CJ Series
General-purpose Serial Connection Guide (RS-232C)

OMRON Corporation Displacement Sensor (ZW-7000 series)

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Table of Contents

1. Related Manuals

To ensure system safety, make sure to always read and follow the information provided in all Safety Precautions and Precautions for Safe Use in the manuals for each device which is used in the system.

Cat. No.	Model	Manual name
W472	CJ2M-CPU[][] CJ2H-CPU6[] CJ2H-CPU6[]-EIP	CJ-series CJ2 CPU Unit Hardware USER'S MANUAL
W473	CJ2M-CPU[][] CJ2H-CPU6[] CJ2H-CPU6[]-EIP	CJ-series CJ2 CPU Unit Software USER'S MANUAL
W336	CJ1W-SCU[]1-V1 CJ1W-SCU[]2	CJ Series Serial Communications Units OPERATION MANUAL
W474	CJ2[]-CPU[][]	CJ Series Programmable Controllers INSTRUCTIONS REFERENCE MANUAL
W446	CXONE-AL[][]C-V4 / AL[][]D-V4	CX-Programmer OPERATION MANUAL
W344	CXONE-AL[][]C-V4 / AL[][]D-V4	CX-Protocol OPERATION MANUAL
Z362	ZW-7000[]	Displacement Sensor ZW-7000 series Confocal Fiber Type Displacement Sensor User's Manual
Z363	ZW-7000[]	Displacement Sensor ZW-7000 series Confocal Fiber Type Displacement Sensor User's Manual for Communications Settings

2.　Terms and Definitions

Term	Explanation and Definition
Protocol macro	A protocol macro is a function that enables data to be sent and received with general-purpose external devices. This function can be realised by executing the protocol macro instruction (hereinafter referred to as PMCR instruction) in a CPU Unit's user program through storing procedures for sending and receiving data (protocols) in a Serial Communications Board or a Serial Communications Unit to exchange data with general-purpose external devices.
Protocol	A unit of independent communication processing with a specific general-purpose device. A protocol includes procedures for sending and receiving data. A protocol consists of more than one sequence.
Sequence	A unit of the independent communication processing which can be started by executing the PMCR instruction in a program. A sequence that is started by the instruction executes steps registered in its own sequence.
Step	A unit to execute any one of the followings: message send processing, message receive processing, message send/receive processing, receive buffer clear, or step wait. Up to 15 steps can be set for per sequence.
Send message	A communication frame (command) to send to general-purpose external devices. A send message is invoked by steps in the sequence and is sent to general-purpose external devices.
Receive message	A communication frame (response) received from general-purpose external devices. A receive message is invoked by steps in the sequence and is compared with data received from general-purpose external devices.
Receive matrix	A function to register and use some communication frames (responses) when more than one communication frame is expected to be received from general-purpose external devices. The receive processing can be executed according to registered communication frames by using this function.

3. Precautions

(1) Understand the specifications of devices which are used in the system. Allow some margin for ratings and performance. Provide safety measures, such as installing a safety circuit, in order to ensure safety and minimize the risk of abnormal occurrence.

(2) To ensure system safety, make sure to always read and follow the information provided in all Safety Precautions and Precautions for Safe Use in the manuals for each device which is used in the system.

(3) The user is encouraged to confirm the standards and regulations that the system must conform to.

(4) It is prohibited to copy, to reproduce, and to distribute a part or the whole of this document without the permission of OMRON Corporation.

(5) The information contained in this document is current as of June 2016. It is subject to change for improvement without notice.

The following notations are used in this document.

⚠ **Caution**	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

Point on safety

Precautions on what to do and what not to do to ensure safe usage of the product.

Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

Symbol

The triangle symbol indicates precautions (including warnings).
The specific operation is shown in the triangle and explained in the text.
This example indicates a general precaution.

The filled circle symbol indicates operations that you must do.
The specific operation is shown in the circle and explained in the text.
This example shows a general precaution for something that you must do.

