OMRON Sti

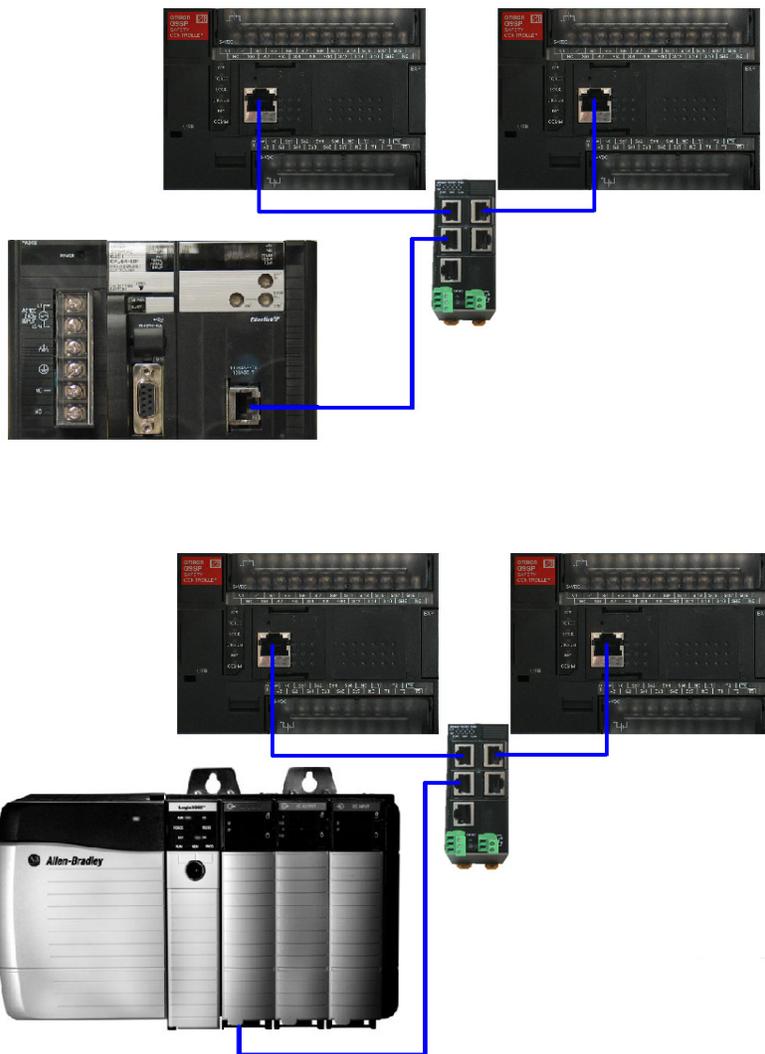# CM-EIP-1

G9SP Safety Controller EtherNet/IP Adapter

Application and Setup Guide

Section 1: Introduction

This document explains the theory, operation, and setup of the Omron STI **CM-EIP-1** EtherNet/IP adapter for the G9SP family of programmable safety controllers.

The CM-EIP-1 is an EtherNet/IP adapter that allows EtherNet/IP Originator products to quickly and easily monitor the operation of a G9SP safety controller, as well as send *non-safety* control data to the G9SP safety controller. Any product that adheres to the ODVA guidelines for EtherNet/IP communications should be able to communicate with a G9SP through the CM-EIP-1. Common examples Originator products are Omron CS and CJ series PLCs, and Rockwell Automation CompactLogix and ControlLogix series programmable controllers.

The CM-EIP-1 supports the Implicit Messaging (Datalink) function of EtherNet/IP, but does not support Explicit Messaging to the G9SP. The CM-EIP-1 functions as an EtherNet/IP Target (slave) device, with the connected PLC functioning as the EtherNet/IP Originator (master) device. The CM-EIP-1 supports a single connection from an Originator. If more than 1 PLC needs to monitor the status of the G9SP, the data must be relayed through a single PLC connected to the G9SP.

The CM-EIP-1 adapter mounts in an Option Board Slot on the front of a G9SP safety controller, and can be used in all G9SP safety controllers with an available Option Board Slot.

The CM-EIP-1 provides assemblies to Consume 6 bytes of data from the PLC, and Produce either 28 bytes or 68 bytes of data, depending on the selected Produced Assembly.

The Consumed Assembly allows the PLC to send 32 bits of 'Optional Data' to the G9SP to be used in the safety controller logic program.

The Produced Assemblies allow the PLC to monitor the On / Off State of the digital inputs and outputs on the G9SP, the Status of the digital inputs and outputs on the G9SP, the 32 bits of 'Optional Data', the Error Causes for the digital inputs and outputs on the G9SP, the Run / Idle state of the G9SP, and the Output Power Supply state. Section 5 of this document details the layout of the Produced and Consumed data.

When setting the RPI (Requested Packet Interval) for the connections to a CM-EIP-1 adapter, setting a value below 100ms will not improve response time. The adapter is an EtherNet/IP to serial communications adapter, and will have the response time characteristics associated with a serial communications device.

Section 2: Applications

The CM-EIP-1 adapter has been developed to allow Omron STI G9SP safety controllers to be monitored and controlled from PLCs and other automation equipment using the EtherNet/IP communications protocol. This communications capability allows the G9SP to function as an integrated part of entire automation system. The adapter is an EtherNet/IP Connection Target, meaning the adapter cannot establish a connection to another device. A device, such as an Omron CJ or CS series PLC or Rockwell Automation CompactLogix or ControlLogix programmable controller with an EtherNet/IP module, functioning as a Connection Originator, must be the device used to establish the Implicit Message (Datalink) connection to the CM-EIP-1. Only 1 Originator can establish a connection to CM-EIP-1. The CM-EIP-1 does not support communications to multiple Originator PLCs.

Some manufacturers, including Omron, require an .eds file for use in a software configuration package to connect the CM-EIP-1 to a PLC. This .eds file is available from the Omron STI website:

http://www.sti.com/controllers/G9SP/index.htm.
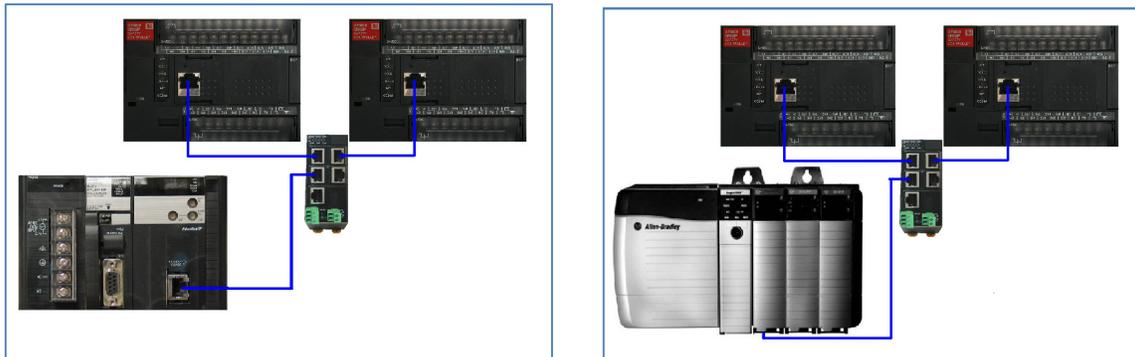
Typical configurations of Omron Industrial Automation or Rockwell Automation controllers connected to Omron G9SP safety controllers

Note: The CM-EIP-1 uses standard EtherNet/IP communications, and does not use CIP Safety protocols. The EtherNet/IP communications to a G9SP should not be considered part of the Safety circuit, and the connection to a G9SP is for monitoring or non-safety control of the G9SP only.

