MITSUBISHI ELECTRIC AUTOMATION, INC.

Custom Solutions Center

Quick Start Guide

Ethernet TCP Communication Function Blocks

Version 1.0

Content

1 Introduction

The purpose of this document is to describe the design considerations and implementation approaches of implementing a library of Ethernet TCP communication function blocks using GX Works2 software.

It is important to note that these function blocks are designed to use with either Mitsubishi Ethernet communication modules QJ71EJ71-100 or the Ethernet port on a QnUDEH or L PLC to communicate with other devices using TCP sockets.

2 Development System Architecture

The system that is used for development includes the following components:

- A copy of Mitsubishi GX Works2 Version 1.48A running on a development PC
- System 1:
  - One Mitsubishi Q06UDEH CPU
  - Two Mitsubishi QJ71E71-100 Ethernet Modules
- System 2
  - One Mitsubishi Q13UDEH CPU with Ethernet Front Port

The following diagram illustrates the system architecture for the development implementation:

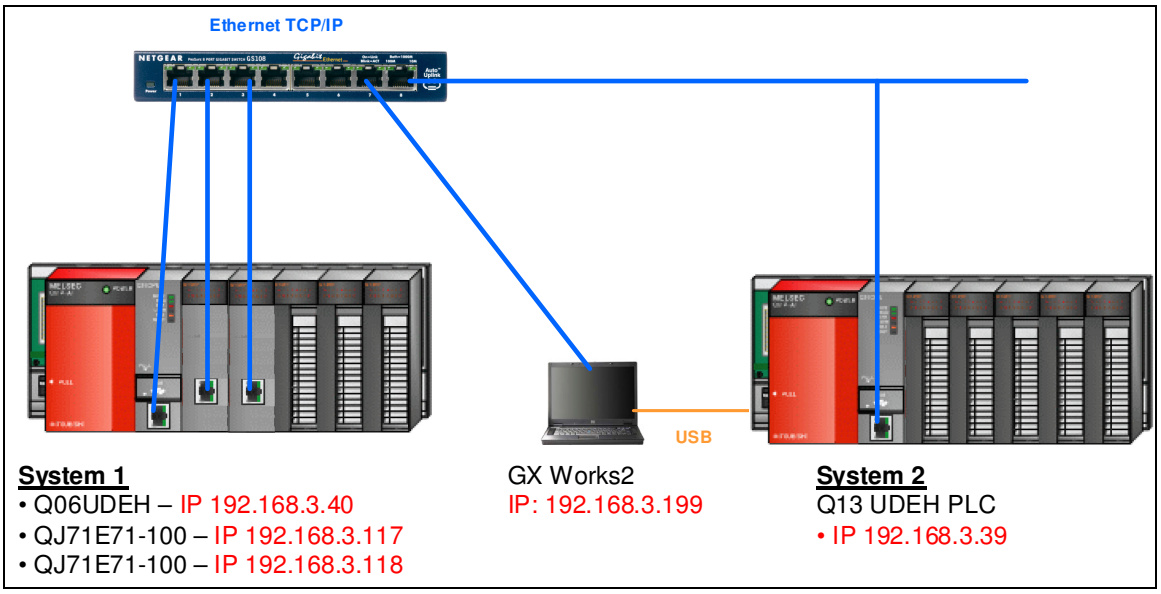


Figure 1: Development System Architecture

Two TCP communication function block libraries have been developed. One library contains TCP Communication function blocks that utilize a QJ71E71-100 Ethernet communication module and the other one contains the TCP communication function blocks that utilize the front port of an L PLC or a QnUDEH PLC.

For the QJ71E71 system, only one Ethernet module is required in most applications. For the development purposes, two modules are installed to validate the function blocks are flexible to be configured and used in either module.

A Q13UDEH PLC is used in the development architecture. However, the TCP Communication Function Blocks can be used with either an L02 PLC or any QnUDEH PLC.

2.1 *Development System Operations*

The development system is used in the development of TCP Communication FBs. The test scenarios include System 1 sending TCP packets to System 2 as well as System 2 sending TCP packets to System 1.

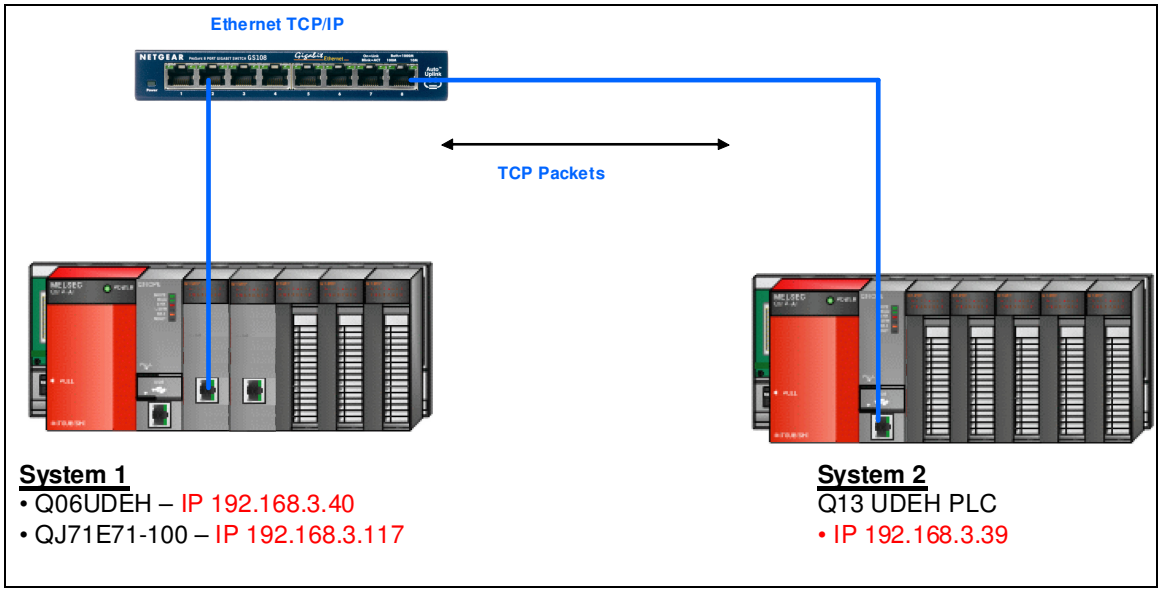


Figure 2: TCP Communication from System 1 to System 2

Proper Ethernet communication configurations of the two systems are described in Chapter 3 of this document to accomplish this communication operation.

