Grid Connect Modbus/TCP Adapter
CP1W-MODTCP61

Application and Setup Guide

1

Introduction

This section describes the features of the CP1W-MODTCP61 Modbus TCP adapter.

1-1   Introduction

1-1-1   Features

Modbus TCP Slave/Server Mode

The adapter allows a PLC to act as a Modbus TCP slave device. The adapter will respond to Modbus TCP commands from another master device using the Modbus TCP protocol. The following functions are supported.

- Read Coil Status
- Read Input Status
- Read Holding Registers
- Read Input Registers
- Write Single Coil
- Preset Single Register
- Write Multiple Coils
- Preset Multiple Register

Modbus TCP Master/Client Mode

The adapter allows a PLC to act as a Modbus TCP master device. The adapter will initiate Modbus TCP commands and process responses to other slave devices using the Modbus TCP protocol.

PLC Option Board Slot Mounting

The adapter mounts in the Option Board Slot on the front of a CP1L or CP1H PLC, and can be used in all CP1L / CP1H PLCs with an available Option Board Slot. A CP1L or CP1H PLC with 2 option board slots can use 2 CP1W-MODTCP61 adapters, with one functioning as a Modbus TCP Master / Client and one functioning as a Modbus TCP Slave / Server.

The adapter mounts in the Option Board Slot on the front of a CJ2M-3☐ PLC. When used in a CJ2M series PLC, the adapter will only function as a Modbus TCP Slave / Server.

1-1-2   Compatible PLCs

The following table provides compatibility and configuration details about PLC models that support the CP1W-MODTCP61 Unit.

PLC Model	Compatible	Mode	Details
CP1E-E	NO	--	Option port does not support the required proto-col
CP1E-N		--	
CP1L-L	YES	Slave/Server and Master/Client	Compatible on models with available option port, configure with DIP switches/CX-Programmer
CP1L-EL			Configure with CX-Programmer
CP1L-EM			
CP1L-M			Configure with DIP switches/CX-Programmer
CP1H-Y			
CP1H-X			
CJ2M-3☐		Slave/Server	Option port does not support the required proto-col for Master/Client mode

2

Operation

This section describes the configuration details of the CP1W-MODTCP61 Unit.

2-1   Installation

The CP1W-MODTCP61 Modbus TCP adapter mounts in an available Option Board Slot on the front of the CPU.
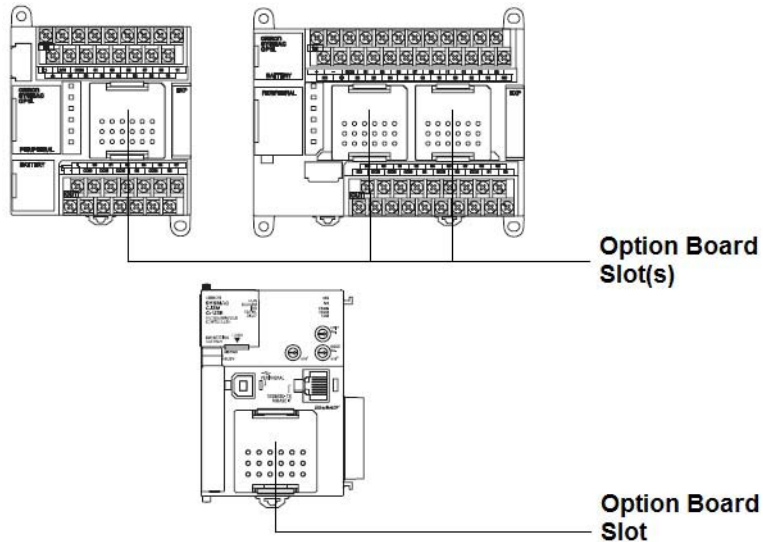
● **Mounting an Option Board**

When mounting an Option Board, first remove the slot cover. Grasp the lock levers at the top and bottom of the cover at the same time to unlock the cover, and then pull the cover out. Then to mount the Option Board, check the alignment and firmly press it in until it snaps into place.

Precautions for Correct Use

Always turn OFF the power supply to the PLC before mounting or removing an Option Board.