4. Overview

This document describes the procedures for connecting Displacement Sensor (hereinafter referred to as Sensor Controller) to CJ-series Programmable Controller + Serial Communications Unit (hereinafter referred to as PLC) using serial communications, both produced by OMRON Corporation (hereinafter referred to as OMRON), and for checking their connections.

Refer to *Section 6. Serial Communications Settings* and *Section 7. Serial Communications Connection Procedure* to understand setting methods and key points to send / receive messages using the serial communications.

The ladder program in a prepared CX-Programmer project file and the protocol macro data in a prepared CX-Protocol project file are used to check the serial connection by sending or receiving a message of "version information acquisition" to/from Sensor Controller.

■ Sending /receiving the "version information acquisition" message

PLC	Serial communications (RS-232C)	Sensor Controller
Sending the command data	Command data ➡	Executing the command
Receiving the response data and storing in memory	⬅ Response data	Returning the response data

Prepare latest project files of both CX-Programmer and CX-Protocol beforehand.
To obtain a project file, contact your OMRON representative.

Name	File name	Version
CX-Programmer project file (extension: cxp)	P652_CJ_PMCR232C_OMRON_ZW-7000_ EV100.cxp	Ver.1.00
CX-Protocol project file (extension: psw)	P652_CJ_PMCR232C_OMRON_ZW-7000_ EV100.psw	Ver.1.00

⚠ Caution

This document aims to explain wiring methods and communications settings necessary to connect corresponding devices and to provide setting procedures.
The program used in this document is designed to check if the connections are properly established, and is not designed to be constantly used at a site.
Therefore, functionalities and performances are not sufficiently taken into consideration.
When you construct an actual system, please use the wiring methods, communications settings and setting procedures described in this document as a reference and design a new program according to your application needs. .

5. Applicable Devices and Device Configuration

5.1. Applicable Devices

The applicable devices are as follows:

Manufacturer	Name	Model
OMRON	CJ2 CPU Unit	CJ2[]-CPU[][]
OMRON	Serial Communications Unit	CJ1W-SCU[]1-V1 CJ1W-SCU[]2
OMRON	Confocal Fiber Type displacement sensor	
	Sensor Controller	ZW-7000[]
	Sensor Head	ZW-S70[][]

▶ **Precautions for Correct Use**

In this document, the devices with models and versions listed in *5.2. Device Configuration* are used as examples of applicable devices to describe the procedures for connecting the devices and checking their connections.

You cannot use devices with versions lower than the versions listed in *5.2*.

To use the above devices with models not listed in *5.2.* or versions higher than those listed in *5.2.*, check the differences in the specifications by referring to the manuals before operating the devices.

📑 **Additional Information**

This document describes the procedures for establishing the network connections.

It does not provide information on operation, installation, wiring method, device functionality, or device operation, which is not related to the connection procedures. Refer to the manuals or contact your OMRON representative.