3 System 1 - Ethernet Module Configurations

The key to TCP communication is to configure the QJ71E71-100 modules correctly in the system. The important configuration considerations of the Ethernet modules are:

- Location of the modules in the rack
- The communication channels that are used within each module.

The location of the module(s) in the rack determines the "Starting I/O" number of each rack. This information is important since it is used by the Communication FBs to determine which module the particular function block is interacting with. Similarly, the communication channels determine the paths data are sent and received.

3.1 Ethernet Module References

In the Development System architecture shown in Figure 1 above, the Starting I/O numbers are shown here:

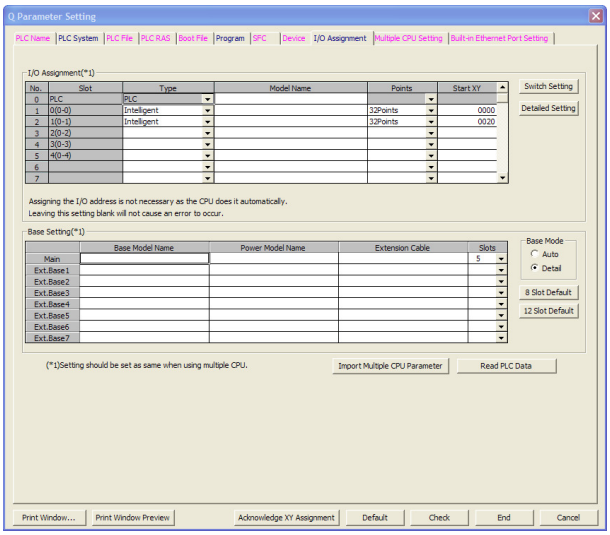


Figure 3: System 1 PLC Parameters I/O Assignments

The first Ethernet module has the Starting I/O address of 0000H and the second module 0020H.

3.2 Ethernet Module Parameter Configurations

The figure below shows the Network Parameter configuration of these two Ethernet modules in the system:

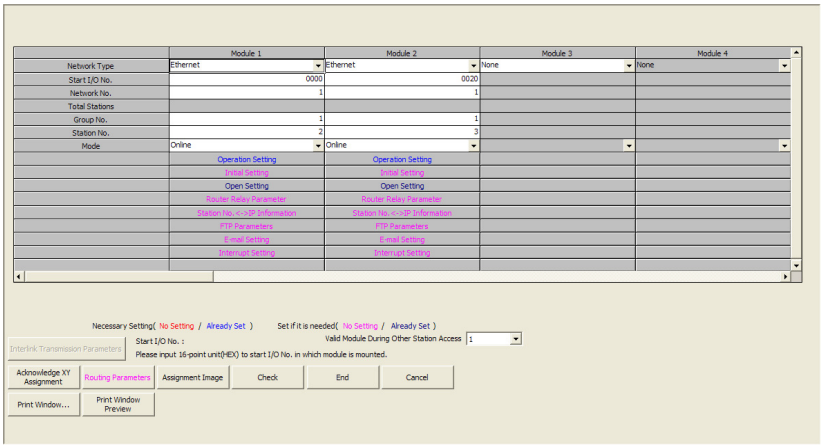


Figure 4: System 1 Ethernet Module Parameters Configurations

The Ethernet modules have the Starting I/O addresses defined properly. Both modules are on the same network (e.g. Network Number 1) and the same group (e.g. Group1). The Station numbers are assigned as 2 and 3 respectively for Module #1 and #2.

3.2.1. Ethernet Operation Settings

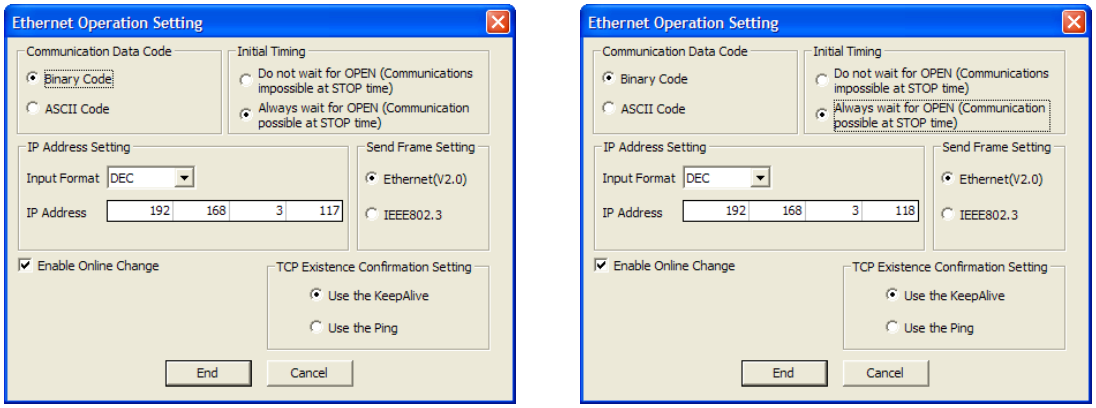


Figure 5: Operation Settings for Both Ethernet Modules

- By selecting the "Always wait for Open" check box, a TCP/IP connection needs to be opened in the PLC program using the ZP_OPEN command. In the TCP Communication FB Library, the Open_Connection_QJ71E71 FB is used to establish an active connection.
- The IP addresses of the modules are also set in the Operation Setting windows separately.
- The "Enable Online Change" selection should be checked if the module will receive MC Protocol commands to write data to the PLC.

3.2.2. Ethernet Open Settings

The Open Setting window Figure 6 allows a user to define the channels to be used for communication.