2-1-1   PLC Setup

The CP1W-MODTCP61 adapter uses the Toolbus protocol when in the Modbus TCP Slave/Server mode and the Serial Gateway protocol when in the Modbus TCP Master/Client Mode. Switch settings and/or PLC port settings must be adjusted based on the mode selected. More details on operating mode can be found in *2-3 Operation Modes*.

Precautions for Safe Use

Always turn OFF the power supply to the PLC before attempting to set the DIP switches. Not turning OFF the power supply may result in malfunction or electric shock.

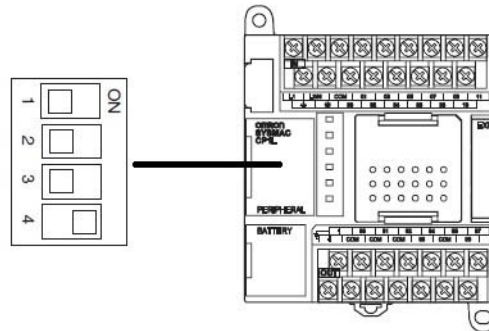**Precautions for Correct Use**

Always turn OFF the power supply to the PLC before mounting or removing the CP1W-MODTCP61 unit.

Modbus TCP Slave/Server PLC Setup

The CP1W-MODTCP61 adapter uses the Toolbus protocol when operating in the Slave / Server mode. PLC settings are shown below to configure the Option Board Slot.
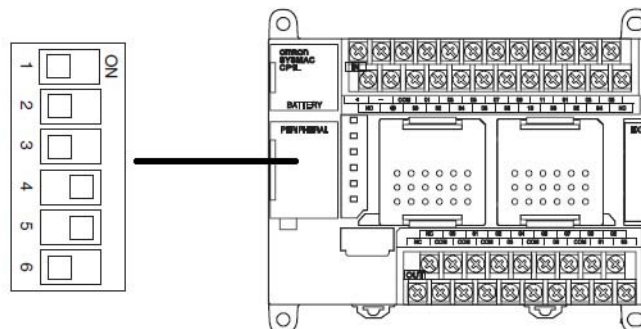
● CP1L-L PLCs with one option board slot

Switch ON DIP switch 4 to select Peripheral Bus (Toolbus) protocol.

Switch No.	Setting	Description	Application	Default
4	ON	Used for peripheral bus (Toolbus).	Used to enable a Serial Communications Option Board mounted in Option Board Slot 1 to be used by the peripheral bus.	OFF
	OFF	According to PLC Setup.		

● CP1L-M, CP1H PLCs with two option board slots

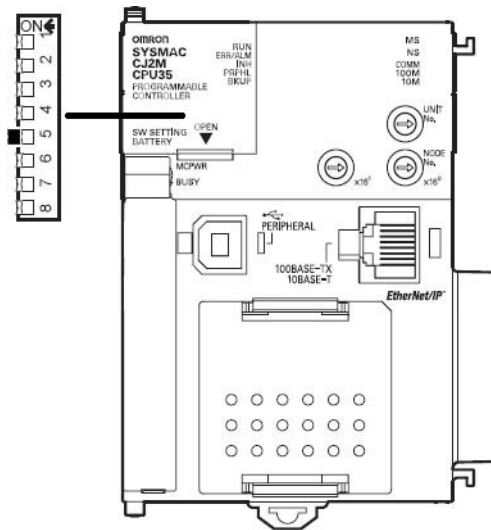| Switch No.	Setting	Description	Application	Default
4	ON	Used for peripheral bus (Toolbus).	Used to enable a Serial Communications Option Board mounted in Option Board Slot 1 to be used by the peripheral bus.	OFF
	OFF	According to PLC Setup.		
5	ON	Used for peripheral bus (Toolbus).	Used to enable a Serial Communications Option Board mounted in Option Board Slot 1 to be used by the peripheral bus.	OFF
	OFF	According to PLC Setup.		

● **CP1L-EL/EM PLCs with no DIP switches**

Use the following CX-Programmer settings to configure the Option Board slot for Peripheral Bus (Toolbus) usage. Transfer these settings to the PLC and cycle power to apply the changes.

