

Ethernet Global Data

Objectives

UPON COMPLETION OF THIS MODULE, YOU SHOULD BE ABLE TO:

- Explain how Ethernet Global Data (EGD) exchanges are configured
- View data that is being sent and received via EGD



Overview

Ethernet Global Data

Ethernet Global Data is a mechanism that enables one CPU, referred to as a producer, to share a portion of its internal reference memory with one or more other CPUs, referred to as consumers, at a regularly scheduled periodic rate. Such a snapshot of internal reference memory, mediated by an Ethernet interface, is referred to as an exchange. An exchange is identified by a unique combination of three identifiers:

- The Producer ID (the producer's IP address)
- The Exchange ID (the exchange's identifier)
- The Adapter Name (the Ethernet interface identifier)

Ethernet Global Data: Example 1

The figure that follows shows three devices (two PLCs and a PC running HMI) participating in an Ethernet Global Data exchange.

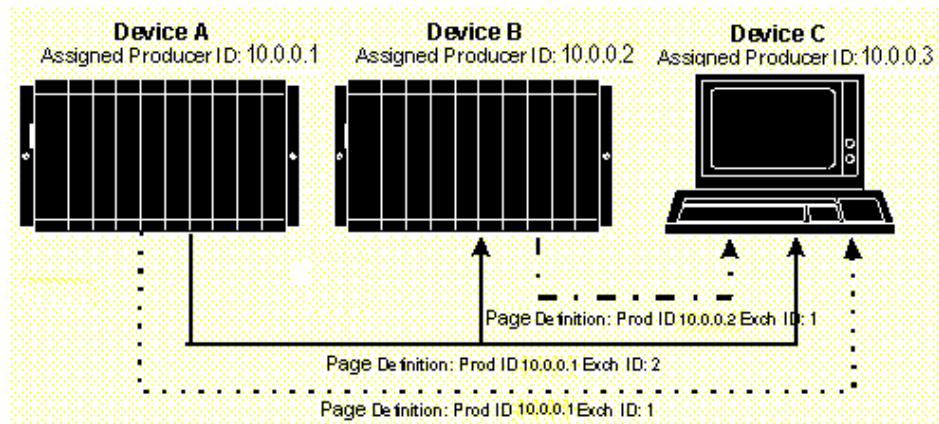


Figure 9-1. EGD Exchanges between HMI and 2 PLC's

In this example, Device A produces two exchanges and consumes none, Device B produces one exchange and consumes one, and Device C produces no exchanges but consumes three. The exchange produced by Device A and consumed by both Device B and Device C is an example of Group Usage, whereby multiple devices consume data produced by one producing device.

Ethernet Global Data: Example 2

This example shows the details of a simple exchange of data from producing device A to consuming device B.

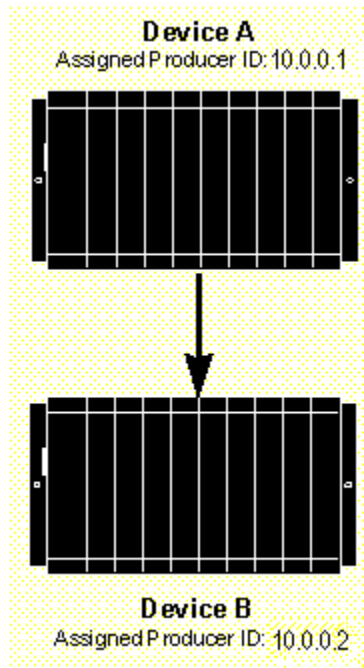


Figure 9-2. EGD Exchanges between 2 PLC's

Device A sends the information contained in the following reference memory locations. Each of the three bytes in the exchange contains eight discrete bits aligned at byte boundaries.

%I00001 to %I00016

%Q00001 to %Q00008

Device B receives the information and stores it in three consecutive bytes in %G memory, as follows:

%G00001 to %G00024

To configure the produced exchange sent by Device A, you need to set its properties and configure a variable range.

To configure the consumed exchange received by Device B, you need to set its properties and configure a variable range.

Logic Developer Implementation of EGD

The EGD Component

The first step in using Ethernet Global Data (EGD) in a GE Fanuc PLC or ENIU target is adding the EGD component. In a PLC target, you can do so even if the CPU presently configured in the target does not support EGD, as long as the target belongs to one of the PLC families that support EGD.

This flexibility enables you to start configuring EGD even if the hardware specifications of your system have not been determined.

The EGD component is automatically added if you import the Hardware Configuration. For Ethernet modules that support EGD uploads, the EGD component is automatically added when you upload the Hardware Configuration and EGD configuration.

When the EGD component is added, the Project tab of the Navigator displays the Ethernet Global Data folder, which contains the following empty folders:

- Consumed Exchanges
- Produced Exchanges



Figure 9-3. EGD Exchanges Folders

Consumed Exchange

All of a GE Fanuc target's Ethernet Global Data (EGD) consumed exchanges are in the Consumed Exchanges folder. When you add the Ethernet Global Data component, the Consumed Exchanges folder is empty. You must add every consumed exchange manually, unless you import an entire EGD configuration (including all the produced exchanges) or upload the Hardware Configuration and the EGD configuration (including all the produced exchanges).

When you right-click a consumed exchange, you can do one of the following:

- Configure its variables in the EGD Variable editor.
- Rename the consumed exchange.
- Delete the consumed exchange.
- Synchronize the consumed exchange to the EGD Configuration Server.
- Set the consumed exchange's properties.

Consumed Exchange Properties

When you right-click a Consumed Exchange and choose Properties, the Inspector displays the following properties:

Name

This is the name of the consumed exchange. Valid characters: A - Z, a - z, 0 - 9, and underscores (_). The name must start with a letter and be at most 32 characters long.

Producer ID

The producer's IP Address in dotted decimal format (n.n.n.n, where n represents a number in the range of 0 through 255). When you add a consumed exchange to a target, the Producer ID has the default value of 0.0.0.0, which is invalid. In the Project tab of the Navigator, the exchange is flagged as invalid. Enter a valid producer ID.

The Producer ID, Exchange ID, and Adapter Name must be a unique combination of values specific to this consumed exchange so as to identify it.