In this configuration example for the test architecture, the Channel 2 and Channel 3 of the first Ethernet module are used to send TCP packets and receive the TCP responses. This channel pair enables the QJ71E71 to be the "master" of the communication. In other words, the QJ71E71 module will establish a TCP connection to the System 2 at 192.168.3.39 through Port H2005.

Channel 4 is configured to allow the QJ71E71 module to be a "slave" of the communication. It will respond to TCP packets that are sent to the module through Port H11DB. The "master" of the communication will establish a TCP connection with this module through Port H11DB first before the module will respond.

	Protocol	Open System	Fixed Buffer	Fixed Buffer Communication Procedure	Pairing Open	Existence Confirmation	Host Station Port No.	Destination IP Address	Destination Port No.
1									
2	TCP	Active	Receive	No Procedure	Enable	No Confirm	11DA	192.168. 3. 39	2005
3	TCP	Active	Send	No Procedure	Enable	No Confirm	11DA	192.168. 3. 39	2005
4	TCP	Unpassive	Receive	No Procedure	Disable	No Confirm	11DB		
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

Figure 6: Open Setting of the QJ71E71 Module

Channel 2 and Channel 3 Configurations

- The "Open System" parameter is set to "Active" which requires the establishment of connection[1] using open connection command.
- The "Fixed Buffer Communication Procedure" is set to "No Procedure." The handshaking with an external device must be performed within a sequence program.
- The "Pairing Open" should be set to "Enable" so that two channels are used for the communication, one for receiving and one for sending. In this particular configuration above, Channel 2 is used to receive data from the target system (i.e. System 2 in the Test Architecture also referred to as the Destination in this case) located at 192.168.3.39 Port H2005.
    - In this case, TCP packets will be sent to System 2 at 192.168.3.39 and Port H2005 is configured to respond to the TCP packets as described in Section 4.1.1 "Channel 3 Configurations" below.
- The "Existence Confirmation" is set to "No Confirm" so the system does not have to confirm the existence of the external device.
- The "Host Station Port No." is set to the appropriate port number allocated to the system. In this example, it was set at H11DA.

Channel 4 Configurations

- The "Open System" parameter is set to "Unpassive" since this channel is used to respond to MC Protocol commands from external systems.
- The "Fixed Buffer" is configured to be the "Receive".
- The "Fixed Buffer Communication Procedure" is set to "No Procedure".
- The "Pairing Open" is left at the default value which is "Disable."
- The "Existence Confirmation" is left at the default value which is "No Confirm"
- The "Host Station Port No." to the appropriate port number allocated to the system. In this example, it was set at H11DB which designates this port to respond to TCP packets. This channel enables the Ethernet Front Port to be the "slave" in the TCP communication and will wait for the external system to establish the TCP connection with the Port before enabling TCP communication.

[1] *Refer to the QJ71EJ71-100 Manual Section 5.6 (b) for more information.*

4 System 2 - Ethernet Front Port Configurations

Similar Ethernet configurations are necessary to configure the front port of a QnUDEH or L Series PLC for TCP communication. The important configuration considerations of the Ethernet front port are the communication channels that are used with the Ethernet front port.

4.1 ***Ethernet Front Port Parameter Configurations***

The figure below shows the "Built-in Ethernet Port Setting" under "PLC Parameter" configuration:

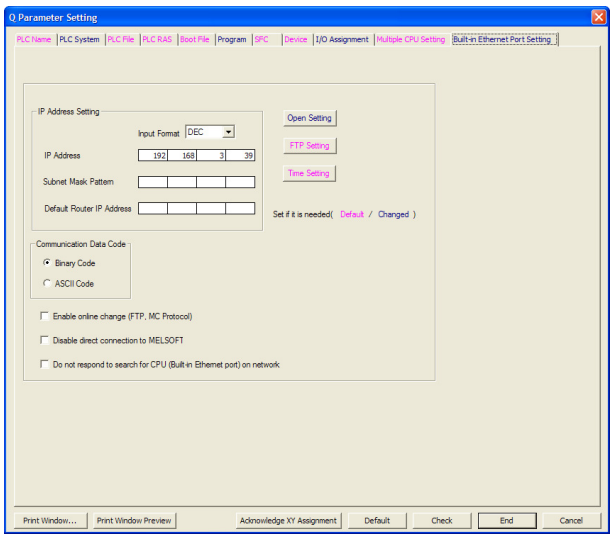


Figure 7: System 2 Ethernet Port Parameter Configurations

- The IP address of the front port is set in this window as shown.
- The "Enable Online Change (FTP, MC Protocol)" selection should be checked if the module will receive MC Protocol commands to write data to the PLC. However, it is left unchecked for TCP communication.

4.1.1. Ethernet Open Settings

The Open Setting window as shown in Figure 8 allows a user to define the channels to be used for communication.

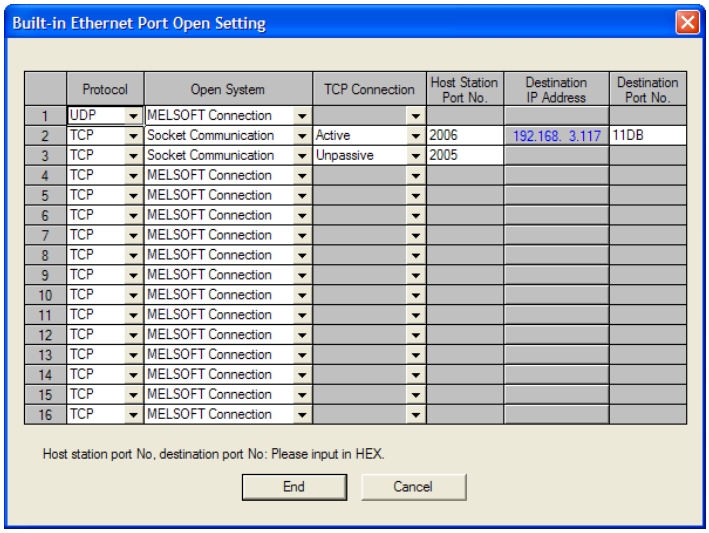


Figure 8: Open Setting of the Ethernet Front Port

In this configuration example for the test architecture, the Channel 2 of the Ethernet front port is used for Socket Communication to send and receive TCP packets. This channel enables the Ethernet front port to be the master of the communication and the responsibility to establish the TCP connection with the destination system.