- Custom Port Settings
- Baud 115200
- Format 7,2,E
- Mode Toolbus
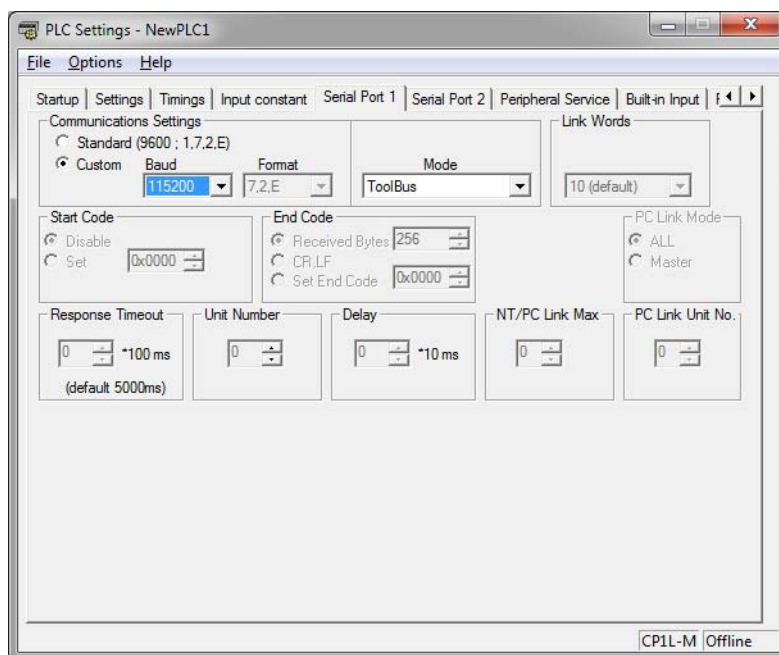
● **CJ2M-CPU3□ Option Board Setting**

Switch ON DIP switch 5 to select Peripheral Bus (Toolbus) protocol.

Switch No.	Setting	Description	Application	Default
5	ON	Used for peripheral bus (Toolbus).	Used to enable a Serial Communications Option Board mounted in Option Board Slot 1 to be used by the peripheral bus.	OFF
	OFF	According to PLC Setup.		

Modbus TCP Master/Client PLC Setup

The CP1W-MODTCP61 adapter uses the Serial Gateway function of the PLC when operating in the Master / Client mode. DIP switch settings and CX-Programmer port settings are shown below to configure the Option Board Slot. This mode is not selectable for use with the CJ2-series PLC.
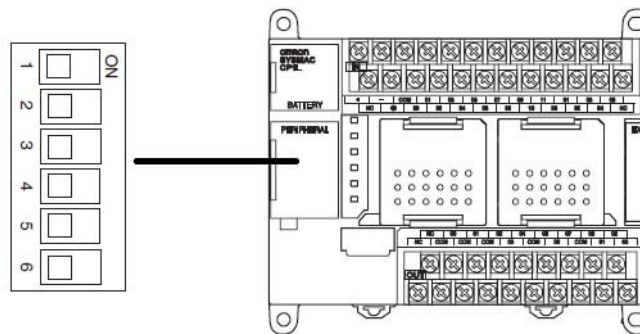
● **CP1L-L PLCs with one option board slot**

Switch OFF DIP switch 4 to allow user setup with CX-Programmer.
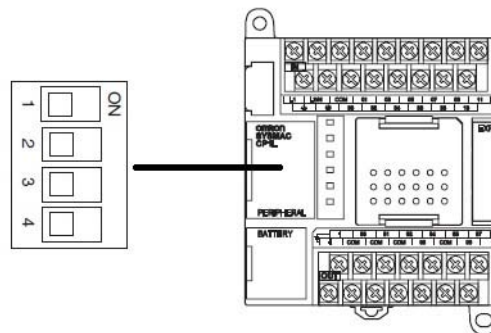
● **CP1L-M, CP1H PLCs with two option board slots**

Switch OFF DIP switch 5 to allow user setup with CX-Programmer.

● **CP1L-EL/EM PLCs with no DIP switches**

Use the CX-Programmer Port settings below to configure the CP1L-EL/EM CPU.

● **CX-Programmer Port Settings**

Use CX-Programmer to change and download the following Serial Port communication settings for the PLC port that the CP1-MODTCP61 is mounted in.