Group ID

(Required only if the exchange is subject to a Multicast exchange, that is, the exchange is consumed by more than one consuming device but not by all consuming devices.) The unique identifying number of the group of consuming devices that this exchange is to be consumed by. The same value must be entered in the Group ID parameter of a produced exchange to be multicast to the same group.

Valid range: 0 through 32. The value 0 means that the consumed exchange is not part of a Multicast exchange.

Default: 0.

Exchange ID

The numerical value that, combined with the Producer ID and the Adapter Name, identifies this exchange. The Exchange ID, Producer ID, and Adapter Name must be a unique combination of values specific to this consumed exchange so as to identify it.

If the target is consuming multiple exchanges from one producer, the Exchange ID must be unique in this target.

If the target is consuming only this exchange from a producer, the Exchange ID does not need to be unique in this target, because the Producer ID distinguishes the exchange from other exchanges that have the same Exchange ID.

Valid range: 1 through 16,383; 32,769 through 49,151.

Adapter Name

The network adapter (within this target) that consumes the exchange. The Adapter Name, Producer ID, and Exchange ID must be a unique combination of values specific to this consumed exchange so as to identify it. The nature and origin of the selectable Adapter Names depends on the Ethernet interface.

Consumed Period

(Read-only for PACSystems.) The scheduled repetition period (in milliseconds) at which the consuming device is to scan the local network adapter for new data and/or status updates. The actual scan time may be affected by the logic sweep time. Scanning the data does not interrupt normal logic sweep execution. For peak efficiency, the Consumed Period should be set to the same value as the Produced Period property in the corresponding produced exchange.

PACSystems and Series 90-30 IC693CPU374 and IC693NIU004: Value set to 200 ms.

Series 90-30 IC693CPU364 and Series 90-70 IC697CMM742:

Valid range: 0 through 3,600,000 milliseconds (1 hour).

Default: 200 ms.

VersaMax IC200CPUE05: Disregards the Consumed Period parameter. The built-in network adapter notifies the CPU when there is data to consume.

NOTE

The PACSystems controllers ignore this parameter. As soon as the network adapter receives new data it is transferred to the controller.

Update Timeout

The time interval (in milliseconds) when a refresh error is declared if data is not received. The error signals when a first or subsequent packet of data does not arrive within the specified time. The value should be at least double the producer's Produced Period value to allow for transient network delays.

Range: 0 (no timeout); 10 to 3,600,000 ms (10 ms to 1 hour). Default: 0.

Signature

(Read-only for PACSystems, firmware version 2.50 or later. Read-only and value set to 0 for IC693CPU374, firmware version 12.00 and later.) Value that the EGD Configuration Server assigns to a consumed exchange when you add it or synchronize it. This value is the same as the signature of the produced exchange that corresponds to the consumed exchange.

If the Use Signature property of the Ethernet Global Data folder is set to True, every scan the PACSystems compares the Signature property of the consumed exchange with the Signature property of the produced exchange, to detect whether the produced exchange contains data in a format that differs from that expected by the consumer. The properties are also compared every time you validate either target (the producer or the consumer).

Valid range: 0.0 through 255.255. Default: 0.0.

Timestamp

(Read-only for PACSystems, firmware version 2.50 or later. Read-only and value set to 0 for IC693CPU374, firmware version 12.00 and later.) The day of the week, date, and time when the produced exchange that this consumed exchange consumes was published to the EGD Configuration Server after configuring or reconfiguring its variables. The server assigns the same timestamp to the consumed exchange when you add it or synchronize it.

An EGD configuration timestamp is different from a data sample timestamp of a consumed exchange. A data sample timestamp is the time when the data sample originated from the producer. The memory range of a data sample timestamp is defined in the EGD Variable editor, and a data sample timestamp is constantly updated when the PLC is producing EGD data samples.

For more information, see EGD configuration timestamps and EGD data sample timestamps.

Produced Exchange

All of a GE Fanuc target's Ethernet Global Data (EGD) produced exchanges are in the Produced Exchanges folder. When you add the Ethernet Global Data component, the Produced Exchanges folder is empty. You must add every produced exchange manually, unless you import an entire EGD configuration (including all the consumed exchanges) or upload the Hardware Configuration and the EGD configuration (including all the consumed exchanges).

When you right-click a produced exchange, you can:

- Configure its variables in the EGD Variable editor.
- Rename the produced exchange.
- Delete the produced exchange.
- Set the produced exchange's properties.

Produced Exchange Properties

When you right-click a Produced Exchange and choose Properties, the Inspector displays the following properties:

Name

The name of the produced exchange. Valid characters: A - Z, a - z, 0 - 9, and underscores (_). The name must start with a letter and be at most 32 characters long.

Exchange ID

A numerical value that identifies a specific data exchange to be sent by the producing device. No two produced exchanges can use the same Exchange ID on this target. A consumed exchange can use the same numerical value. Range: 1 through 16,383.

Adapter Name

The network adapter (within this target) that produces the exchange. The nature and origin of the selectable Adapter Names depends on the Ethernet interface.

Destination Type

Determines whether the produced exchange is sent to a single consumer, a group of consumers, or all EGD consumers on the same network as the producer. In the case of a single consumer, the destination type also determines the manner in which the consumer is identified in the Destination parameter. Available destination types depend on the PLC or ENIU family type:

PACSystems:

Unicast. (Default.) The exchange is sent to a single destination address, specified in the Destination parameter.

Multicast. The exchange is sent to a group of consumers. The group is specified in the Destination parameter. You can have up to 32 groups, numbered uniquely from 1 through 32.

Broadcast. The exchange is sent to all EGD consumers.

Series 90-30 IC693CPU364, IC693CPU374, and IC693NIU004, Series 90-70 IC697CMM742, and VersaMax IC200CPUE05:

Group ID. (Default.) The exchange is sent to a group of consumers. The group is specified in the Destination parameter. You can have up to 32 groups, numbered uniquely from 1 through 32.

IP Address. The exchange is sent to a single destination address, specified in the Destination parameter.