Channel 3 is configured to respond to TCP packets that are sent to the front port through Port H2005. This channel enables the Ethernet Front Port to be the "slave" of the communication and will need the TCP connection to be established first by the external system.

Channel 2 Configurations

- The "Open System" parameter is set to "Socket Communication" which configures the front port to communicate using TCP Sockets. TCP packets are sent and received through socket communication using this channel.
- The "Open System" parameter is set to "Active" which requires the establishment of connection using open connection command making this channel the "master" of the communication.
- The "Host Station Port No." to the appropriate port number allocated to the system. In this example, it was set at H2006.
- The Destination system (i.e. the first Ethernet Module in System 1 of the Test Architecture) is located at 192.168.3.117 Port H11DB.
    - In this case, TCP packets will be sent to first Ethernet Module in System 1 at 192.168.3.117 and Port H11DB. The port is configured to use TCP packets described in Section 3.2.2 "Channel 4 Configuration."

Channel 3 Configurations

- The "Open System" parameter is set to "Socket Communication" which configures this channel for TCP communication.
- The "Host Station Port No." to the appropriate port number allocated to the system. In this example, it was set at H2005 which designates this port to respond to TCP packets. This channel enables the Ethernet Front Port to be the "slave" in the TCP communication and will wait for the external system to establish the TCP connection with the Port before enabling TCP communication.

5 Communication Function Blocks for Use with QJ71E71 Modules

TCP Communication Function blocks are designed to be configurable without hard-coding of parameters. Thus, the FBs do not assume a QJ71EJ71-100 module is located at a certain slot in the PLC rack and the module is addressed using its starting I/O location. Similarly, the channels that are used for communication are also configurable.

5.1 Communication Library for use with QJ71E71

The GX Works 2 User Library **Comm_Lib_QJ71E71** contains the following function blocks:

Function Blocks	Description
Open_Connection_QJ71E71	Establishing TCP connection with the target system
Close_Connection_QJ71E71	Disconnecting the existing TCP connection with the target system
Buffer_Send_QJ71E71	Sending TCP packets to the target system
Buffer_Receive_QJ71E71	Receiving TCP packets to the target system

5.2 Open_Connection_QJ71E71 Function Block

The purpose of the Open_Connection_QJ71E71 Function Block is used to establish a TCP/IP connection between the Ethernet module and the target system.

The Open_Connection_QJ71E71 Function Block is shown below:

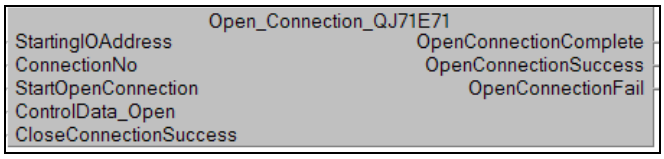


Figure 9: Open_Connection_QJ71E71 Function Block

5.2.1. FB Local Variables

The local variables that are used by the FB are described in this section.

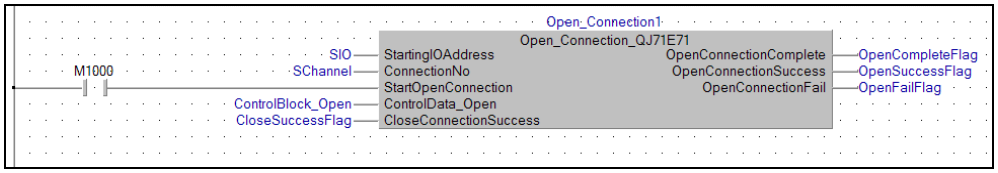
Variable Type	Variable Label	Data Type	Description
VAR_INPUT	StartingIOAddress	Word[Signed]	The Starting I/O Address of the Ethernet module as defined in the Network Parameter -> Ethernet/CC IE / MELSECNET parameter screen.
VAR_INPUT	ConnectionNo	Word[Signed]	The connection number of the first connection of the Receive / Send pair as defined in the "Open Setting" screen.
VAR_INPUT	StartOpenConnection	Bit	The transition of this input from 0 to 1 will cause the FB to operate.
VAR_INTPUT	ControlData_Open	Word[Signed](0..9)	The user should allocate the 10 word array where the control data for the ZP_OPEN command that is being used in the Open_Connection FB. The FB is operating under the assumption that the Ethernet configurations in defined in the Parameter Setting of the GX Works 2 are used to define how ZP_OPEN should operate, i.e. the first word of Control Data array is set to zero. (Refer to Section 10.8 of QJ71EJ71-100 manual) Thus, the users of the Open_Connection FB do not have to configure the Control Data array before calling the FB. However, the status of the ZP_Open command is written back to the second word of the Control Data array. (Refer to Section 10.8 of QJ71EJ71-100 manual) thus the Control Data Array locations need to be defined.

Variable Type	Variable Label	Data Type	Description
VAR_INPUT	CloseConnectionSuccess	Bit	The status of the previous Close Connection FB operation should be fed here.
VAR_OUTPUT	OpenConnectionComplete	Bit	When the flag is set, it indicates the completion of Open Connection operation.
VAR_OUTPUT	OpenConnectionSuccess	Bit	When the flag is set, it indicates the successful completion of Open Connection operation.
VAR_OUTPUT	OpenConnectionFail	Bit	When the flag is set, it indicates the Open Connection operation has failed.

5.2.2. Example

This example consists of the following factors:

- Using the second QJ71E71 module in the system as defined by SIO, SIO = H0020;
- Using the first pair of channels of the module as defined in label SChannel, SChannel = 1;
- When M1000 transitions from off to on, the TCP connection as defined in the Open Settings of Ethernet Module 2 will be opened. If the connection is successfully established, the OpenCompleteFlag and the OpenSuccessFlag will both be on. If the connection failed, the OpenCompleteFlag and the OpenFailFlag will both be on.