- 115200 Baud Rate
- 8,1,N Format
- Serial Gateway Mode
- 20 Response Timeout (20*100 ms = 2.0 seconds)[1]
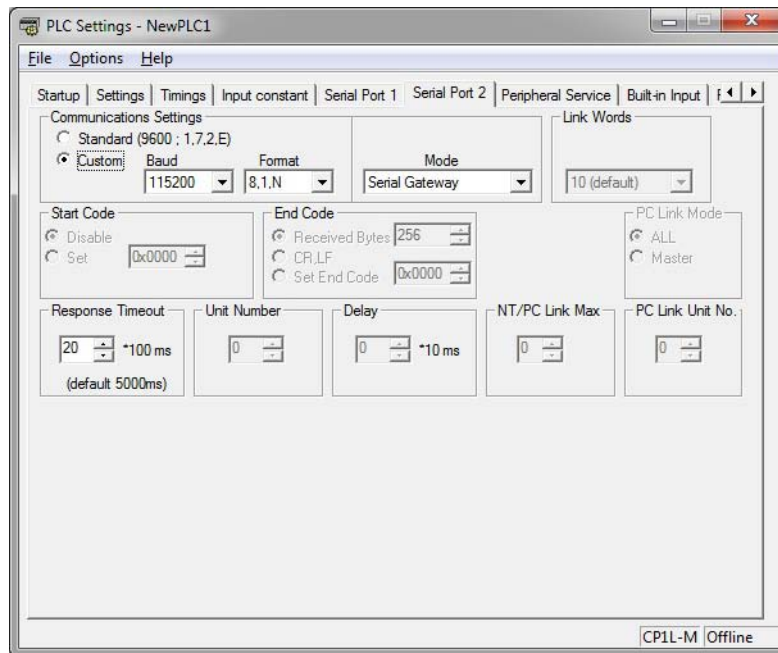
Note 1 Setting the Response Timeout value for 2.0 seconds will optimize communications recovery when a timeout occurs.

Peripheral Service

To maximize the throughput of the CP1W-MODTCP61, the amount of time per PLC scan that is allowed for servicing communications ports should be increased. This setting applies for both Slave/Server and Master/Client modes and is accessed through the PLC Settings in CX-Programmer. On the Peripheral Service tab, uncheck the 'default' option, and enter 50 (5.0 ms). Transfer these settings to the PLC and cycle power to apply the changes.
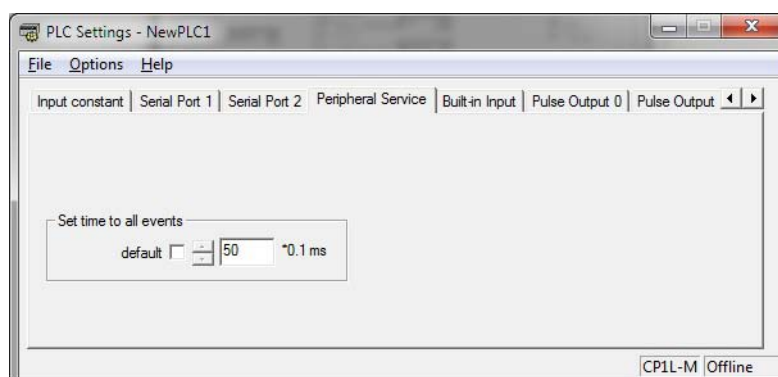
2-2　Adapter Setup

2-2-1　Configuring the Adapter

The CP1W-MODTCP61 is assigned a default IP address of 192.168.250.11. The IP address can be changed using a web browser and the default 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 adapter in the web browsers address field to access the configuration page. Enter the desired new IP address (192.168.1.156 shown as an example), subnet mask, and default gateway (if applicable).

● **Mode Selection**

Select the operating mode of the adapter. See *2-3 Operation Modes* for more information.

Clicking **Apply Setting** will save the changes and configure the adapter with the new settings.

2-2-2　Recovering a Lost IP Address Setting

If the IP address is lost or unknown, inspecting PLC memory areas can reveal the CP1W-EIP61's current IP address setting. Data memory areas D1200 ad 1201 store the IP address in the following format.