Destination

The consumer or consumers that receive this produced exchange. The type of information required to identify the consumer(s) depends on the setting of the Destination Type parameter:

<i>Destination Type</i>	<i>Destination</i>
Unicast or IP Address	The IP address of the destination device in dotted decimal format (n.n.n.n, where <i>n</i> represents a number in the range of 0 through 255). Default: 0.0.0.0, which is invalid and must be replaced with a valid IP address.
Multicast or Group ID	The Group ID. Valid range: 1 through 32. The same value is entered in the Group ID parameter of each consumed exchange that belongs to the group. Default: 1. Group usage .
Broadcast or Broadcast IP	(Read-only.) Value set to 255.255.255.255.
Alias	The character string that represents a remote Ethernet interface. How do I set an alias .
Name	The consumer's symbolic name. Enter an ASCII string of up to 31 characters. This name must be either an Alias that was configured in the Name Resolution and Routing Table dialog box, or a name that the network adapter will resolve into the required IP Address using available name resolution protocols. Note: The Symbolic Name Consumer Type is not supported by PACSystems. Upon target conversion to a PACSystems, the Symbolic Name Consumer Type and the Consumer Address are respectively converted to a Unicast Destination Type and an IP Address of 0.0.0.0. This IP address is invalid and must be replaced with a valid IP address.

Figure 9-3. EGD Destination Type

Produced Period

A value, in milliseconds, representing the scheduled repetition period at which the data is to be produced on the network. In the producer, the Ethernet Interface produces the data at the set interval independently of when the CPU updates the data sample. Default: 200 ms.

Valid range:

PACSystems, Series 90-30 IC693CPU374 and IC693NIU004: 0, and 1 through 3,600,000 ms (1 millisecond through 1 hour), with a 2 ms granularity. Zero means once every output scan, but no faster than every 2 ms. Machine Edition lets you enter any value within the valid range, but if you enter an odd number of milliseconds, the firmware rounds it up to the next even number of milliseconds. For example, if you enter 125 ms, the firmware rounds it up to 126 ms, even though Machine Edition still displays 125 ms.

Series 90-30 IC693CPU364, VersaMax IC200CPUE05, Series 90-70 IC697CMM742: 10 to 3,600,000 ms, with a 10 ms granularity. Machine Edition lets you enter any value within the valid range, but if you enter a number of milliseconds that is not an exact multiple of 10 ms, the firmware rounds it up to the next exact multiple of 10 ms. For example, whether you enter 233 or 237 ms, the firmware rounds it up to 240 ms, even though Machine Edition still displays 233 or 237 ms.

Reply Rate

(Read-only.) Reserved for future use. Value set to 0.

Send Type

(Read-only.) The conditions under which data is produced. Value set to Always.

Signature

(Read-only for PACSystems, firmware version 2.50 or later. Read-only and value set to 0 for IC693CPU374, firmware version 12.00 and later.) Value that the EGD Configuration Server assigns to a produced exchange when you publish it to the server after configuring or reconfiguring its variables.

If the Use Signature property of the Ethernet Global Data folder is set to True, every scan the PACSystems compares the Signature property of the consumed exchange with the Signature property of the produced exchange, to detect whether the produced exchange contains data in a format that differs from that expected by the consumer. The properties are also compared every time you validate either target (the producer or the consumer).

Valid range: 0.0 through 255.255. Default: 0.0.

Timestamp

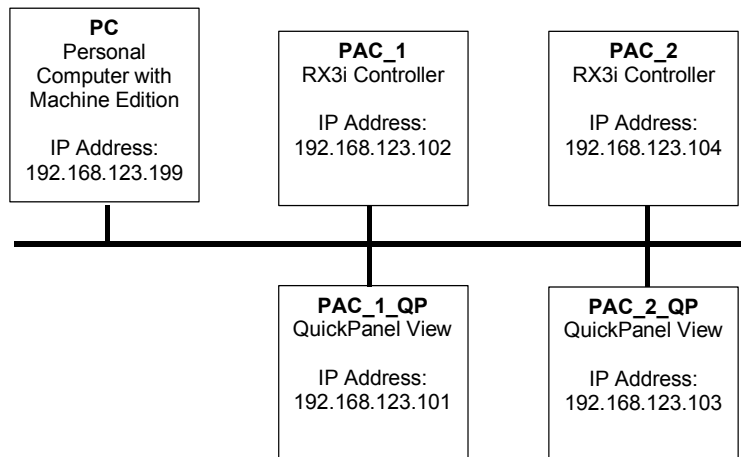
(Read-only for PACSystems, firmware version 2.50 or later. Read-only and value set to 0 for IC693CPU374, firmware version 12.00 and later.) The day of the week, date, and time when the produced exchange is published to the EGD Configuration Server after configuring or reconfiguring its variables.

An EGD configuration timestamp is different from a data sample timestamp of a consumed exchange. A data sample timestamp is the time when the data sample originated from the producer. The memory range of a data sample timestamp is defined in the EGD Variable editor, and a data sample timestamp is constantly updated when the PLC is producing EGD data samples.

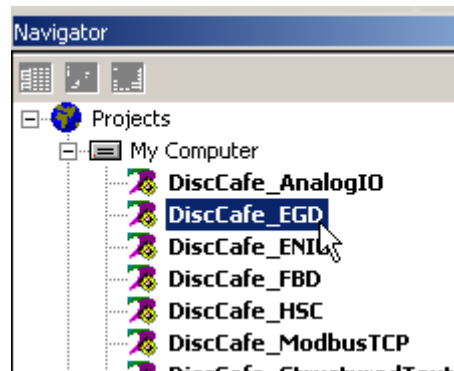
Lab Exercise – Working with EGD Configurations

In this exercise you will examine the EGD configuration properties of the two PAC controllers that will participate in the EGD exchanges.