5.3 *Close_Connection_QJ71E71 Function Block*

The purpose of the Close_Connection_QJ71E71 Function Block is to close the TCP/IP connection that has been established between the PLC system Ethernet module and the Target System.

The Close_Connection_QJ71E71 Function Block is shown below:

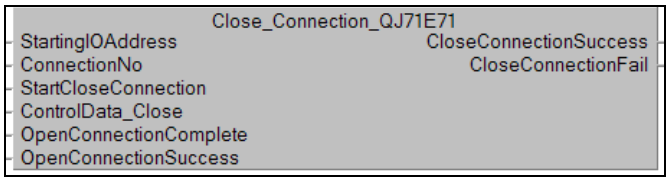


Figure 10: Close_Connection_QJ71E71 Function Block

5.3.1. FB Local Variables

The local variables that are used by the FB are described in this section.

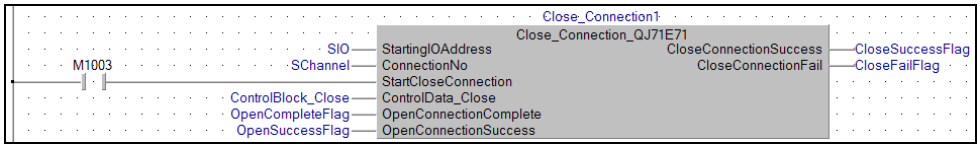
Variable Type	Variable Label	Data Type	Description
VAR_INPUT	StartingIOAddress	Word[Signed]	The Starting I/O Address of the Ethernet module as defined in the Network Parameter -> Ethernet/CC IE / MELSECNET parameter screen.
VAR_INPUT	ConnectionNo	Word[Signed]	The connection number of the first connection of the Receive / Send pair as defined in the "Open Setting" screen.
VAR_INPUT	StartCloseConnection	Bit	The transition of this input from 0 to 1 will cause the Close_Connection FB to operate.

Variable Type	Variable Label	Data Type	Description
VAR_INPUT	ControlData_Close	Word[Signed](0..1)	The user should allocate the 2 word array where the control data for the ZP_CLOSE command that is used in the Close_Connection FB. The status of the ZP_CLOSE command is written back to the second word of the Control Data array. (Refer to Section 10.5 of QJ71EJ71-100 manual).
VAR_INPUT	OpenConnectionComplete	Bit	The open connection complete status of the previous Open_Connection FB operation should be fed here.
VAR_INPUT	OpenConnectionSuccess	Bit	The open connection success status of the previous Open_Connection FB operation should be fed here.
VAR_INPUT	ControlData_Close	Word[Signed](0..1)	The user should allocate the 2 word array where the control data for the ZP_CLOSE command that is used in the Close_Connection FB. The status of the ZP_CLOSE command is written back to the second word of the Control Data array. (Refer to Section 10.5 of QJ71EJ71-100 manual).
VAR_OUTPUT	CloseConnectionSuccess	Bit	When the flag is set, it indicates the successful completion of Close Connection operation.
VAR_OUTPUT	CloseConnectionFail	Bit	When the flag is set, it indicates the Close Connection operation has failed.

5.3.2. Example

This example consists of the following factors:

- Using the second QJ71E71 module in the system as defined by SIO, SIO = H0020;
- Using the first pair of channels of the module as defined in label SChannel, SChannel = 1;
- When M1003 transitions from off to on, the opened TCP connection as defined in the Open Settings of Ethernet Module 2 will be closed. If the connection is successfully closed, the CloseSuccessFlag will be on. If the connection close failed, the CloseFailFlag will be on.



5.4 *Buffer_Send_QJ71E71 Function Block*

The purpose of the Buffer_Send_QJ71E71 Function Block is to send a number of data bytes to the target system. The FB allows the user to specify the starting I/O address of the Ethernet module and the connection channel that is used to send the TCP packets.

If the Buffer_Send command does not complete properly, an error code will be returned.

The Buffer_Send_QJ71E71 Function Block is shown below:

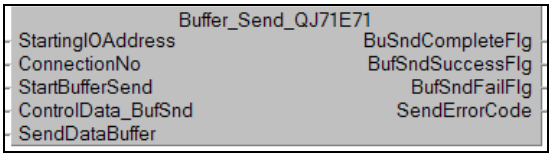


Figure 11: Buffer_Send_QJ71E71 Function Block

5.4.1. FB Local Variables

The local variables that are used by the FB are described in this section.

Variable Type	Variable Label	Data Type	Description
VAR_INPUT	StartingIOAddress	Word[Signed]	The Starting I/O Address of the Ethernet module as defined in the Network Parameter -> Ethernet/CC IE / MELSECNET parameter screen.
VAR_INPUT	ConnectionNo	Word[Signed]	The connection number of the first connection of the Receive / Send pair as defined in the "Open Setting" screen.
VAR_INPUT	StartBufferSend	Bit	The transition of this input from 0 to 1 will cause the Buffer_Send FB to operate.
VAR_INTPUT	ControlData_BufSnd	Word[Signed](0..1)	The user should allocate the 2 word array where the control data for the ZP_BUFSND command that is used in the Buffer_Send FB. The status of the ZP_BUFSND command is written back to the second word of the Control Data array. (Refer to Section 10.4 of QJ71EJ71-100 manual).
VAR_INPUT	SendDataBuffer	Word[Signed](0..1023)	The 1024 word array to hold the data to be sent to the target system. The buffer is allowed for the maximum number of words that can be sent per each ZP_BUFSND command.
VAR_OUTPUT	BuSndCompleteFlg	Bit	This bit indicates the buffer send operation is complete.
VAR_OUTPUT	BufSndSuccessFlg	Bit	When the flag is set, it indicates the successful completion of Buffer Send operation.
VAR_OUTPUT	BufSndFailFlg	Bit	When the flag is set, it indicates the Buffer Send operation has failed.
VAR_OUTPUT	SendErrorCode	Word[Signed]	If the Buffer_Send command does not complete as expected, the error code from the system will be stored here. If there is no error, this code will be zero.