* D1200 stores the first and second octets in hexadecimal
* D1201 stores the third and fourth octets in hexadecimal

Example for an IP address of 192.168.1.154: D1200 = C0A8, D1201= 019A

> **Precautions for Correct Use**
>
> This feature is only available when the adater is configured in Modbus TCP Slave/Server mode. When in TCP Master/Client mode:
>
> * Take note of any change to default IP Address settings and record for later recovery.
> * Use network protocol analyzer software to inspect any active Modbus TCP request messages to the slaves from the Master module's IP address.
> * Contact your local Omron or Grid Connect representative for assistance.

2-3   Operation Modes

The CP1W-MODTCP61 adapter can operate in Modbus TCP Slave/Server or in Modbus TCP Master/Client mode when mounted in a CP1 series PLC. When mounted in a CJ2M PLC, the adapter can only operate in Modbus TCP Slave/Server mode.

The operating mode is selected with the web browser configuration method detailed in *2-2-1 Configuring the Adapter*. Select *Modbus TCP Slave/Server* Mode or *Modbus TCP Master/Client* Mode and click **Apply Setting** to save the configuration.

2-3-1   Modbus TCP Slave/Server Mode

When configured for Modbus TCP Slave/Server mode, the adapter functions as a slave node allowing a Modbus TCP Master/Client device to send commands to and receive responses from the adapter. A Modbus Master device could be a PC with software that use the Modbus TCP protocol, as well as PLCs and other hardware devices functioning as Modbus TCP masters.

See *2-1-1 PLC Setup* for more information on PLC setup and switch configuration.

The adapter supports the following Modbus function codes.

Modbus Function Code	Description
01	Read Coil Status
02	Read Input Status
03	Read Holding Registers
04	Read Input Registers
05	Write Single Coil
06	Preset Single Register
0F	Write Multiple Coils
10	Preset Multiple Register

> **Additional Information**
>
> The adapter uses the standard Modbus/TCP port 502.

PLC Memory Area Access

The supported Modbus function codes allow access to the PLC memory areas as shown.

● Bit (Coil) Read/Write

All supported Bit (Coil) read/write operations access the CIO memory area from CIO 1000 to CIO 1199. This provides a total of 3200 coils for access from the Modbus master device. These function codes include:

- 01, Read Coil Status
- 02, Read Input Status
- 05, Write Single Coil
- 0F, Write Multiple Coils

● Channel (Register) Read/Write

All supported Channel (Register) read/write commands access the DM memory area from D1000 to D1199. This provides a total of 200 registers to be accessed from the Modbus master device. These function codes include:

- 03, Read Holding Registers
- 04, Read Input Registers
- 06, Preset Single Register
- 10, Preset Multiple Registers

Modbus Addressing

When addressing the PLC memory map using the Modbus TCP protocol, D1000 is considered the first register and CIO 1000.00 is considered the first coil.

● Channel (Register) Calculation Example

To determine the Modbus TCP register number for a PLC address, simply subtract 1000 from the PLC Data Memory location as shown in the examples below.

PLC Memory Location	Calculation	Modbus Register
D1000	(D)1000 - 1000 = 0	0
D1050	(D)1050 - 1000 = 50	50
D1099	(D)1099 - 1000 = 99	99
D1199	(D)1199 - 1000 = 199	199

● **Bit (Coil) Calculation Example**

To determine the Modbus TCP coil for a PLC bit, subtract 1000 from the CIO Channel number, multiply by 16, and add the bit number as shown in the examples below.

PLC Memory Location	Calculation	Modbus Coil
CIO 1000.00	[(CIO) 1000 - 1000]*16 + 0 = 0	0
CIO 1100.12	[(CIO) 1100 - 1000]*16 + 12 = 1612	1612
CIO 1122.07	[(CIO) 1122 - 1000]*16 + 7 = 1959	1959
CIO 1199.15	[(CIO) 1199 - 1000]*16 + 15 = 3199	3199

Command Size Limitations

Modbus Function Codes have the following size limitations. Do not attempt to exceed the size limits.

Modbus Function Code	Read/Write Size Limit
03, 04	125 Channels (Registers)
10	123 Channels (Registers)
06	1 Channel (Register)
01, 02	998 Bits (Coils)
0F	998 Bits (Coils)
05	1 Bit (Coil)

2-3-2   Modbus TCP Master/Client Mode

When configured for Modbus TCP Master / Client mode, the adapter functions as a master device, controlling the communications with other slave devices such as I/O blocks, inverters, PLCs, etc. The adapter sends Modbus TCP commands to and receives Modbus TCP responses from the slave devices. This mode is not selectable for use with the CJ2M-series PLC.