5.2. Device Configuration

The hardware components to reproduce the connection procedures in this document are as follows:
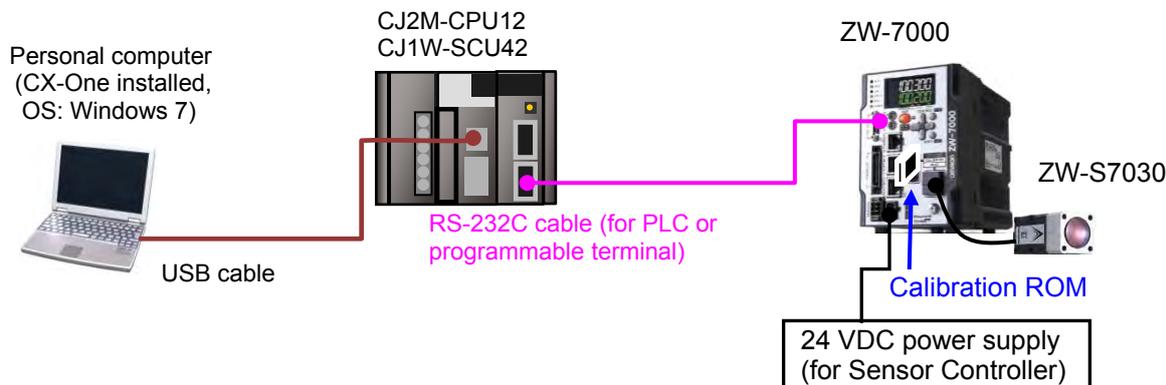
Manufacturer	Name	Model	Version
OMRON	Serial Communications Unit	CJ1W-SCU42	Ver.2.0
OMRON	CPU Unit	CJ2M-CPU12	Ver.2.0
OMRON	Power Supply Unit	CJ1W-PA202	
OMRON	CX-One	CXONE-AL[][]C-V4 /AL[][]D-V4	Ver.4.[][]
OMRON	CX-Programmer	(Included in CX-One)	Ver.9.60
OMRON	CX-Protocol	(Included in CX-One)	Ver.1.99
OMRON	CX-Programmer project file (Ladder program)	P652_CJ_PMCR232C_OMRON_ZW-7000_EV100.cxp	Ver.1.00
OMRON	CX-Protocol project file (Protocol macro data)	P652_CJ_PMCR232C_OMRON_ZW-7000_EV100.psw	Ver.1.00
-	Personal computer (OS: Windows 7)	-	
-	USB cable (USB 2.0 type B connector)	-	
OMRON	RS-232C cable (for PLC or programmable terminal)	ZW-XPT2	
OMRON	Sensor Controller	ZW-7000	Ver.2.020
OMRON	Sensor Head	ZW-S7030	
OMRON	Calibration ROM	(supplied with Sensor Head)	
OMRON	24 VDC power supply (for Sensor Controller) (DC24V 2.5A 60W)	S8VS-06024	

📝 **Precautions for Correct Use**

Prepare latest project files of both CX-Programmer and CX-Protocol beforehand.

To obtain a project file, contact your OMRON representative.

▶ **Precautions for Correct Use**

Update CX-Programmer and CX-Protocol to the version specified in this *Clause 5.2.* or to a higher version. If you use a version higher than the one specified, the procedures and related screenshots described in *Section 7.* and subsequent sections may not be applicable.
In that case, use the equivalent procedures described in this document by referring to the *CX-Programmer OPERATION MANUAL* (Cat. No. W446) and the *CX-Protocol OPERATION MANUAL* (Cat. No. W344).

📑 **Additional Information**

For information on the serial cable (RS-232C), refer to *3-4 RS-232C and RS-422A/485 Wiring* of the *CJ Series Serial Communications Units OPERATION MANUAL* (Cat. No. W336).

📑 **Additional Information**

For specifications of 24 VDC power supply available for Sensor Controller, refer to the *Displacement Sensor ZW-7000 series Confocal Fiber Type Displacement Sensor User's Manual* (Cat. No. Z362).

📑 **Additional Information**

The system configuration in this document uses USB for the connection between Personal computer and PLC. For information on how to install the USB driver, refer to *A-5 Installing the USB Driver* in *Appendices* of the *CJ-series CJ2 CPU Unit Hardware USER'S MANUAL* (Cat. No. W472).

6. Serial Communications Settings

This section describes the contents of parameter settings and wiring that are all defined in this document.

6.1. Parameters

The parameters required for connecting PLC and Sensor Controller using the serial communications are shown below.