5.4.2. Example

This example consists of the following factors:

- Using the first QJ71E71 in the system,
- Using Channel 1 and 2 of the module,
- Sending 3 bytes from the SndDataBuffer array to the target system

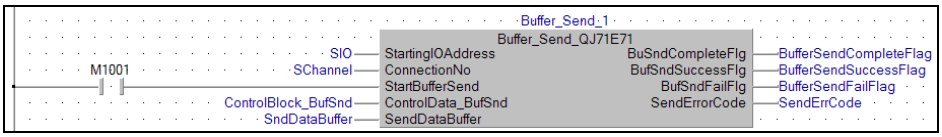


Figure 12: Example of Using Buffer_Send_QJ71E71

The user should provide the following input values to the function block before executing the function block:

Label	Value
SIO	H0000
SChannel	1
SndDataBuffer[0]	3
SndDataBuffer[1]	HBBAA
SndDataBuffer[2]	HDDCC

When M1001 bit is on, the function block executes and 3 bytes of data will be send in TCP packets in the order of AA, BB, and CC to the target system.

5.5 Buffer_Receive_QJ71E71 Function Block

The purpose of the Buffer_Receive_QJ71E71 Function Block is to receive a number of data bytes from the target system using TCP sockets. The FB allows the user to specify the starting I/O address of the Ethernet module and the connection channel that is used to receive the TCP packets.

The Buffer_Receive_QJ71E71 Function Block is shown below:

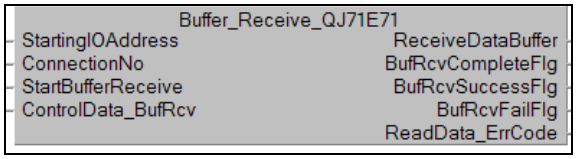


Figure 13: Batch_Receive_QJ71E71 Function Block

5.5.1. FB Local Variables

The local variables that are used by the FB are described in this section.

Variable Type	Variable Label	Data Type	Description
VAR_INPUT	StartingIOAddress	Word[Signed]	The Starting I/O Address of the Ethernet module as defined in the Network Parameter -> Ethernet/CC IE / MELSECNET parameter screen.
VAR_INPUT	ConnectionNo	Word[Signed]	The connection number of the first connection of the Receive / Send pair as defined in the "Open Setting" screen.
VAR_INPUT	StartBufferReceive	Bit	The transition of this input from 0 to 1 will cause the FB to operate.
VAR_INPUT	ControlData_BufRcv	Word[Signed](0..1)	The user should allocate the 2 word array where the control data for the ZP_BUFRCV command that is used in the Buffer_Receive FB. The status of the ZP_BUFRCV command is written back to the second word of the Control Data array. (Refer to Section 10.2 of QJ71EJ71-100 manual).
VAR_OUTPUT	ReceiveDataBuffer	Word[Signed](0..1023)	The 1024 word array to hold the data to that are received from the target system. The buffer is allowed for the maximum number of words that can be received per each ZP_BUFRCV command. The first word of the array will be the number of bytes received.
VAR_OUTPUT	BuRcvCompleteFlg	Bit	This bit indicates the buffer receive operation is complete.
VAR_OUTPUT	BufRcvSuccessFlg	Bit	When the flag is set, it indicates the successful completion of Buffer Receive operation.
VAR_OUTPUT	BufRcvFailFlg	Bit	When the flag is set, it indicates the Buffer Receive operation has failed.
VAR_OUTPUT	ReceiveData_ErrCode	Word[Signed]	If the Buffer_Receive command does not receive the data properly, the error code will be stored here. If there is no error, this code will be zero.

5.5.2. Example

This example consists of the following factors:

- Using the second QJ71E71 in the system,
- Using Channel 3 of the module,
- Receiving 5 bytes (H12, H34, H56, H78, H9A in sequence in the TCP data packet) from the target system

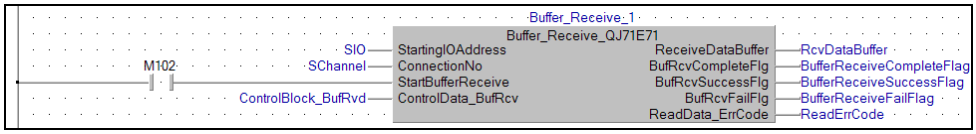


Figure 14: Example of Using Buffer_Receive_QJ71E71

When M102 bit is on, the function block executes and the results of the Buffer_Receive operation will be as follows:

Label	Value
SIO	H0020
SChannel	3
RcvDataBuffer	[0]: 5 [1]: H3412 [2]: 7856 [3]: 9A00

6 Communication Function Blocks for Use with PLC Ethernet Front Ports

This chapter describes the TCP Communication Function blocks to be used with the Ethernet front port of a PLC module (i.e. QnUEDH or L).

6.1 Communication Library for use with PLC Ethernet Front Ports

The GX Works 2 User Library **Comm_Lib_PLCEPort** contains the following function blocks:

Function Blocks	Description
Open_Connection_PLCEPort	Establishing TCP connection with the target system
Close_Connection_PLCEPort	Disconnecting the existing TCP connection with the target system
Buffer_Send_PLCEPort	Sending TCP packets to the target system
Buffer_Receive_PLCEPort	Receiving TCP packets to the target system

6.2 Open_Connection_PLCEPort Function Block

The purpose of the Open_Connection_PLCEPort Function Block is used to establish a TCP/IP connection between the PLC Ethernet port and the target system.

The Open_Connection_PLCEPort Function Block is shown below:

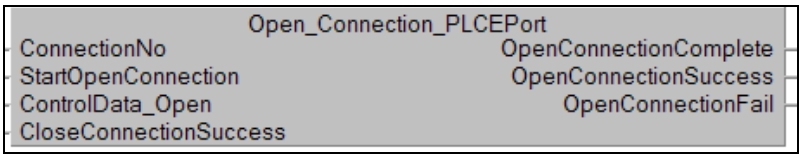


Figure 15: Open_Connection_PLCEPort Function Block

6.2.1. FB Local Variables

The local variables that are used by the FB are described in this section.