See *2-1-1 PLC Setup* for more information on PLC setup and switch configuration.

2-4   Applications

2-4-1   Modbus TCP Slave/Server Applications

The CP1W-MODTCP61 allows Omron CP1L , CP1H, and CJ2M-CPU3□ PLCs to function as programmable I/O modules.

The adapter is a Modbus/TCP slave device, meaning the adapter cannot establish a connection to another device. A device, such as a PC or PLC, functioning as Modbus/TCP Master, must be the device used to establish the TCP connection and control the communications to the CP1W-MODTCP61.

When using the adapter in Modbus TCP Slave/Server mode, the adapter will also function as a FINS slave device, allowing the use of an NS-Series HMI and/or CX-Programmer programming software.

Up to 2 Modbus TCP Master/Client devices can communicate simultaneously with the adapter, in addition to 2 FINS devices.

When using Modbus TCP clients to connect to the PLC through the CP1W-MODTCP61, the client will be automatically disconnected after 30 seconds of inactivity to allow other clients to connect. To maintain a TCP connection from a client, send at least 1 command at intervals of less than 30 seconds.
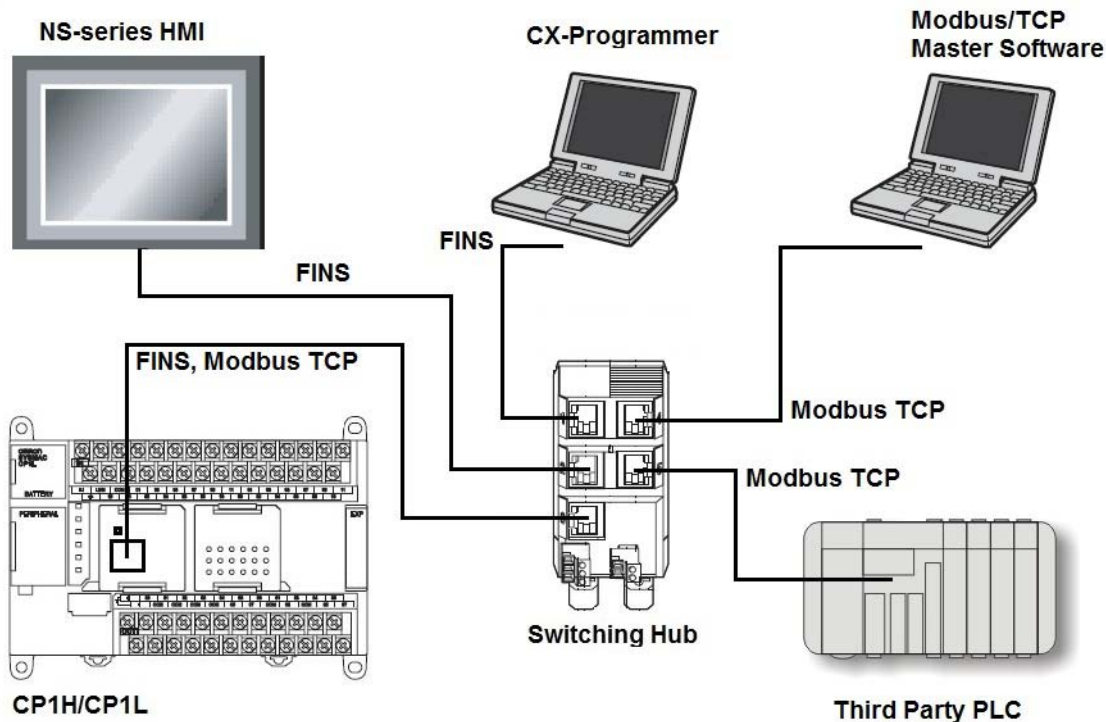
2-4-2 Modbus TCP Master/Client Applications

The CP1W-MODTCP61 allows Omron CP1L and CP1H PLCs to function as control devices for remote I/O slaves that use the Modbus TCP protocol. The adapter is a Modbus TCP master device, meaning the adapter will not respond to Modbus TCP commands issued from another Modbus TCP master device. The Easy Modbus function of the PLC is used to send Modbus RTU commands to the adapter, which are converted to Modbus TCP commands and delivered to the remote device. The Modbus RTU Node Number is automatically used as the last octet of the IP address of the destination device, with the first 3 octets of IP address of the adapter used as the first 3 octets of the destination device.