Item	PLC (Serial Communications Unit)	Sensor Controller
Unit number	0	-
Communications port (Communications type)	Port 2 (RS-232C)	RS-232C (Default)
Serial communications mode	Protocol macro	-
Data length (bit)	8 bits	8bit (Default)
Stop bits (length)	1 bit	1bit (Default)
Parity	None	OFF (None: Default)
Baud rate	38400 bps	38400 (bps) (Default)
Protocol macro transmission method (Full-duplex / Half-duplex)	Full-duplex	Full-duplex communications (Fixed)
CS/RS control	-	OFF (Default)
Terminator	-	CR（Default）

Precautions for Correct Use

This document describes the setting procedures of CJ1W-SCU42 Serial Communications Unit with the unit number 0 and communications (connection) port 2.
To connect devices under different conditions, change the CIO area and the control words of PMCR instruction used in the program. Refer to *Section 9. Program* for details.

6.2. Cable Wiring

For details on cable wiring, refer to *SECTION 3 Installation and Wiring* of the *CJ Series Serial Communications Units OPERATION MANUAL* (Cat. No. W336).

Check connector configuration and pin assignments before wiring.

■Connector configuration and pin assignments

CJ1W-SCU42 Serial Communications Unit applicable connector: D-sub 9-pin female

Pin No.	Symbol	Signal name	Input/Output
1	FG	Shield	-
2	SD	Send data	Output
3	RD	Receive data	Input
4	RS	Request to send	Output
5	CS	Clear to send	Input
6	5V	Power supply	-
7	DR	Data set ready	Input
8	ER	Data terminal ready	Output
9	SG	Signal ground	-
Shell	FG	Shield	-
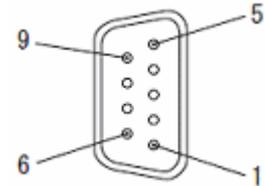
Sensor Controller (ZW-7000) applicable connector: Square 17-pin female

Usage	Pin No.	Terminal name	Function
RS-232C	1	GND(0V)	Signal ground
	2	TXD(SD)	Send data
	3	RXD(RD)	Receive data
	4	RTS(RS)	Request to send
	5	CTS(CS)	Clear to send
	6 to 17	NC	(Not used)
	Shell	FG	Shield
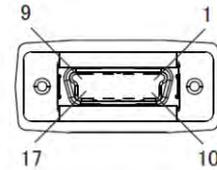
■Cable/Pin assignments (RS-232C cable for connecting to PLC: ZW-XPT2)

Serial Communications Unit (CJ1W-SCU42)				Sensor Controller (ZW-7000)		
RS-232C Interface	Signal name	Pin No.		Pin No.	Signal name	RS-232C Interface
	FG	1		1	GND(0V)	
	SD	2		2	TXD(SD)	
	RD	3		3	RXD(RD)	
	RS	4		4	RTS(RS)	
	CS	5		5	CTS(CS)	
	5V	6		6 to 17	NC	
	DR	7				
	ER	8				
	SG	9				
	FG	Shell		Shell	FG	
D-sub 9-pin Connector contact: Male				Square 17-pin Connector contact: Male		
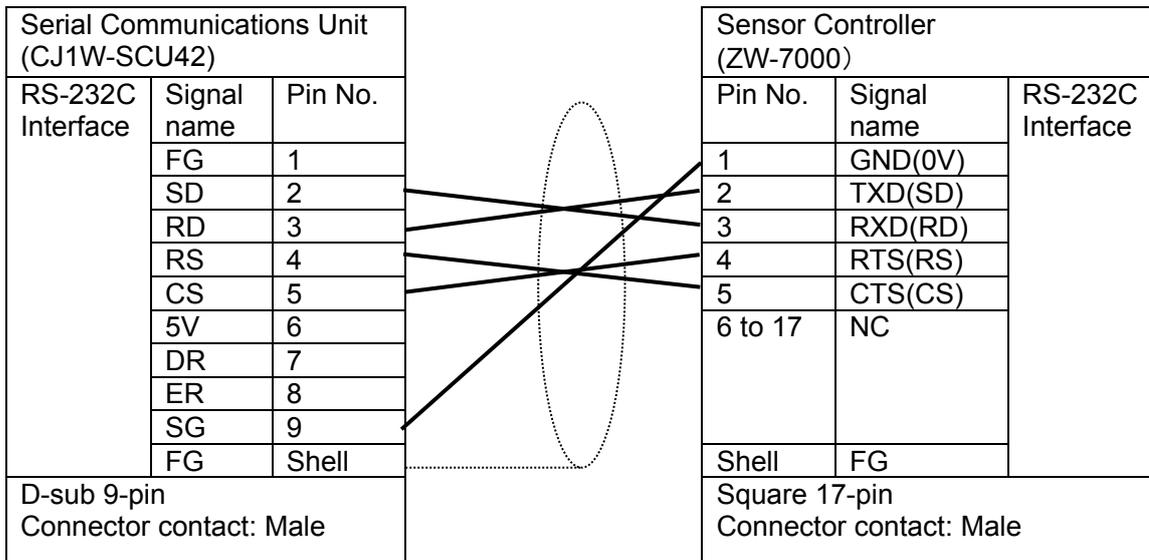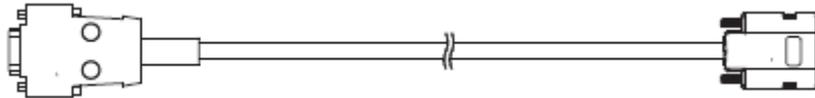
7. Serial Communications Connection Procedure