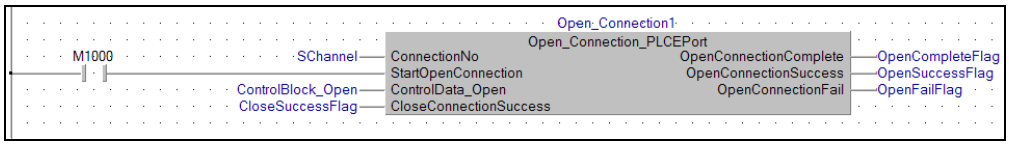
Variable Type	Variable Label	Data Type	Description
VAR_INPUT	ConnectionNo	Word[Signed]	The connection number of the channel as defined in the "Open Setting" screen to use the Socket Communication.
VAR_INPUT	StartOpenConnection	Bit	The transition of this input from 0 to 1 will cause the FB to operate.
VAR_INPUT	ControlData_Open	Word[Signed](0..9)	The user should allocate the 10 word array where the control data for the SP_SOCOPEN command that is being used in the Open_Connection FB. The FB is operating under the assumption that the Ethernet configurations in defined in the Parameter Setting of the GX Works 2 are used to define how SP_SOCOPEN should operate, i.e. the first word of Control Data array is set to zero. Thus, the users of the Open_Connection FB do not have to configure the Control Data array before calling the FB. However, the status of the SP_SOCOpen command is written back to the second word of the Control Data array. thus the Control Data Array locations need to be defined.
VAR_INPUT	CloseConnectionSuccess	Bit	The status of the previous Close Connection FB operation should be fed here.
VAR_OUTPUT	OpenConnectionComplete	Bit	When the flag is set, it indicates the completion of Open Connection operation.
VAR_OUTPUT	OpenConnectionSuccess	Bit	When the flag is set, it indicates the successful completion of Open Connection operation.

Variable Type	Variable Label	Data Type	Description
VAR_OUTPUT	OpenConnectionFail	Bit	When the flag is set, it indicates the Open Connection operation has failed.

6.2.2. Example

This example consists of the following factors:

- Using the first pair of channels of the module as defined in label SChannel, SChannel = 1;
- When M1000 transitions from off to on, the TCP connection as defined in the Open Settings of Ethernet Module 2 will be opened. If the connection is successfully established, the OpenCompleteFlag and the OpenSuccessFlag will both be on. If the connection failed, the OpenCompleteFlag and the OpenFailFlag will both be on.



6.3 *Close_Connection_PLCEPort Function Block*

The purpose of the Close_Connection_PLCEPort Function Block is to close the TCP/IP connection that has been established between the PLC system Ethernet module and the Target System.

The Close_Connection_PLCEPort Function Block is shown below:

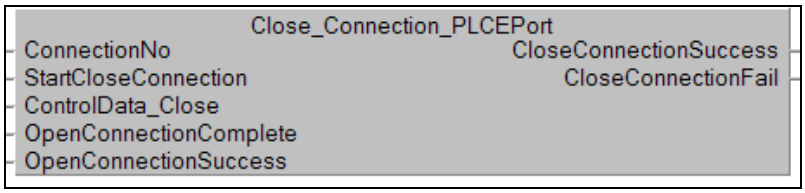


Figure 16: Close_Connection_PLCEPort Function Block

6.3.1. FB Local Variables

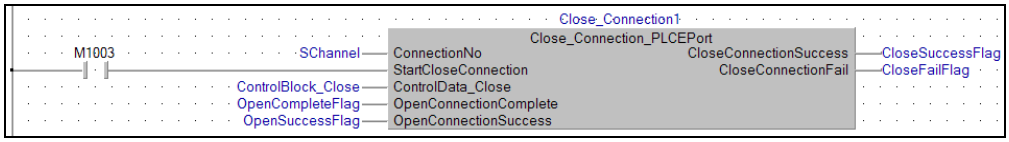
The local variables that are used by the FB are described in this section.

Variable Type	Variable Label	Data Type	Description
VAR_INPUT	ConnectionNo	Word[Signed]	The connection number of the channel as defined in the "Open Setting" screen to use the Socket Communication.
VAR_INPUT	StartCloseConnection	Bit	The transition of this input from 0 to 1 will cause the Close_Connection FB to operate.
VAR_INPUT	ControlData_Close	Word[Signed](0..1)	The user should allocate the 2 word array where the control data for the SP_SOCCLOSE command that is used in the Close_Connection FB. The status of the SP_SOCCLOSE command is written back to the second word of the Control Data array.
VAR_INPUT	OpenConnectionComplete	Bit	The open connection complete status of the previous Open_Connection FB operation should be fed here.
VAR_INPUT	OpenConnectionSuccess	Bit	The open connection success status of the previous Open_Connection FB operation should be fed here.
VAR_OUTPUT	CloseConnectionSuccess	Bit	When the flag is set, it indicates the successful completion of Close Connection operation.
VAR_OUTPUT	CloseConnectionFail	Bit	When the flag is set, it indicates the Close Connection operation has failed.

6.3.2. Example

This example consists of the following factors:

- Using the first pair of channels of the module as defined in label SChannel, SChannel = 1;
- When M1003 transitions from off to on, the opened TCP connection as defined in the Open Settings of Ethernet Module 2 will be closed. If the connection is successfully closed, the CloseSuccessFlag will be on. If the connection close failed, the CloseFailFlag will be on.



6.4 Buffer_Send_PLCEPort Function Block

The purpose of the Buffer_Send_PLCEPort Function Block is to send a number of data bytes to the target system. The FB allows the user to specify the starting connection channel that is used to send the TCP packets.

If the Buffer_Send command does not complete properly, an error code will be returned.

The Buffer_Send_PLCEPort Function Block is shown below:

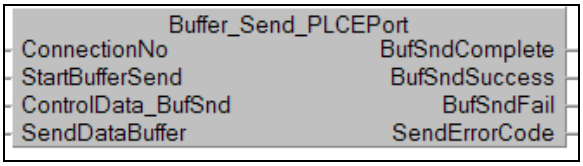


Figure 17: Buffer_Send_PLCEPORT Function Block

6.4.1. FB Local Variables

The local variables that are used by the FB are described in this section.