Section 3: EtherNet/IP Adapter Setup

The CM-EIP-1 is assigned a default IP address of 192.168.250.1. The IP address can be changed using a web browser pointed to the IP address of the adapter. A static IP address must be assigned to the PC's Ethernet card for this purpose. Simply enter the IP address of the CM-EIP-1 adapter (192.168.250.1) in the web browsers address field to access the configuration page. Enter the desired new IP address (192.168.1.155 shown as an example), subnet mask, and default gateway (if applicable). When finished, click **Apply Setting**.
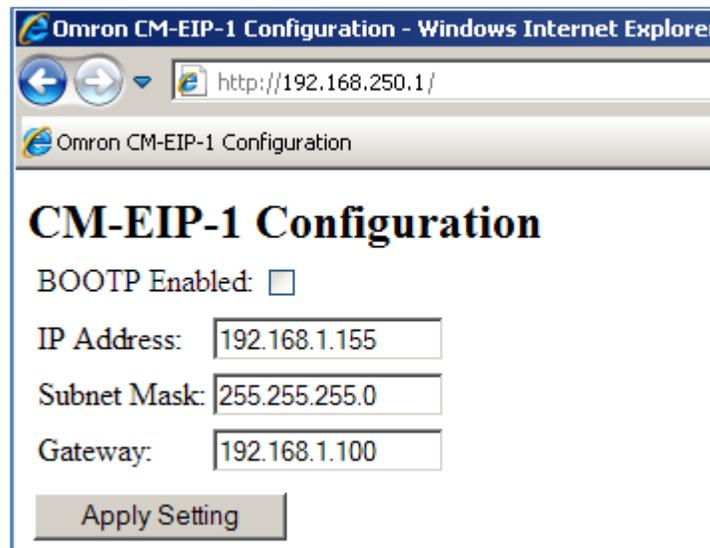
Reboot the G9SP safety controller after changing the IP address through the web page interface.

Note: The IP address of the CM-EIP-1 cannot be configured from within the G9SP Configurator. The configuration section for Ethernet in the G9SP Configurator is only for the FINS Ethernet Adapter CP1W-CIF41.

Section 4: G9SP Setup
There is no setup necessary for the G9SP.

Section 5: Data Exchanged with a G9SP

5.1 Produced Data:

There are 2 assemblies that Produce data from the G9SP to the PLC. The user can select which assembly is used at the time the connection to the G9SP is configured. Consult the G9SP Operation Manual (Z922) for a definition of the data in the assemblies. Note: The order of the data from the CM-EIP-1 is **not** identical to that shown in Omron manual Z922 for serial or FINS Ethernet communications.

Assembly 100

| Bytes	Data
0 + 1	Optional Comms Transmission Data
2 + 3	Optional Comms Transmission Data
4 + 5	Safety Input Terminal Data Flags
6 + 7	Safety Input Terminal Data Flags
8 + 9	Safety Input Terminal Data Flags
10 + 11	Safety Output Terminal Data Flags
12 + 13	Safety Output Terminal Data Flags
14 + 15	Safety Input Terminal Status Flags
16 + 17	Safety Input Terminal Status Flags
18 + 19	Safety Input Terminal Status Flags
20 + 21	Safety Output Terminal Status Flags
22 + 23	Safety Output Terminal Status Flags
24 + 25	Safety Input Terminal Error Causes
26 + 27	Safety Input Terminal Error Causes
28 + 29	Safety Input Terminal Error Causes
30 + 31	Safety Input Terminal Error Causes
32 + 33	Safety Input Terminal Error Causes
34 + 35	Safety Input Terminal Error Causes
36 + 37	Safety Input Terminal Error Causes
38 + 39	Safety Input Terminal Error Causes
40 + 41	Safety Input Terminal Error Causes
42 + 43	Safety Input Terminal Error Causes
44 + 45	Safety Input Terminal Error Causes
46 + 47	Safety Input Terminal Error Causes
48 + 49	Safety Output Terminal Error Causes
50 + 51	Safety Output Terminal Error Causes
52 + 53	Safety Output Terminal Error Causes
54 + 55	Safety Output Terminal Error Causes
56 + 57	Safety Output Terminal Error Causes
58 + 59	Safety Output Terminal Error Causes
60 + 61	Safety Output Terminal Error Causes
62 + 63	Safety Output Terminal Error Causes
64 + 65	Unit Status
66 + 67	Communications Status

Assembly 102

Bytes	Data
0 + 1	Optional Comms Transmission Data
2 + 3	Optional Comms Transmission Data
4 + 5	Safety Input Terminal Data Flags
6 + 7	Safety Input Terminal Data Flags
8 + 9	Safety Input Terminal Data Flags
10 + 11	Safety Output Terminal Data Flags
12 + 13	Safety Output Terminal Data Flags
14 + 15	Safety Input Terminal Status Flags
16 + 17	Safety Input Terminal Status Flags
18 + 19	Safety Input Terminal Status Flags
20 + 21	Safety Output Terminal Status Flags
22 + 23	Safety Output Terminal Status Flags
24 + 25	Unit Status
26 + 27	Communications Status

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Bit layout of the **O**ptional **C**ommunications **T**ransmission **D**ata

| Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	OCTD 07	OCTD 06	OCTD 05	OCTD 04	OCTD 03	OCTD 02	OCTD 01	OCTD 00
1	OCTD 15	OCTD 14	OCTD 13	OCTD 12	OCTD 11	OCTD 10	OCTD 09	OCTD 08
2	OCTD 23	OCTD 22	OCTD 21	OCTD 20	OCTD 19	OCTD 18	OCTD 17	OCTD 16
3	OCTD 31	OCTD 30	OCTD 29	OCTD 28	OCTD 27	OCTD 26	OCTD 25	OCTD 24