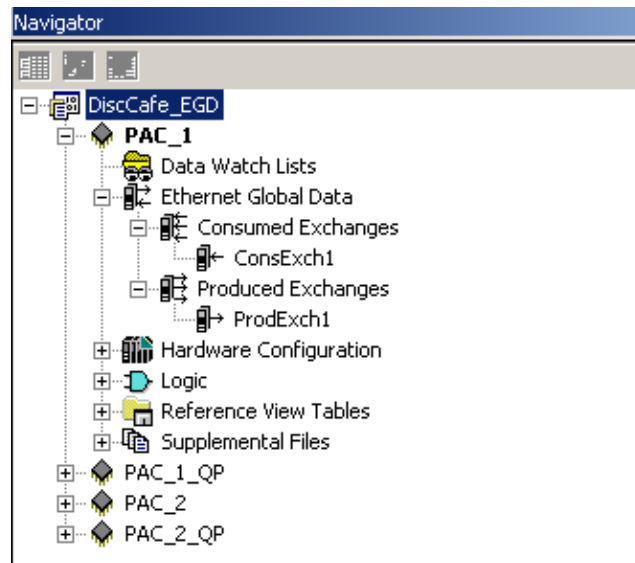
This lab assumes the following hardware configuration and setup. The IP Addresses defined below are used in the Project provided with this lab.



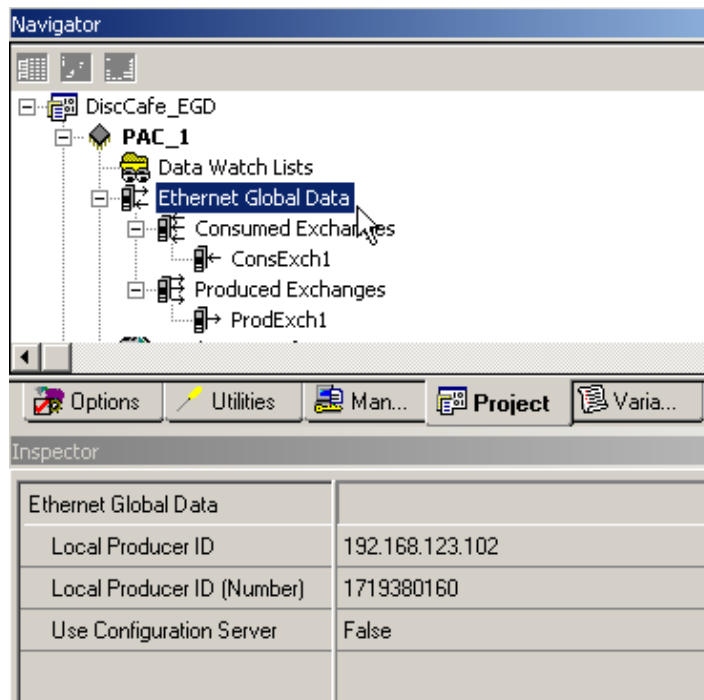
1. Begin in the **Navigator** window by **double-clicking** on the project called **DiscCafe_EGD** to open it.



- Next, expand the target labeled **PAC_1** and the section labeled **Ethernet Global Data**.



- Click on **Ethernet Global Data** and view its' properties in the **Inspector** window.



- The **Local Producer ID** is the **IP address** of the **PAC_1** target. The **Local Producer ID (Number)** is a value that is **automatically generated** by the software when you enter an **IP address** above. We are not using the Configuration Server so that property has been set to False.
- Next, **double-click** on **ProdExch1** to open its' configuration window.

InfoViewer ProdExch1 [PAC_1]						
Add Insert Delete Length (Bytes): 4						
Offset (Byte.Bit)	Variable	Ref Address	Ignore	Length	Type	Description
Status		%R00100	False	1	WORD	
0.0	Analog_Input_3	%AI0005	N/A	1	REAL	Potentiometer Input on PAC_1

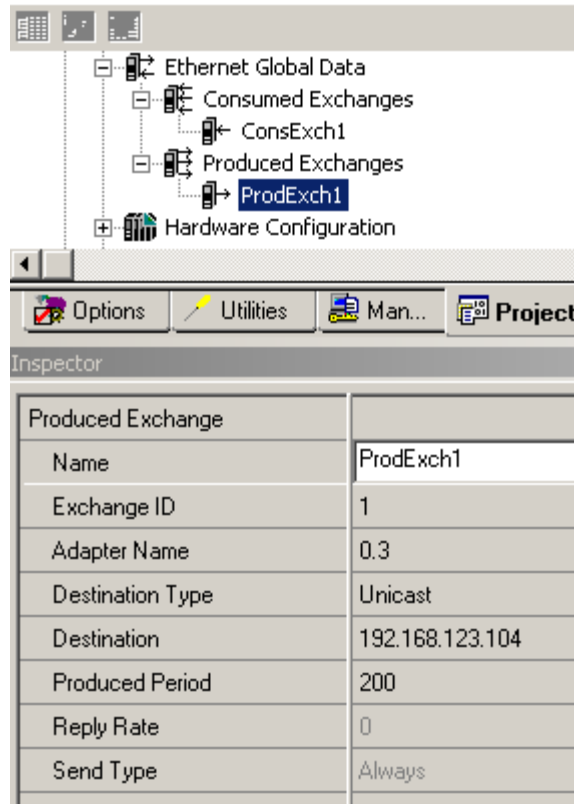
- Each EGD exchange requires **one word** of memory for **status data**. Here register 100 (%R00100) has been assigned for this purpose.
- Analog_Input_3** is the value that will be **produced** onto the network. Click on this variable to examine its' properties in the **Inspector** window.

Inspector	
Variable [PAC_1]	
Name	Analog_Input_3
Description	Potentiometer Input on PAC_1
Publish	External
Array Dimension 1	0
Data Source	GE FANUC PLC
Ref Address	%AI0005
Data Type	REAL
Current Value	72.82797
Initial Value	0.0
Default Display Format	Scientific notation
Precision	7
Retentive	True

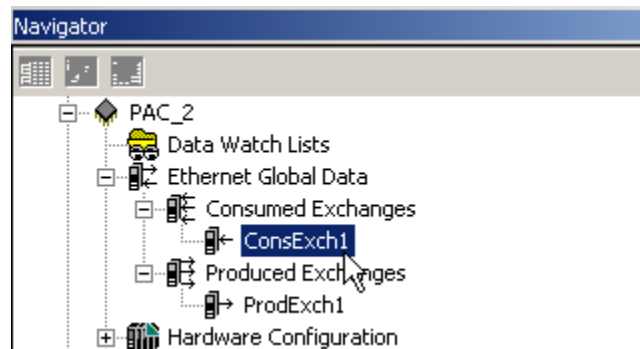
NOTE

The analog inputs on the IC695ALG600 Universal Analog Input module can be configured as either 16-bit Integer or 32-bit Real data. This module has been configured for 32-bit Real. Because of this, each analog input uses 2 %AI addresses so Analog_Input_3 uses %AI00005 and %AI00006.

