOBAL	CommandLocation	MSG_SDT			
VAR_GLOBAL	WriteData	Word(Signed)(0..59)			
VAR_GLOBAL	ReadData	Word(Signed)(0..59)			
VAR_GLOBAL	DeviceClass	Word(Unsigned)/Bit String(16-bit)			
VAR_GLOBAL	DeviceInstance	Word(Unsigned)/Bit String(16-bit)			
VAR_GLOBAL	DeviceAttribute	Word(Unsigned)/Bit String(16-bit)			
VAR_GLOBAL	DataBytes	Word(Unsigned)/Bit String(16-bit)			
VAR_GLOBAL	MessageError	Word(Unsigned)/Bit String(16-bit)			

Figure 5.3 MST_Test Global Labels

For Explicit Message Instance 0, the Starting Data Register is defined as D0.

For the first Device of the “CommandLocation” Label, set it to “D0” to match.



Label Name	Data Type	Device	Address
Version	Word(Unsigned)/Bit String(16-bit)	D0	%MW0.0
Active	Word(Unsigned)/Bit String(16-bit)	D1	%MW0.1
ResponseGeneralStatus	Word(Unsigned)/Bit String(16-bit)	D2	%MW0.2
ResponseExtendedStatus	Word(Unsigned)/Bit String(16-bit)	D3	%MW0.3
CSPGeneralStatus	Word(Unsigned)/Bit String(16-bit)	D4	%MW0.4
CSPExtendedStatus	Word(Unsigned)/Bit String(16-bit)	D5	%MW0.5
ServiceCode	Word(Unsigned)/Bit String(16-bit)	D6	%MW0.6
IPAddress	Double Word(Unsigned)/Bit String(32-bit)	D7	%MD0.7
Port	Word(Unsigned)/Bit String(16-bit)	D9	%MW0.9
Slot	Word(Unsigned)/Bit String(16-bit)	D10	%MW0.10
TagName	String(30)	D11	%MW0.11
FileNo	Word(Unsigned)/Bit String(16-bit)	D27	%MW0.27
TagFileOffset	Word(Unsigned)/Bit String(16-bit)	D28	%MW0.28

Figure 5.3.1 Register Mapping

Each Explicit Label Instance will have to have a different Global Label of Structured Data Type “MSG_SDT”. Keep in mind the SAME Instance can be used for multiple Function Blocks Instances, but the Function Block can only be called one at a time. This is true for this QSG Example. Both Function Block Instances use the same Explicit Message Instance and the same Global Label of “CommandLocation”.

5.4 Explicit Message Function Block and Labels (OPTION 2 ONLY)

OPTION 2 does NOT use any Function Blocks or Labels.

No Code is required in the iQ CPU to use OPTION 2.

See Section 3.3 for reference on how iQ CPU Data Registers are directly written and read to/from the Rockwell CPU.

Terminology

Implicit (I/O Data) Messaging	Connections are established to move application-specific I/O data at regular intervals. These connections often are set up as one-to-many relationships in order to take full advantage of the producer-consumer multicast model. Implicit messaging uses UDP/IP resources to make multicast data transfers over Ethernet a reality.
Explicit Messaging	Point-to-point relationships that are established to facilitate request-response transactions between two nodes. These connections are general purpose in nature and can be used to reach any network-accessible items within a device. Explicit messaging connections utilize TCP/IP services to move messages across Ethernet.
EtherNet/IP	EtherNet/IP is the name given to the Common Industrial Protocol (CIP), as implemented over standard Ethernet (IEEE 802.3 and the TCP/IP protocol suite).
User Defined Data Type	User-defined data types allow a user to organize the data to match a machine or process. This streamlines program development and creates self-documenting code that is easier to maintain. A user-defined data type stores all the data related to a specific aspect of a system. This keeps related data together and easy to locate, regardless of its data type.
Common Industrial Protocol (CIP)	The Common Industrial Protocol (CIP) is a media independent, connection-based, object-oriented protocol designed for automation applications. It encompasses a comprehensive set of communication services for automation applications: control, safety, synchronization, motion, configuration and information.

Revisions

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