The Optional Communications Transmission Data bits correspond to the Optional Communications Transmission Data bits in the G9SP configurator as shown below.
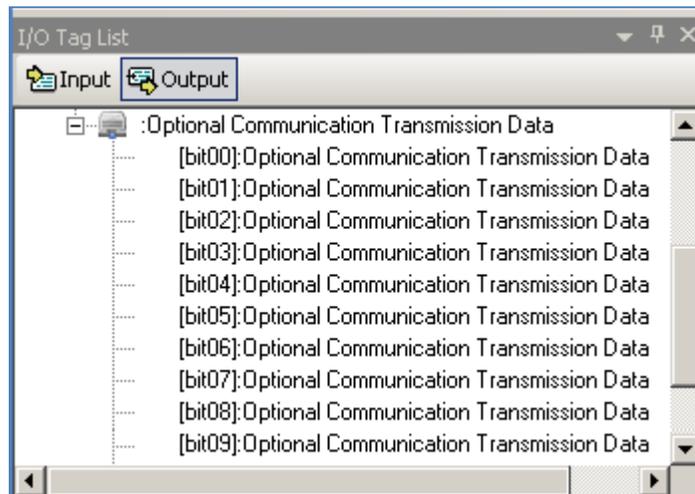
Unit Status: The G9SP Unit Status will be stored in bytes 24 and 25 for assembly 102, and bytes 64 and 65 for assembly 100. The data format is shown below.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
24 or 64	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Unit OK
25 or 65	Reserved	Reserved	FB Error	Reserved	Reserved	Safety Term Err	Output Pwr Err	Reserved

Communications Status: The status of the G9SP to CM-EIP-1 communications will be stored in bytes 26 and 27 for assembly 102, and bytes 66 and 67 for assembly 100. Check the value of Byte 26 / 66 before considering the Produced Data to be valid.

Byte	No Comms Errors	Communications Error
26 or 66	01	00
27 or 67	CB	Error Code

5.2 Consumed Data:

There is 1 assembly that Consumes data from the PLC into the G9SP. The only data consumed by the G9SP is the 32 bits of Optional Communications Reception Data.

Bytes	Data
0 + 1	Optional Communications Reception Data
2 + 3	Optional Communications Reception Data
4 + 5	Reserved

Bit layout of the **O**ptional **C**ommunications **R**eception **D**ata

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	OCRD 07	OCRD 06	OCRD 05	OCRD 04	OCRD 03	OCRD 02	OCRD 01	OCRD 00
1	OCRD 15	OCRD 14	OCRD 13	OCRD 12	OCRD 11	OCRD 10	OCRD 09	OCRD 08
2	OCRD 23	OCRD 22	OCRD 21	OCRD 20	OCRD 19	OCRD 18	OCRD 17	OCRD 16
3	OCRD 31	OCRD 30	OCRD 29	OCRD 28	OCRD 27	OCRD 26	OCRD 25	OCRD 24

The Optional Communications Reception Data bits correspond to the Optional Communications Reception Data bits in the G9SP configurator as shown below.
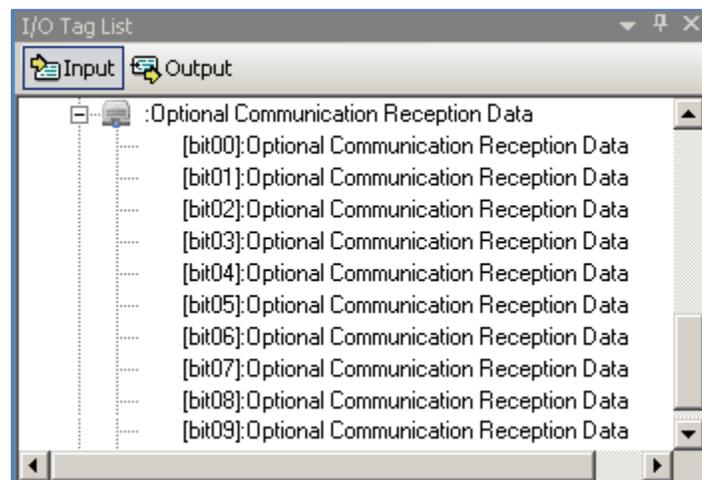
Section 6: Application Heartbeat

An option that many users may find useful is a user created heartbeat signal. This signal would originate from the PLC, transfer to the G9SP, through the logic programming in the G9SP, and back to the PLC. This allows the PLC to easily determine if the entire communications pathway and the associated G9SP program are functioning normally.

A simple Routing Function Block connecting an Optional Communications Reception Data bit to an Optional Communications Transmission bit will accomplish this in the G9SP. The PLC programmer can then pulse the Optional Communication Reception bit, and look for the Optional Communications Reception bit to turn on.
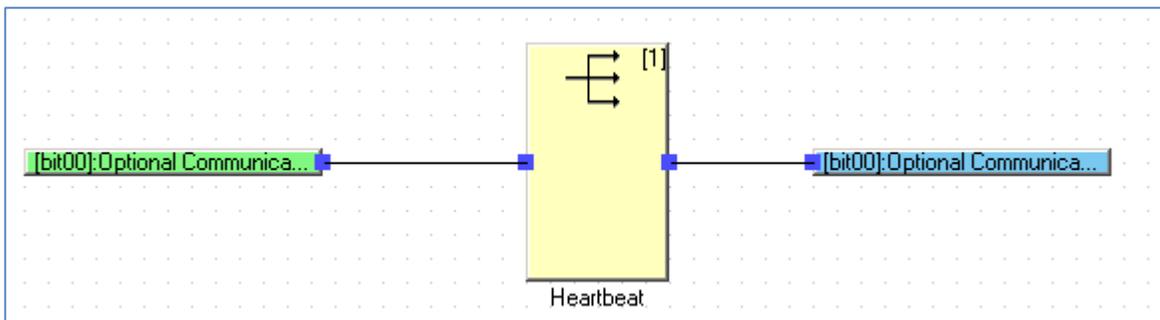
Section 7: Establishing a Connection with an Omron CJ2: Example

A connection will be established between a G9SP and a CJ2H in the following steps, using the 68 byte Produced assembly.
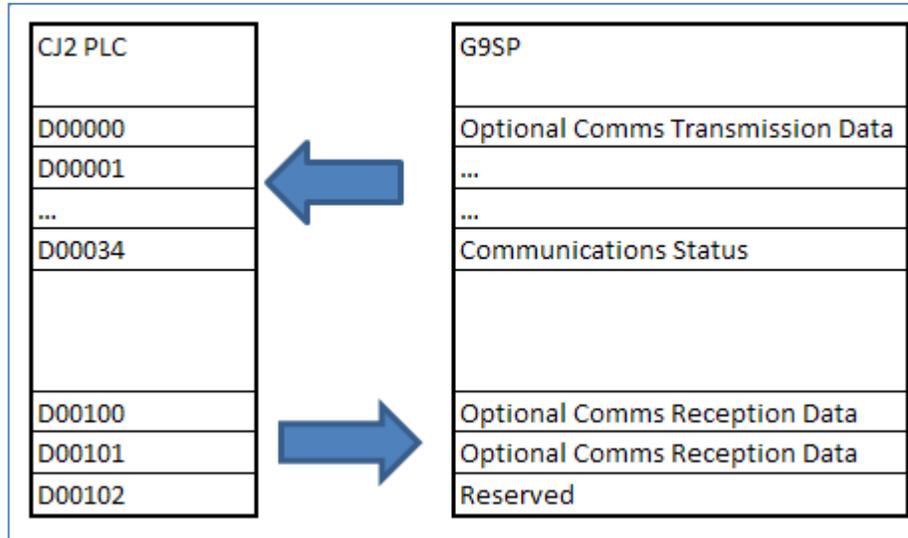
1. Plug the CM-EIP-1 adapter the G9SP, and apply power to the G9SP.