Variable Type	Variable Label	Data Type	Description
VAR_INPUT	ConnectionNo	Word[Signed]	The connection number of the first connection of the Receive / Send pair as defined in the “Open Setting” screen.
VAR_INPUT	StartBufferSend	Bit	The transition of this input from 0 to 1 will cause the Buffer_Send FB to operate.
VAR_INPUT	ControlData_BufSnd	Word[Signed](0..1)	The user should allocate the 2 word array where the control data for the ZP_BUFSND command that is used in the Buffer_Send FB. The status of the ZP_BUFSND command is written back to the second word of the Control Data array. (Refer to Section 10.4 of QJ71EJ71-100 manual).
VAR_INPUT	SendDataBuffer	Word[Signed](0..1023)	The 1024 word array to hold the data to be sent to the target system. The buffer is allowed for the maximum number of words that can be sent per each ZP_BUFSND command.
VAR_OUTPUT	BufSndComplete	Bit	This bit indicates the buffer send operation is complete.
VAR_OUTPUT	BufSndSuccess	Bit	When the flag is set, it indicates the successful completion of Buffer Send operation.
VAR_OUTPUT	BufSndFail	Bit	When the flag is set, it indicates the Buffer Send operation has failed.
VAR_OUTPUT	SendErrorCode	Word[Signed]	If the Buffer_Send command does not complete as expected, the error code from the system will be stored here. If there is no error, this code will be zero.

6.4.2. Example

This example consists of the following factors:

- Using the first PLCEPORT in the system,
- Using Channel 2 and 3 of the module,
- Sending 3 bytes from the SndDataBuffer array to the target system

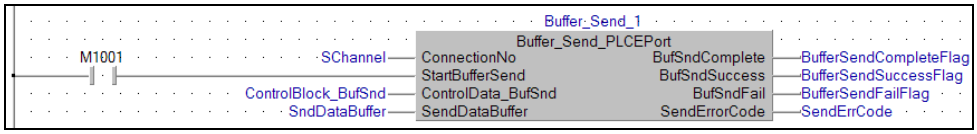


Figure 18: Example of Using Buffer_Send_PLCEPort

The user should provide the following input values to the function block before executing the function block:

Label	Value
SChannel	2
SndDataBuffer[0]	3
SndDataBuffer[1]	HBBAA
SndDataBuffer[2]	HDDCC

When M1001 bit is on, the function block executes and 3 bytes of data will be send in TCP packets in the order of AA, BB, and CC to the target system.

6.5 Buffer_Receive_PLCEPort Function Block

The purpose of the Buffer_Receive_PLCEPort Function Block is to receive a number of data bytes from the target system using TCP sockets. The FB allows the user to specify the connection channel that is used to receive the TCP packets.

The Buffer_Receive_PLCEPort Function Block is shown below:

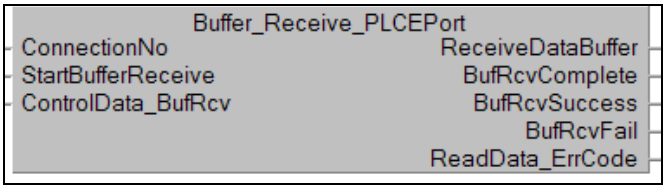


Figure 19: Batch_Receive_PLCEPort Function Block

6.5.1. FB Local Variables

The local variables that are used by the FB are described in this section.

Variable Type	Variable Label	Data Type	Description
VAR_INPUT	ConnectionNo	Word[Signed]	The connection number of the first connection of the Receive / Send pair as defined in the “Open Setting” screen.
VAR_INPUT	StartBufferReceive	Bit	The transition of this input from 0 to 1 will cause the FB to operate.

Variable Type	Variable Label	Data Type	Description
VAR_INPUT	ControlData_BufRcv	Word[Signed](0..1)	The user should allocate the 2 word array where the control data for the ZP_BUFRCV command that is used in the Buffer_Receive FB. The status of the ZP_BUFRCV command is written back to the second word of the Control Data array. (Refer to Section 10.2 of QJ71EJ71-100 manual).
VAR_OUTPUT	ReceiveDataBuffer	Word[Signed](0..1023)	The 1024 word array to hold the data to that are received from the target system. The buffer is allowed for the maximum number of words that can be received per each ZP_BUFRCV command. The first word of the array will be the number of bytes received.
VAR_OUTPUT	BufRcvComplete	Bit	This bit indicates the buffer receive operation is complete.
VAR_OUTPUT	BufRcvSuccess	Bit	When the flag is set, it indicates the successful completion of Buffer Receive operation.
VAR_OUTPUT	BufRcvFail	Bit	When the flag is set, it indicates the Buffer Receive operation has failed.
VAR_OUTPUT	ReadData_ErrCode	Word[Signed]	If the Buffer_Receive command does not receive the data properly, the error code will be stored here. If there is no error, this code will be zero.

6.5.2. Example

This example consists of the following factors:

- Using Channel 3 of the module,
- Receiving 5 bytes (H12, H34, H56, H78, H9A in sequence in the TCP data packet) from the target system

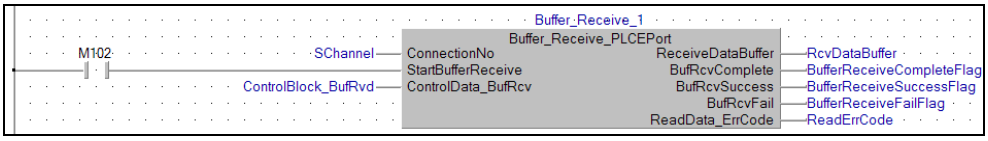


Figure 20: Example of Using Buffer_Receive_PLCEPORT

When M102 bit is on, the function block executes and the results of the Buffer_Receive operation will be as follows:

Label	**Value**	
SChannel	3	
RcvDataBuffer	[0]: 5 [2]: 7856	[1]: H3412 [3]: 9A00