8. Now click on the **Produced Exchange** and view its' properties in the **Inspector** window.



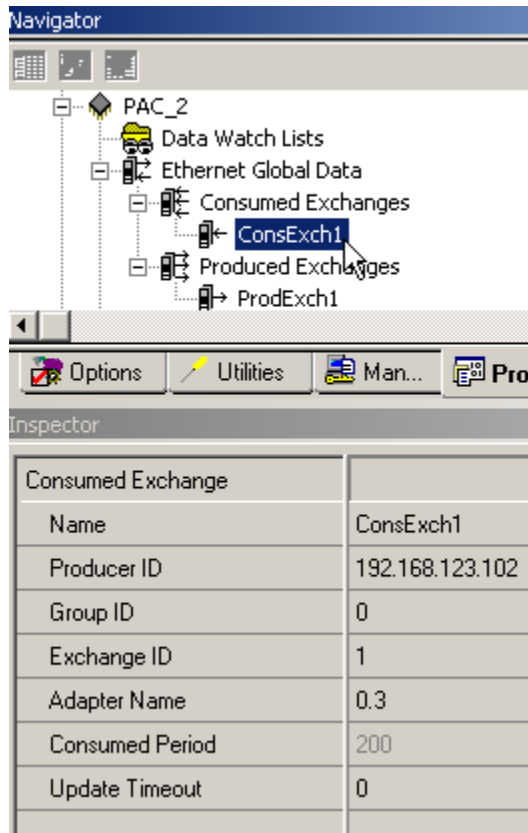
9. This is **ExchangeID 1** and the data is being sent to a **single node (Unicast)** at **IP address 192.168.123.104**. This is the address of the **PAC_2** target.
10. Next, go to the **PAC_2** target and double-click on the **Consumed Exchange (ConsExch1)** to open its configuration properties.



InfoViewer ProdExch1 [PAC_1] ConsExch1 [PAC_2]						
Add Insert Delete Length (Bytes): 4						
Offset (Byte.Bit)	Variable	Ref Address	Ignore	Length	Type	Description
Status		%R00100	False	1	WORD	
TimeStamp		NOT USED	False	0	BYTE	
0.0	PAC_1_Analog_Input	%R00001	False	1	REAL	Analog value from PAC_1

11. The **PAC_2** target will receive or **consume** the data being produced by the **PAC_1** target. The **Consumed Exchange** configuration needs to provide a location in the receiving controller's memory for the data being consumed. In this case the data will be placed in registers 1 and 2 (%R00001 & %R00002). Remember, this is 32-bit Real data being consumed.

12. Click on the **Consumed exchange** to view its' properties in the **Inspector** window.



13. The **ProducerID** is the **IP Address** of the **PAC_1** controller that is producing or sending the data. The **Exchange ID** of 1 matches the **Produced Exchange ID** in the **PAC_1's Produced exchange** configuration.

NOTE

The Produced and Consumed Exchange ID's must match for data exchange to take place.

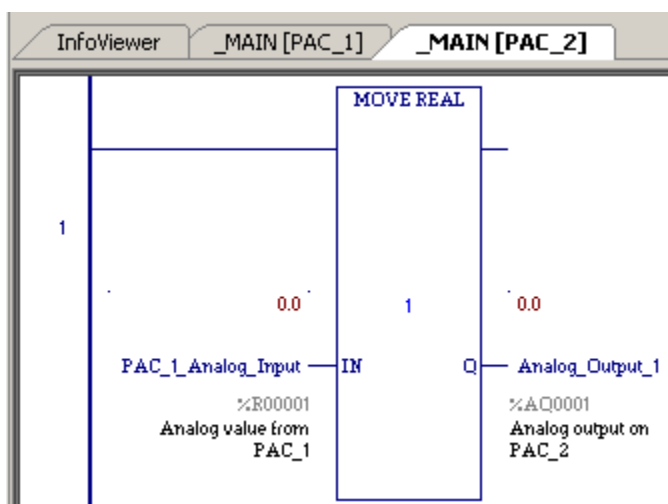
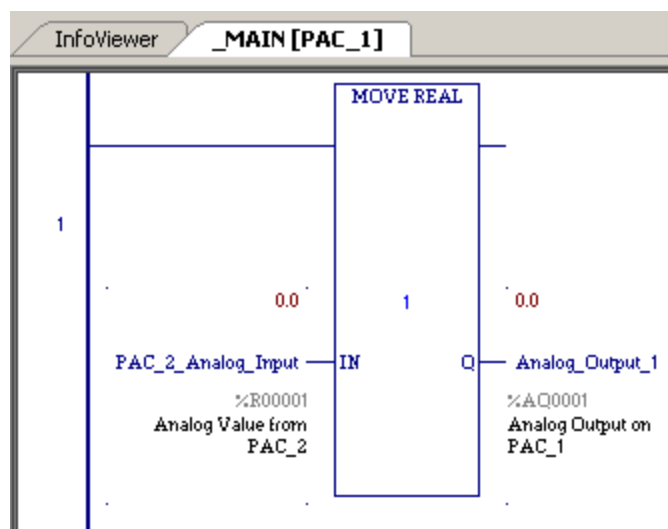
Exchange Scenario

The **PAC_2** target also has a **Produced Exchange** configured with an **ID of 2**. This matches the **Consumed Exchange in PAC_1**.

So **PAC_1** is sending the value of his potentiometer input (**Analog_Input_3**) to **PAC_2** and **PAC_2** is placing this data in **%R00001 & %R00002**.