2. Connect the CJ2H, CM-EIP-1, and PC to an Ethernet Switch.

3. Configure the IP address of the CJ2H as 192.168.1.26 using CX Programmer.

4. Configure the IP address of the CM-EIP-1 as 192.168.1.25 through the Web Page interface, as shown previously in **Section 3.**

5. Launch the Network Configurator for EtherNet/IP from **Start** / **Programs** / **Omron** / **CX-One** / **Network Configurator for EthernetIP** / **Network Configurator**.

6. Install the .eds file (see Section 2) and the associated icon by clicking the **EDS File** / **Install** menus, and browsing for the .eds file and the .ico file.
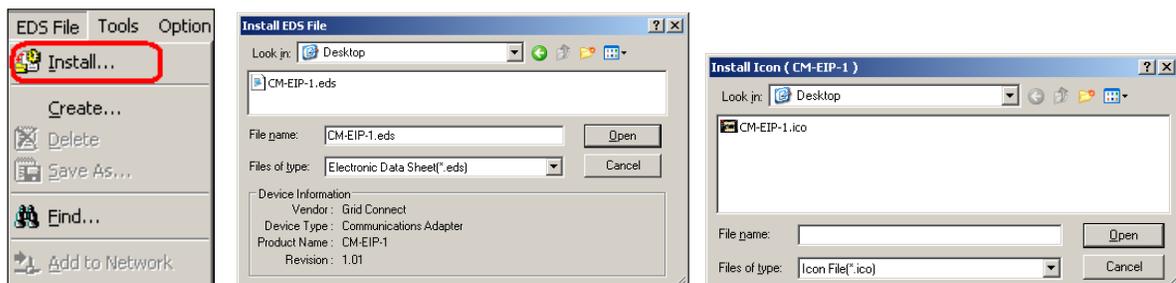
7. Drag a CM-EIP-1 device and a CJ2B-EIP21 onto the network diagram as shown. Change the IP addresses of the devices to 192.168.1.25 and 192.168.1.26 as shown, by right clicking on each device, and selecting **Change Node Address**.
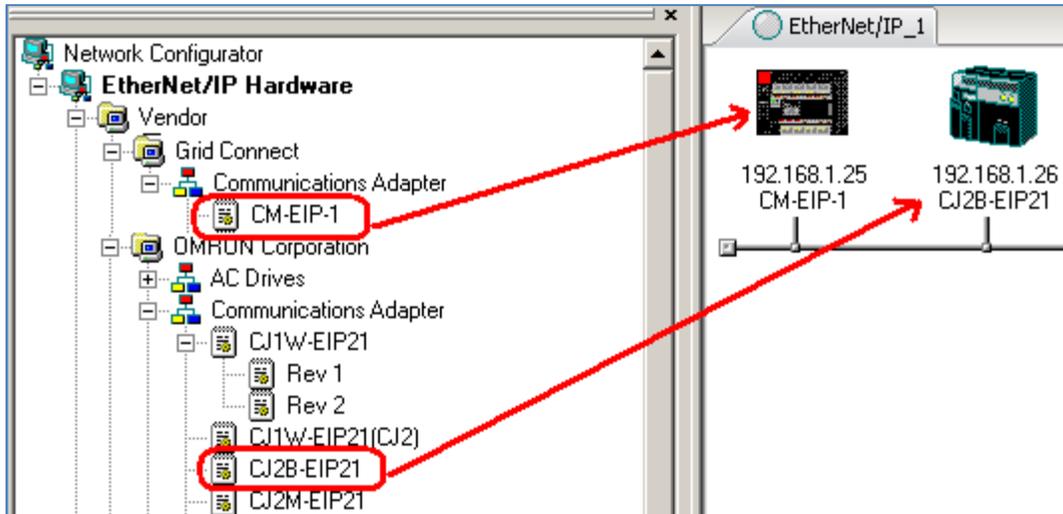
8. Double click on the CJ2B-EIP21 in the network diagram.

9. Click on the **Tag Sets** tab, **In- Consume**, and click **Edit Tags**.

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10. Click **New** to create a new tag.
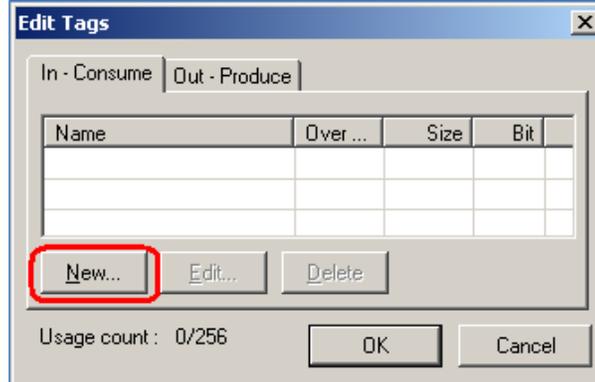
11. Enter **D0** as the tag name (this is also the PLC memory address), and a size of **68 bytes**. Click **Regist** to create the tag.
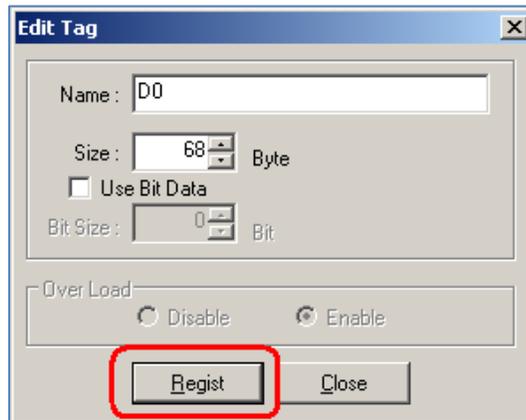
12. Click **Close** after creating the D0 tag, as the software assumes that another tag will be created.

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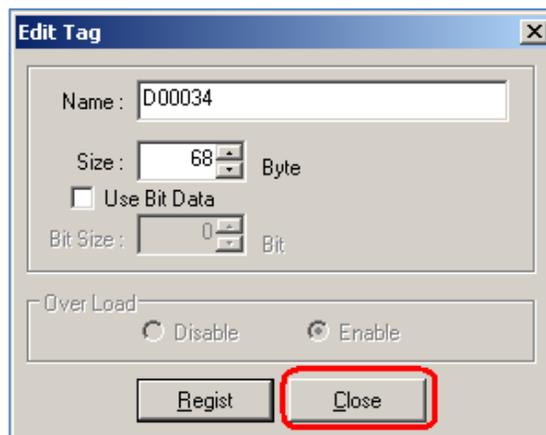
13. Click on the **Out – Produce** tab, and then click New to create a Produced Tag.
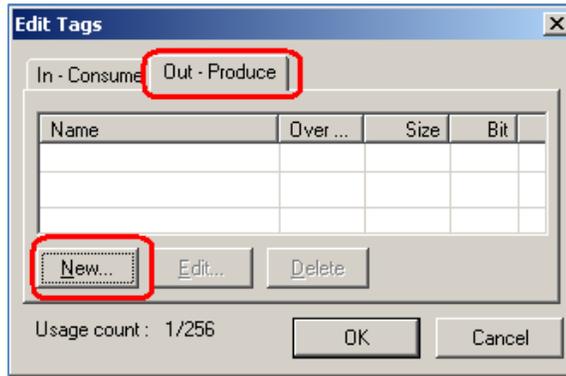
14. Enter **D100** as the tag name (this is also the PLC memory address), and a size of **6 bytes**. Click **Regist** to create the tag