● Example

The CP1W-MODTCP61 Adapter IP address is set as 192.168.1.25. A Modbus RTU command sent to node '2C' in the PLC using Easy Modbus. The Modbus TCP command will be delivered to 192.168.1.44 (44 Decimal = 2C Hex).

Additional Information

- Disconnected slave nodes will cause timeouts in the PLC Easy Modbus function, slowing the update to the remaining nodes.
- Unlike the Modbus TCP Slave/Server mode, the FINS protocol is not available when using the adapter as a Modbus TCP Master/Client. If an NS HMI is required, connect via a serial connection, or via a CP1W-CIF41/CP1W-ETN61/ Ethernet adapter.

2-5   Modbus TCP Server/Slave Command Examples

Function Code 01: Read Coil Status

● **Objective**

• Read 10 Coils starting at CIO 1002.00 through CIO 1002.09. PLC Data for CIO 1002 = 0000000000110010 (0032 HEX)

Command	Value	Command	Value
Function Code	01	Function Code	01
Starting Address Hi	00	Byte Count	02
Starting Address Lo	02	Coils 0 - 7	32
Number of Coils Hi	00	Coils 8 - 9	00
Number of Coils Lo	0A		

Additional Information

Function Code 02 (Read Input Status) operates the same as above example.

Function Code 03: Read Holding Registers

● **Objective**

Read 4 channels starting at D1050. PLC data for D1050 = 1234, D1051 = 5678, D1052 = 90AB, D1053 = CDEF

Command	Value	Command	Value
Function Code	03	Function Code	03
Starting Address Hi	00	Byte Count	08
Starting Address Lo	32	Register Hi D1050	12
Number of Registers Hi	00	Register Lo D1050	34
Number of Registers Lo	04	Register Hi D1051	56
		Register Lo D1051	78
		Register Hi D1052	90
		Register Lo D1052	AB
		Register Hi D1053	CD
		Register Lo D1053	EF

📝 **Additional Information**

Function Code 04 (Read Input Registers) operates the same as above example.

Function Code 05: Write Single Coil

● **Objective**

Turn ON bit CIO 1040.05

Command	Value	Command	Value
Function Code	05	Function Code	05
Starting Address Hi	02	Starting Address Hi	02
Starting Address Lo	85	Starting Address Lo	85
Output Value Hi	FF	Output Value Hi	FF
Output Value Lo	00	Output Value Lo	00

📝 **Additional Information**

To turn a bit ON, set the Output Value to FF00. To turn a bit OFF, set the Output Value to 0000.

Function Code 06: Wrige Single Register

● **Objective**

Write a value of 1467 hex to D1099.

Command	Value	Command	Value
Function Code	06	Function Code	06
Starting Address Hi	00	Starting Address Hi	00
Starting Address Lo	63	Starting Address Lo	63
Output Value Hi	14	Output Value Hi	14
Output Value Lo	67	Output Value Lo	67

Function Code 0F: Write Multiple Coils

● **Objective**

Set the values of CIO 1045.00 through CIO 1045.11 to 011110000011 (783 hex).

Command	Value	Command	Value
Function Code	0F	Function Code	0F
Starting Address Hi	02	Starting Address Hi	02
Starting Address Lo	D0	Starting Address Lo	D0
Number of Coils Hi	00	Number of Coils Hi	00
Number of Coils Lo	0C	Number of Coils Lo	0C
Byte Count	02		
Output Value Hi	83		
Output Value Lo	07		

Function Code 10: Write Multiple Registers

● **Objective**

Write the following data into the PLC.