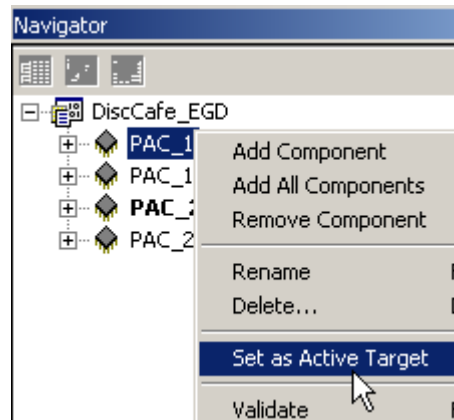
Also, **PAC_2** is sending the value of his potentiometer input (**Analog_Input_3**) to **PAC_1** and **PAC_1** is placing this data in his **%R00001 & %R00002** registers.

Additionally, in the **_MAIN** ladder block of each controller, the value being received from the other controller is being moved to its' analog output (**AnalogOutput_1**).

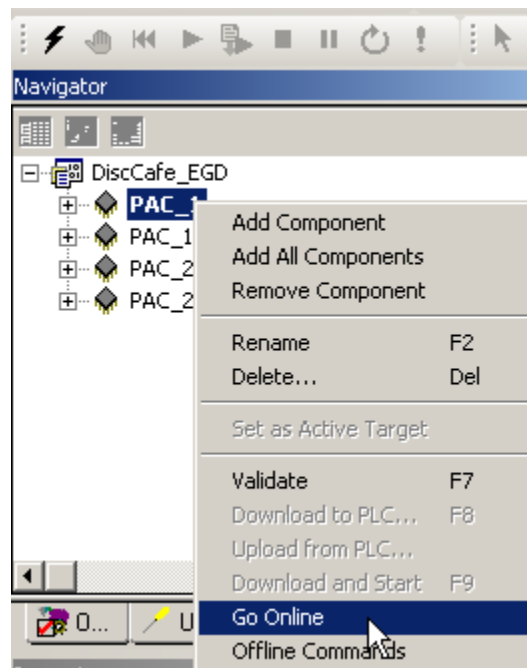


You now need to download to each of the targets in this project.

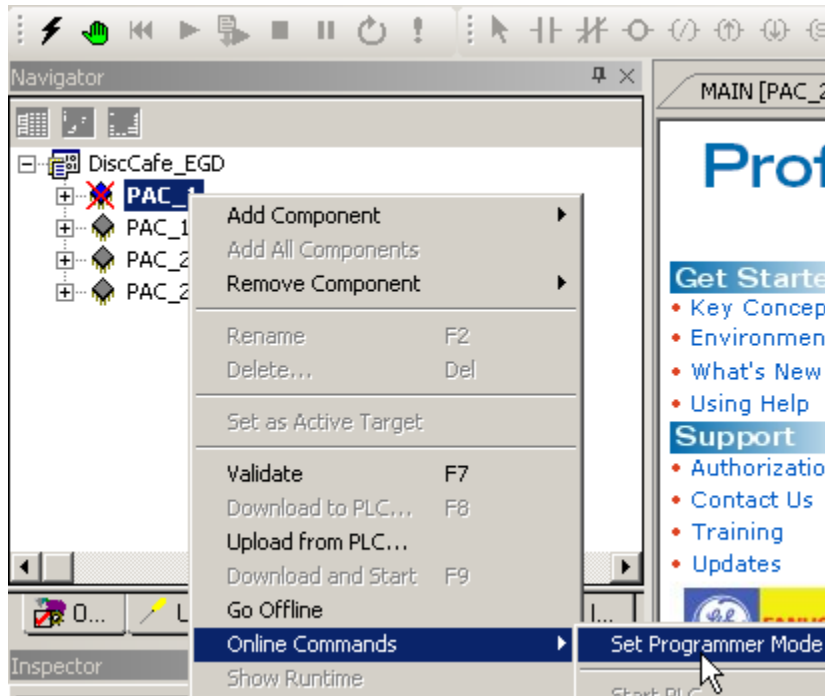
14. Begin by **right-clicking** on the **PAC_1** target and select **Set as Active Target** from the menu.



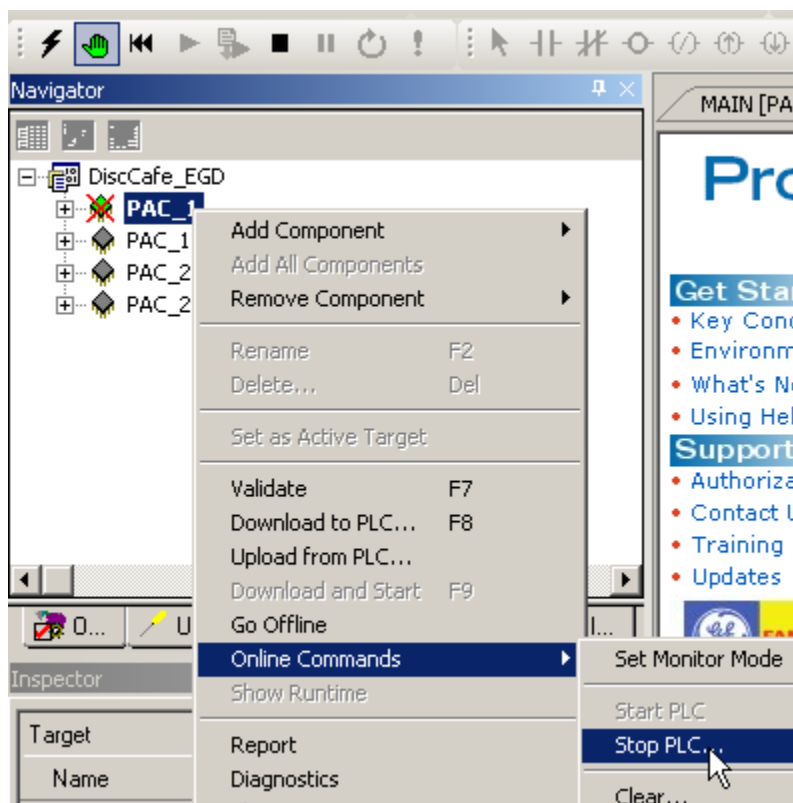
15. Now, **right-click** on the **PAC_1** target and select **Go Online** from the menu, or press the **Online/Offline** toolbar button ⚡



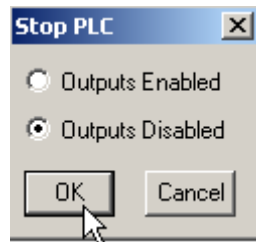
16. Next, **right-click** and select the **Online Commands, Set Programmer Mode** menu, or press the **Toggle Online Mode** toolbar button .