15. Click **Close** after creating the D100 tag, as the software assumes that another tag will be created.

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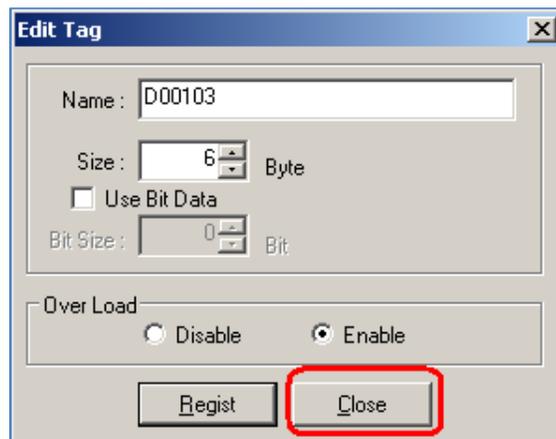
16. Click **OK** to complete the creation of the tags.
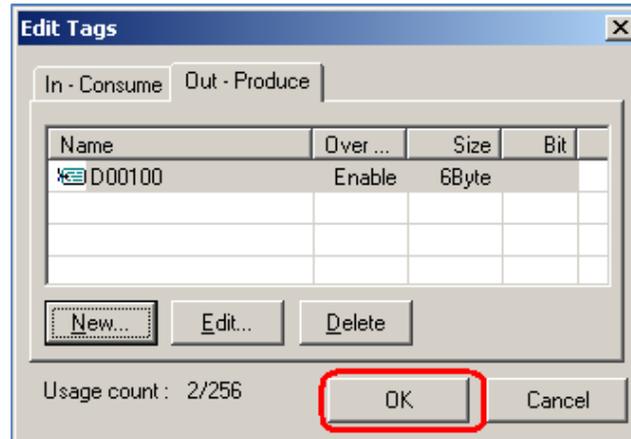
17. When prompted, click **Yes** to create Tag Sets with the same name as the Tags that they contain.

18. Click on the **Connections** tab, highlight the CM-EIP-1 and click the **Down Arrow** as shown to move the device from the Unregistered Device List to the Registered Device List.

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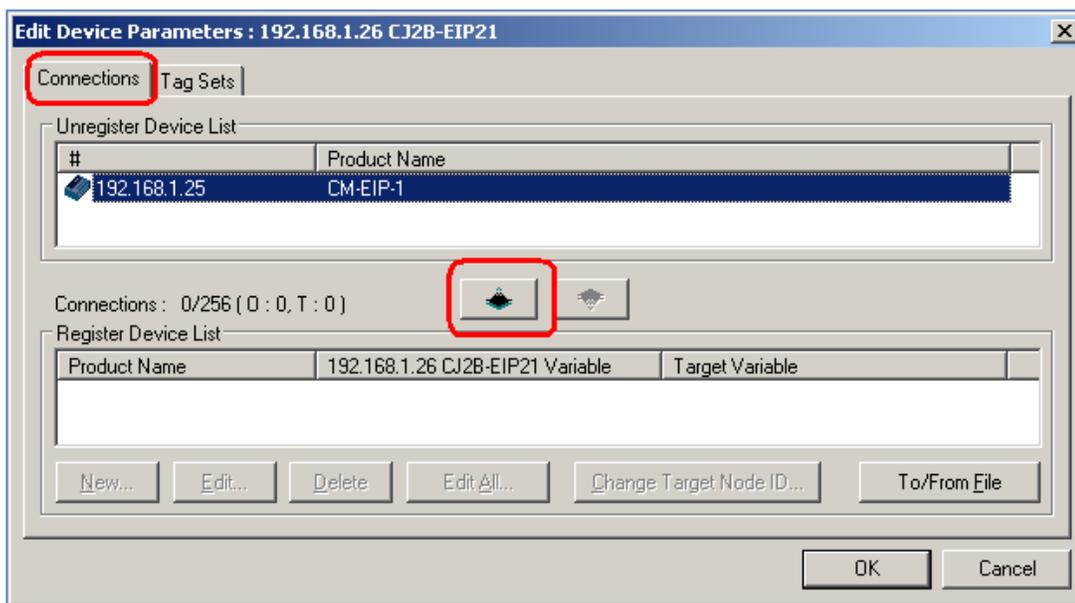
19. Double click on the device in the Registered Device List. Create a new connection as shown. Click **Regist** when finished.

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20. Click **Close** after creating the connection, as the software assumes that another connection will be created.