D1125 = FFEE

D1126 = DDAA

D1127 = BBFA

| Command	Value	Command	Value
Function Code	10	Function Code	10
Starting Address Hi	00	Starting Address Hi	00
Starting Address Lo	7D	Starting Address Lo	7D
Number of Registers Hi	00	Number of Registers Hi	00
Number of Registers Lo	03	Number of Registers Lo	03
Byte Count	06		
Register Value Hi (D1125)	FF		
Register Value Lo (D1125)	EE		
Register Value Hi (D1126)	DD		
Register Value Lo (D1126)	AA		
Register Value Hi (D1127)	BB		
Register Value Lo (D1127)	FA		

2-6   Connecting with CX-Programmer

When using the CP1W-MODTCP61 adapter while connecting with CX-Programmer to CP1L, CP1H, or CJ2M-CPU3x CPUs, specify the communications method as follows.

Network Type: Ethernet

Frame Length: 1004 Bytes

IP Address: Same as the CP1W-MODTCP61 Unit setting
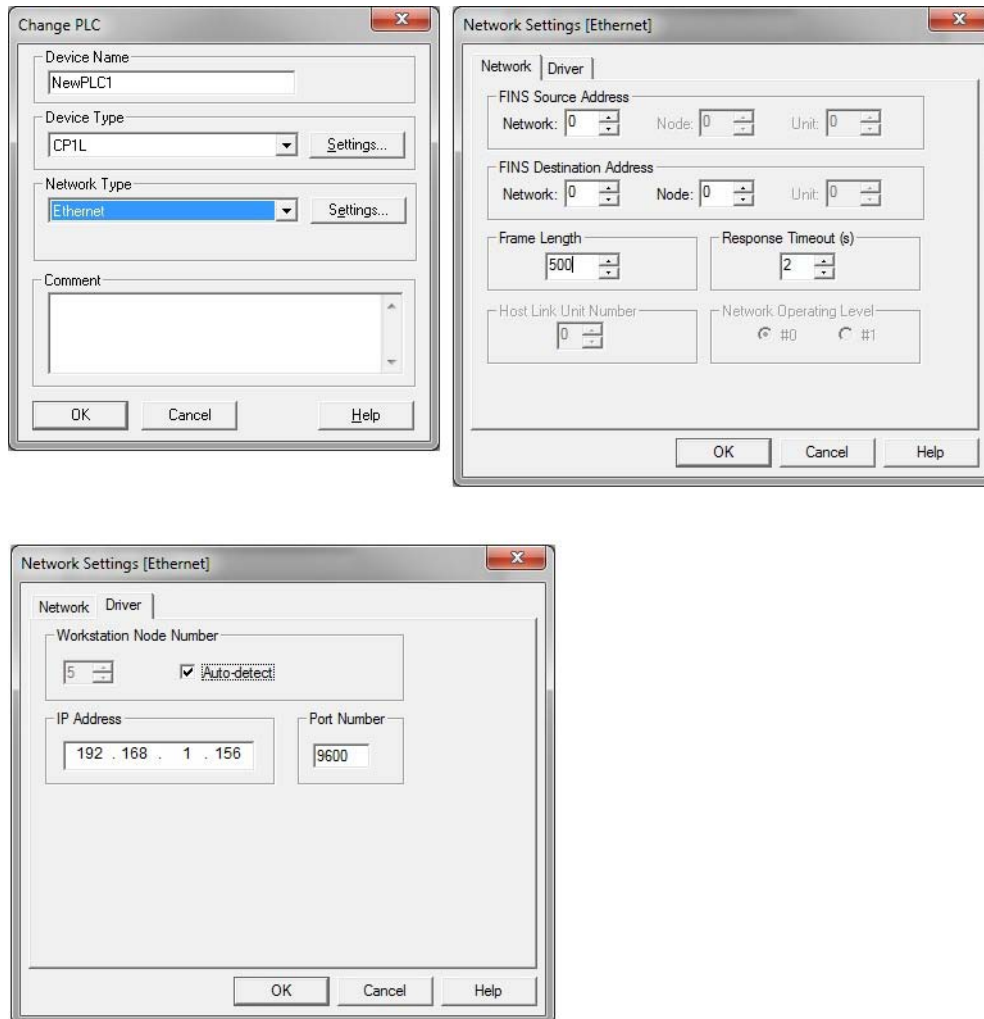
2-7   Additional Support

If additional support is required for the application or operation of the CP1W-EIP61, use the following resources provided below.

- Your local Omron representative
- www.omron247.com
- www.myOMRON.com

Note: Specifications subject to change without notice.