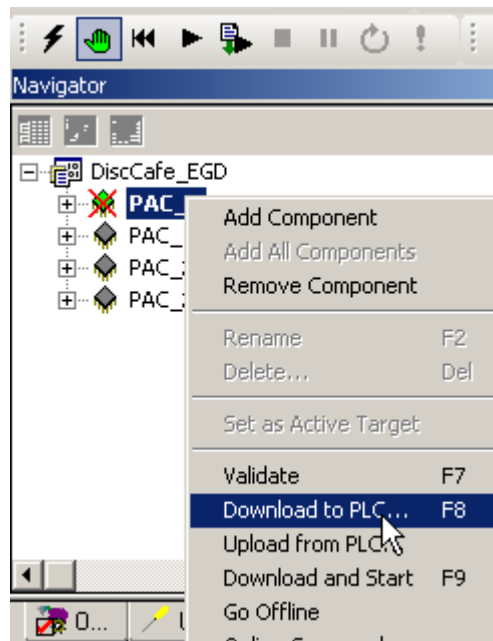
17. Next, select the **Online Commands, Stop PLC** menu, or press the **Stop Active Target** toolbar button .



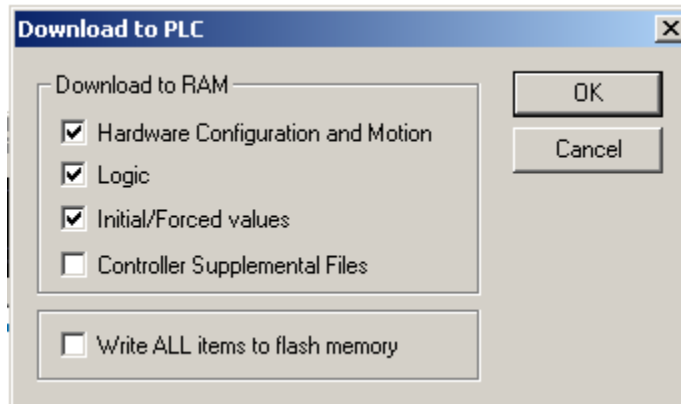
18. Click **OK**.



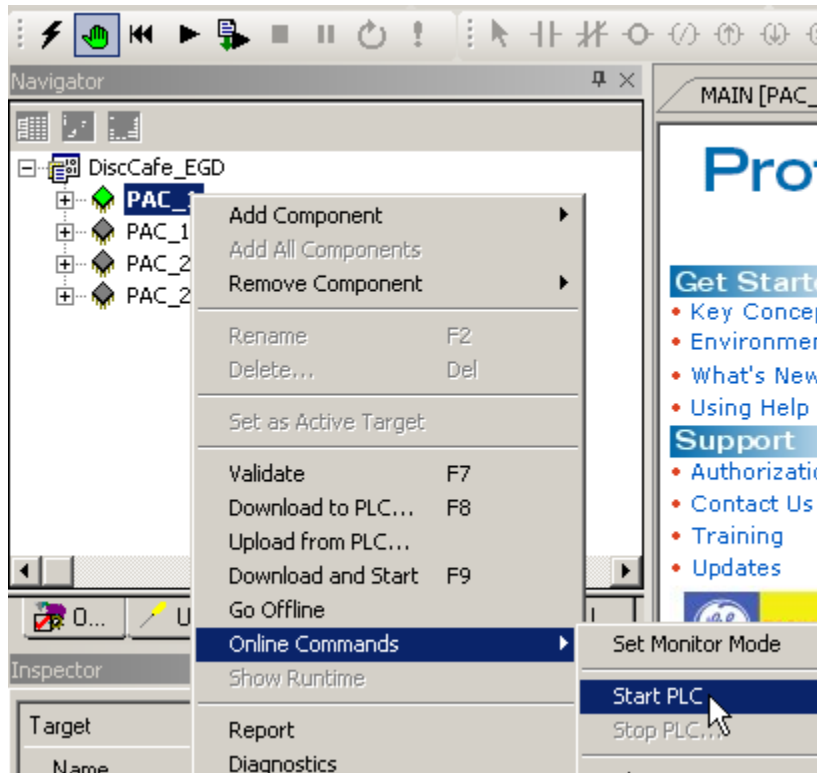
19. **Right-click** and select the **Download to PLC** menu, or press the **F8** function key, or press the **Download Active Target** toolbar button .



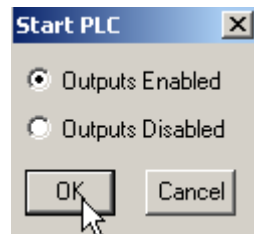
20. Check the boxes to match what is shown and click **OK**.



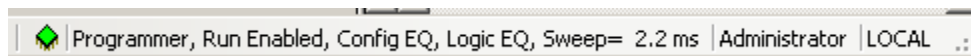
21. Select the **Online Commands, Start PLC** menu, or press the **Start Active Target** toolbar button ▶.



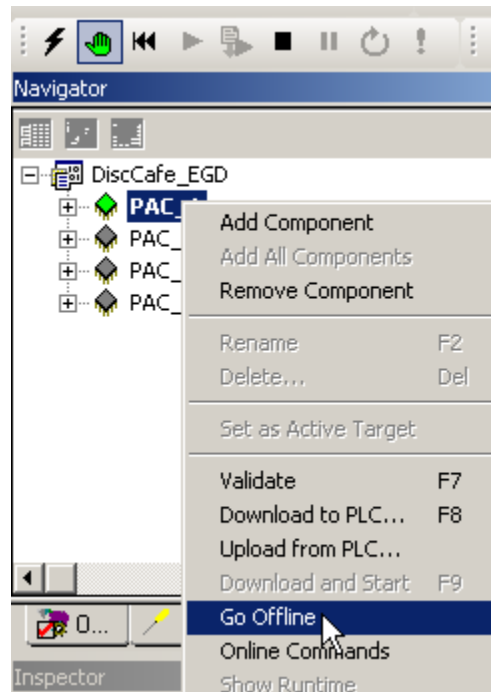
22. Click **OK**.