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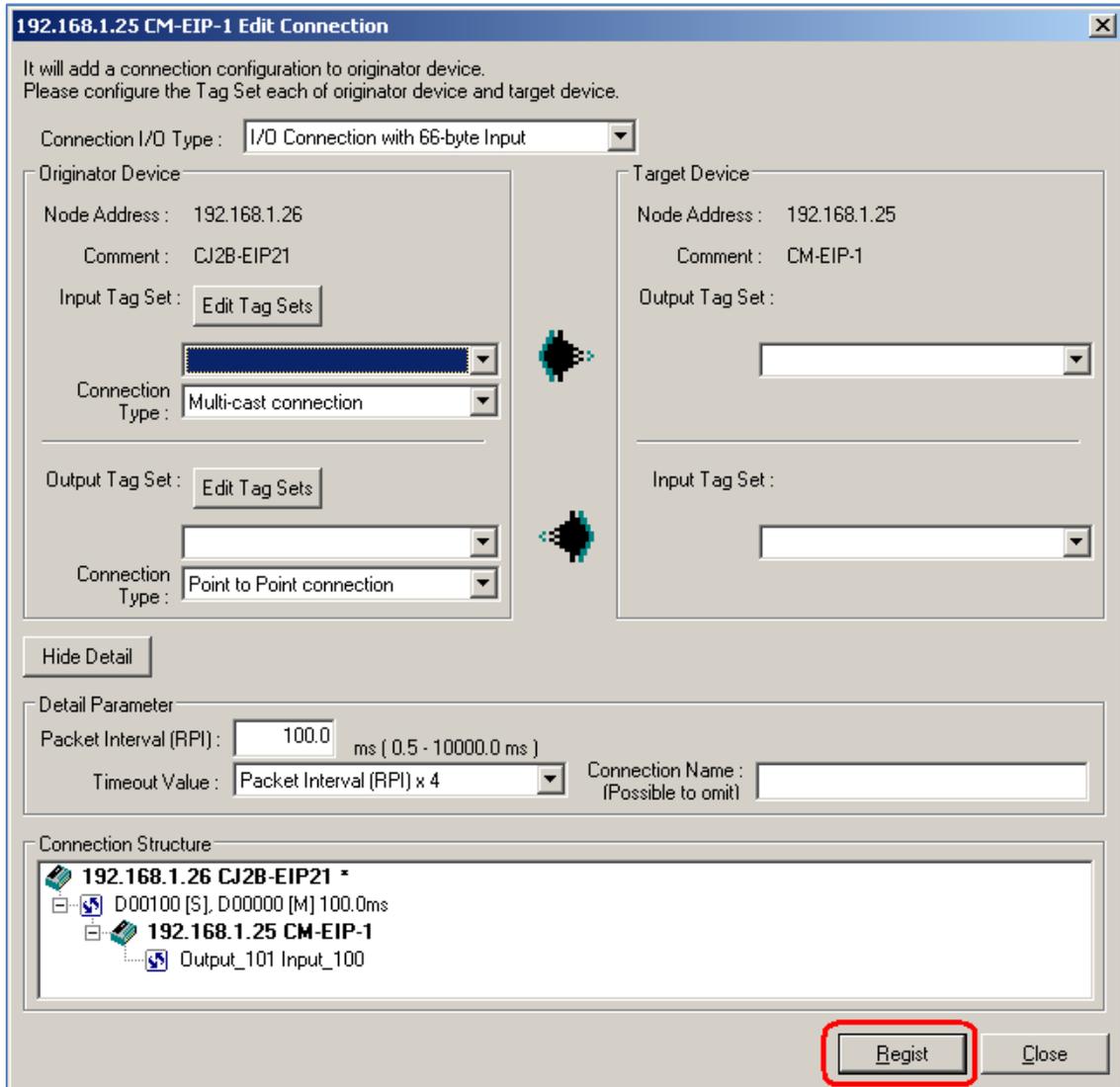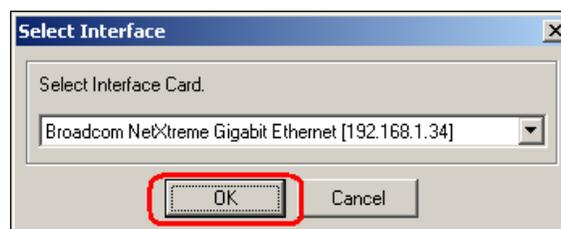
21. Click **OK** to close the Edit Device Parameters window.
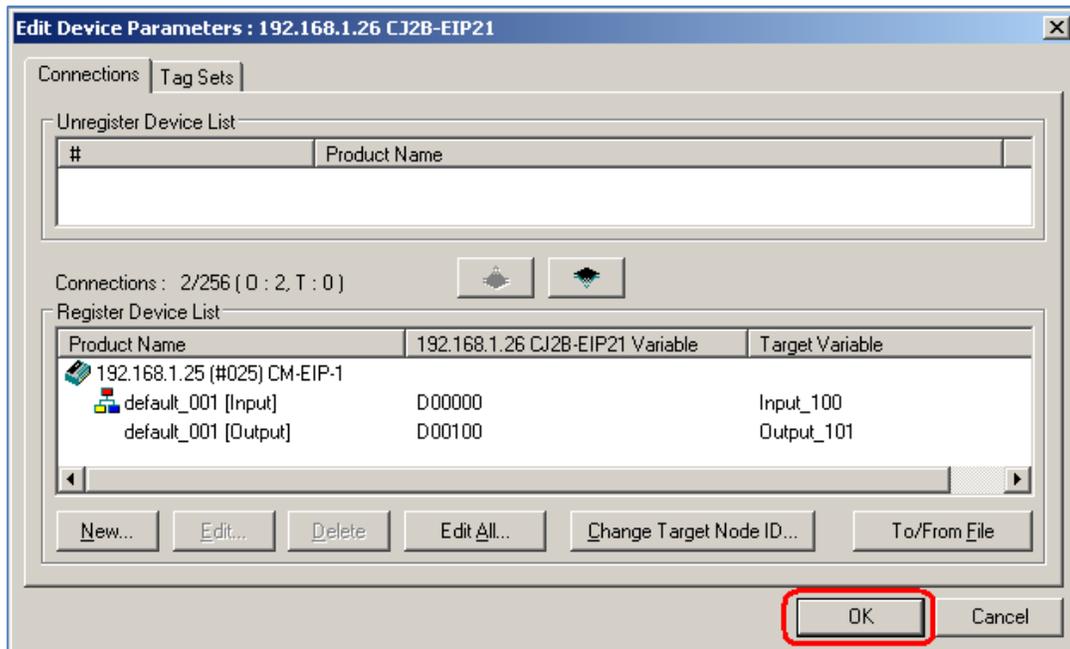
22. To select the connection method to connect to the EtherNet/IP network, click on the **Options** / **Select Interface** menus. **Select Ethernet I/F**.
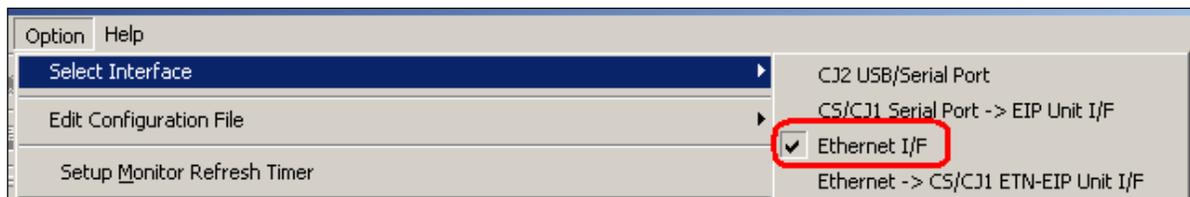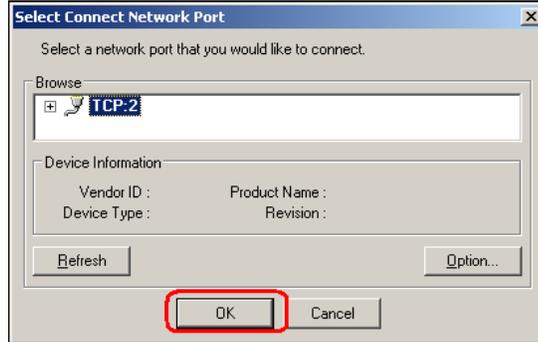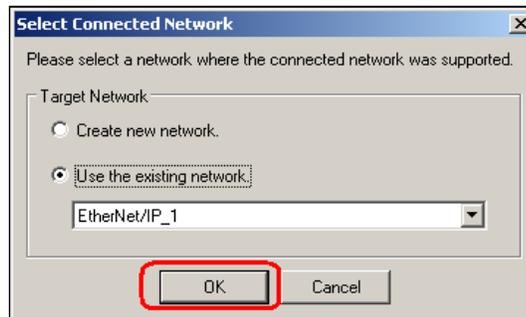

23. Click the **Connect** icon as shown.
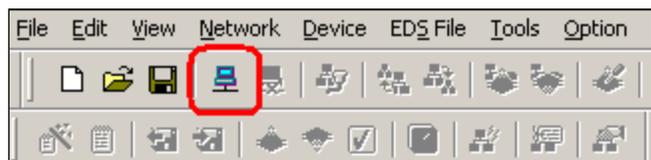
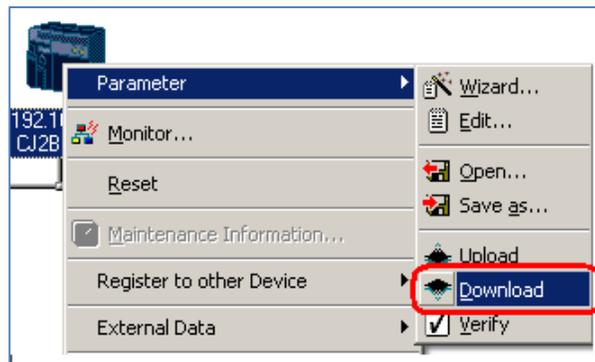24. Select the appropriate network adapter, and click **OK**.

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25. Click **OK** to select TCP port 2 to connect to the network directly.
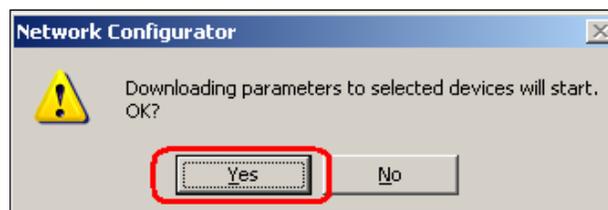

26. Select **Use the existing network**, and click **OK**.
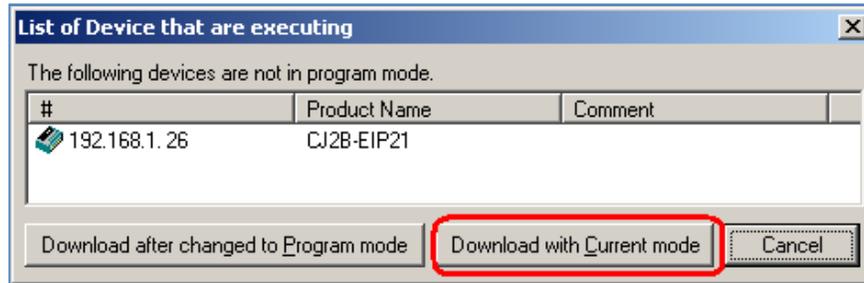

27. Right click on the CJ2B-EIP21 module in the network diagram, and select **Download**.
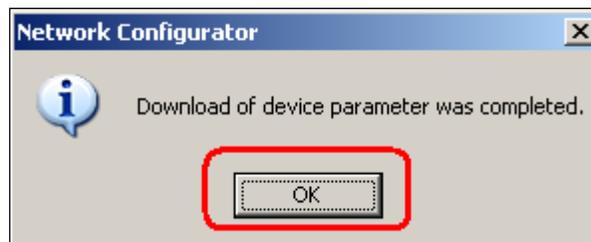

28. Click **Yes** to download the parameters.

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29. To download to the EIP module without changing the PLC to Program mode, click **Download with Current mode.**
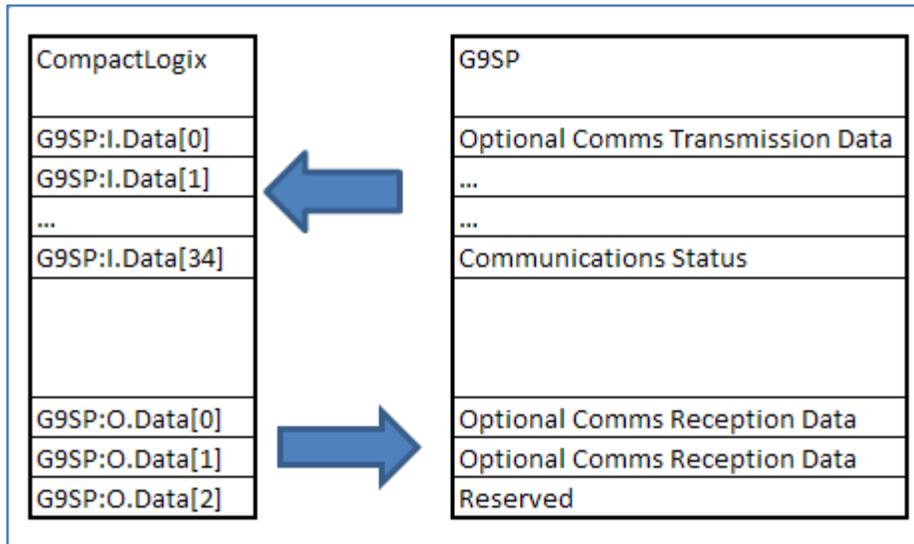

30. When the download completes, click **OK**.

31. Using CX Programmer to monitor the PLC data, and the G9SP Configurator to monitor the G9SP, verify correct data exchange between the CJ2H PLC and the G9SP safety controller.

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Section 8: Establishing a Connection with an Rockwell Automation CompactLogix: Example

A connection will be established between a G9SP and a CompactLogix in the following steps. A ControlLogix would be nearly identical.

| CompactLogix	G9SP
G9SP:I.Data[0]	Optional Comms Transmission Data
G9SP:I.Data[1]	...
...	...
G9SP:I.Data[34]	Communications Status
G9SP:O.Data[0]	Optional Comms Reception Data
G9SP:O.Data[1]	Optional Comms Reception Data
G9SP:O.Data[2]	Reserved

1. Plug the CM-EIP-1 adapter the G9SP, and apply power to the G9SP.

2. Connect the CompactLogix, CM-EIP-1, and PC to an Ethernet Switch.

3. Open the project file or create a new project file for the CompactLogix in RSLogix 5000.

4. Configure the IP address of the CompactLogix as 192.168.1.77 using RSLogix 5000.

5. Configure the IP address of the CM-EIP-1 as 192.168.1.25 through the Web Page interface, as shown previously in **Section 3.**