23. Check the information displayed on the **Status Bar** to verify that the **PACSystems controller** is in **Run Mode**, and that the **Configuration and Logic** are both **Equal**.



24. **Right-click** on the **PAC_1** target and select **Go Offline** from the menu.

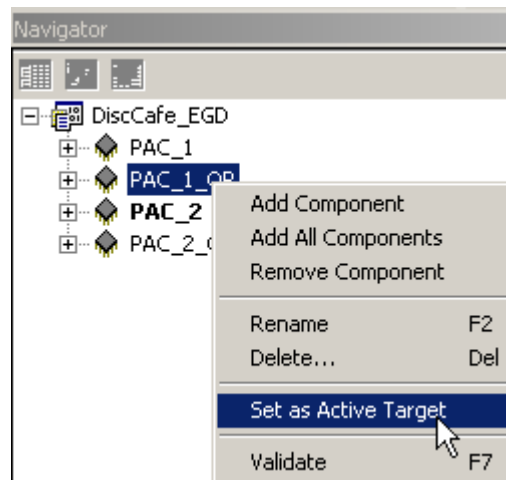


Repeat steps 14 through 24 for the PAC_2 target.

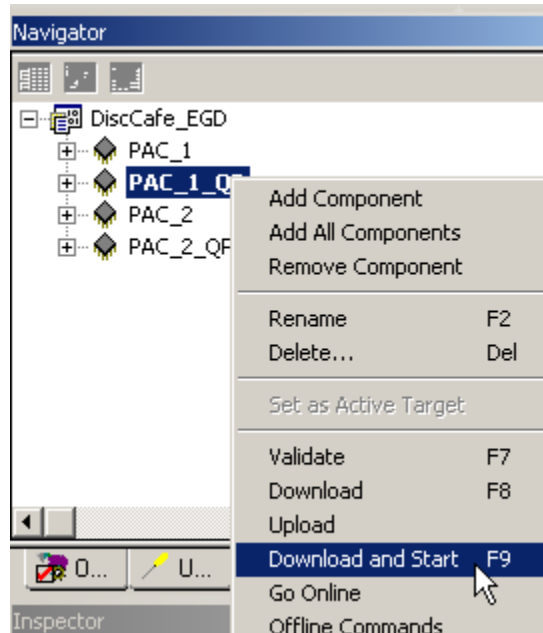
Once you have successfully downloaded and started the controllers, you can use the QuickPanels to exercise the application.

But first, you need to download the QuickPanel applications to the demo units.

25. **Right-click** on the **PAC_1_QP** target and select **Set as Active Target** from the menu.



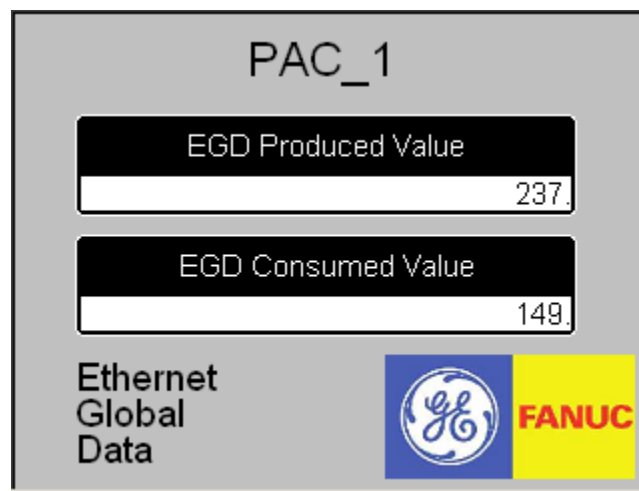
26. **Right-click** on the **QP_1** target and select **Download and Start** from the menu, or press the **F9** function key, or press the **Download and Start Active Target** toolbar button .



Repeat steps 25 and 26 for the PAC_2_QP target.

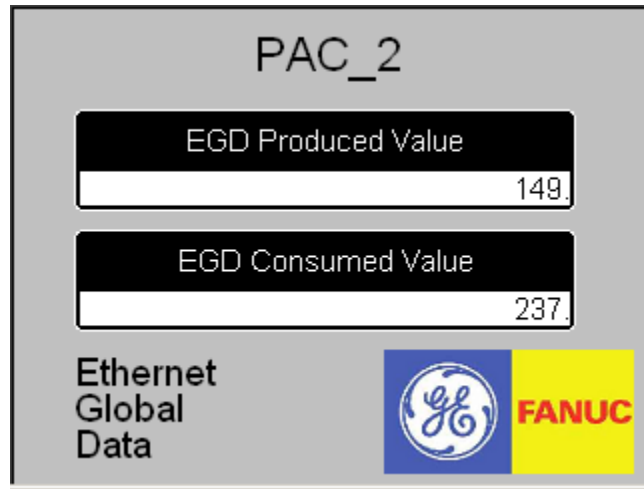
After the PAC_1_QP and PAC_2_QP applications have been successfully downloaded to the QuickPanels go to the QuickPanel screens on the PACSystems demo units and continue as instructed below.

27. Look at the screen on the **PAC_1 QuickPanel** while moving the **potentiometer** on the **PAC_2** controller's demo unit.



You will see the **EGD Consumed Value** changing. You will also see the needle on the **analog meter** on the **PAC_1** demo unit moving.

28. Now turn the **potentiometer** on the **PAC_1** demo unit while viewing the screen on the **PAC_2** demo unit's QuickPanel.



29. You will see the **EGD Consumed Value** changing. You will also see the needle on the **analog meter** on the **PAC_2** demo unit moving.

Review:

In this lab, you have been shown how:

- An EGD Produced Exchange is configured.
- An EGD Consumed Exchange is configured.