6. Right click on the Ethernet module in the CompactLogix, and click **New Module**.
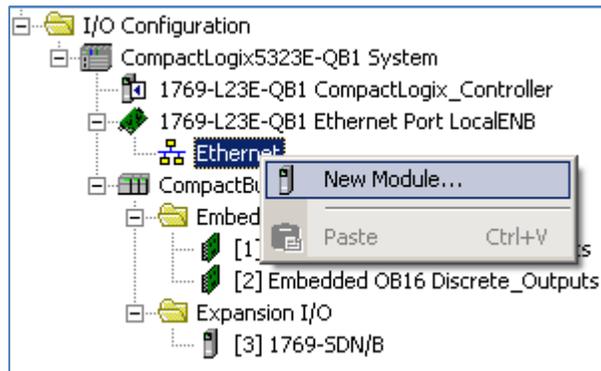
7. In the **Communications** group, select **ETHERNET-MODULE Generic Ethernet Module**, and click **OK**.
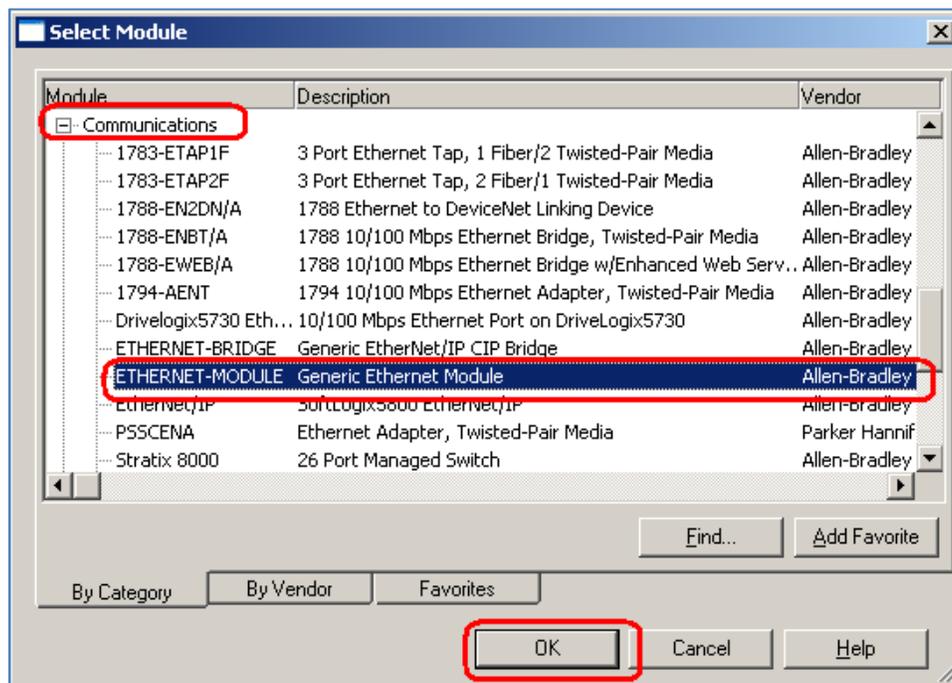
8. Choose either Assembly 100 (68 bytes) or Assembly 102 (28 bytes), and enter the appropriate configuration as shown below in the New Module dialog box, and click **OK**.

New Module

Type:	ETHERNET-MODULE Generic Ethernet Module
Vendor:	Allen-Bradley
Parent:	LocalENB
Name:	G9SP

Description:

Comm Format: Data - INT

Address / Host Name
- ⦿ IP Address: 192 . 168 . 1 . 25
- ○ Host Name:

Connection Parameters

	Assembly Instance:	Size:	
Input:	100	34	(16-bit)
Output:	101	3	(16-bit)
Configuration:	128	0	(8-bit)
Status Input:			
Status Output:			

☑ Open Module Properties

OK   Cancel   Help

New Module

Type:	ETHERNET-MODULE Generic Ethernet Module
Vendor:	Allen-Bradley
Parent:	LocalENB
Name:	G9SP

Description:

Comm Format: Data - INT

Address / Host Name
- ⦿ IP Address: 192 . 168 . 1 . 25
- ○ Host Name:

Connection Parameters

	Assembly Instance:	Size:	
Input:	102	14	(16-bit)
Output:	101	3	(16-bit)
Configuration:	128	0	(8-bit)
Status Input:			
Status Output:			

☑ Open Module Properties

OK   Cancel   Help

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9. Configure the RPI for 100 ms, and click **OK**. Because the connection between the G9SP and the CM-EIP-1 is a serial connection, RPI values below 100ms will not increase throughput of communications.
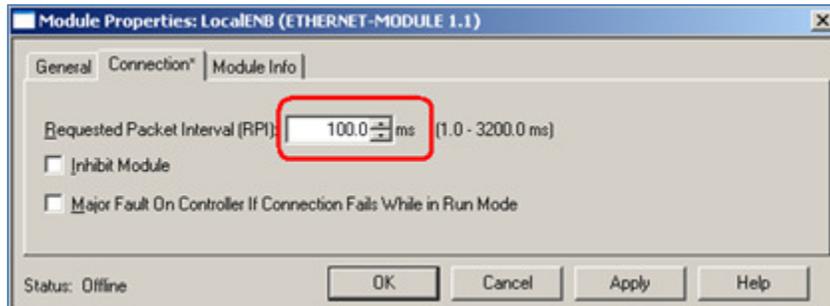
Tags will have been created automatically for the CM-EIP-1 connection as shown below.
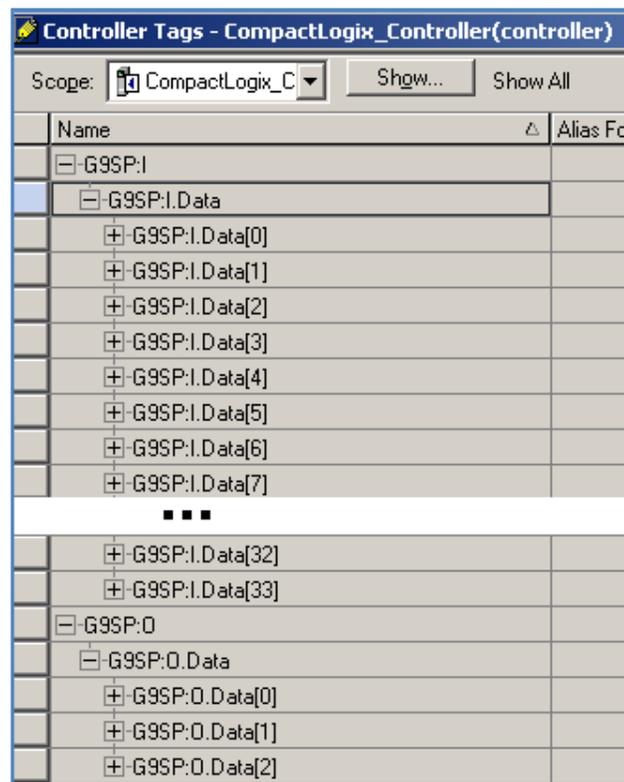
10. Download the project to the CompactLogix processor using RSLogix 5000.

11. Using RSLogix 5000 to monitor the PLC data, and the G9SP Configurator to monitor the G9SP, verify correct data exchange between the CompactLogix processor and the G9SP safety controller.

Section 9: BOOTP

The BOOTP function is disabled by default in the CM-EIP-1 adapter. The CM-EIP-1 adapter can be configured to acquired it's IP address from a BOOTP server by logging into the adapter and **checking BOOTP Enable box**. Once the BOOTP option is activated, the module's IP address will be automatically acquired from a BOOTP server.

If a BOOTP server application that can run on your personal computer is needed one can be acquired at the following web site: http://www.ab.com/networks/ethernet/bootp.html

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