This section describes the procedures for connecting PLC to Sensor Controller using serial communications. The explanations of procedures for setting up PLC and Sensor Controller given in this document are based on the factory default settings.
For the initialization, refer to *Section 8. Initialization Method*.

7.1. Work Flow

Take the following steps to connect PLC to Sensor Controller using serial communications and to send / receive messages.

7.2. Sensor Controller Setup	Set up Sensor Controller.
↓	
7.2.1. Hardware Settings	Connect cables and others to Sensor Controller.
↓	
7.2.2. Parameter Settings	Set the parameters for Sensor Controller.
↓	
7.3. PLC Setup	Set up PLC.
↓	
7.3.1. Hardware Settings	Set the hardware switches on Serial Communications Unit and connect the cables.
↓	
7.3.2. Opening the Project File and Connecting Online with PLC	Start CX-Programmer, open the project file, and connect online with PLC.
↓	
7.3.3. Creating the I/O Table	Create the I/O table for PLC.
↓	
7.3.4. Parameter Settings	Set the parameters for Serial Communications Unit.
↓	
7.3.5. Transferring the Project Data	Transfer the project data to PLC.
↓	
7.3.6. Starting the CX-Protocol and Opening the project file	Start CX-Protocol and open the project file.
↓	
7.3.7. Connecting Online and Transferring the Protocol Macro Data	Connect online with CX-Protocol and transfer the protocol macro data to Serial Communications Unit.
↓	

7.4. Serial Communication Status Check	Start the send/receive processing and confirm that serial communications performs normally.
↓	
7.4.1. Starting the Trace	Start tracing with CX-Protocol.
↓	
7.4.2. Executing the Communications Sequence	Execute the communications sequence using CX-Programmer.
↓	
7.4.3. Checking the Trace Data	Check with the trace data in CX-Protocol that the correct data are sent and received.
↓	
7.4.4. Checking the Receive Data	Check that the correct data is written to the I/O memory of PLC using CX-Programmer.

7.2. Sensor Controller Setup

Set up Sensor Controller.

7.2.1. Hardware Settings

Connect cables and others to Sensor Controller.

> **Precautions for Correct Use**
>
> Make sure that the power supply is OFF when you set up.

1	Make sure that Sensor Controller is powered OFF. *If it is ON, the settings described in the following steps and subsequent procedures may not be applicable.
2	Check the position of connectors on Sensor Controller by referring to the figure on the right.

RS-232C connector

ROM connector

Fiber adapter

24 V input terminal block
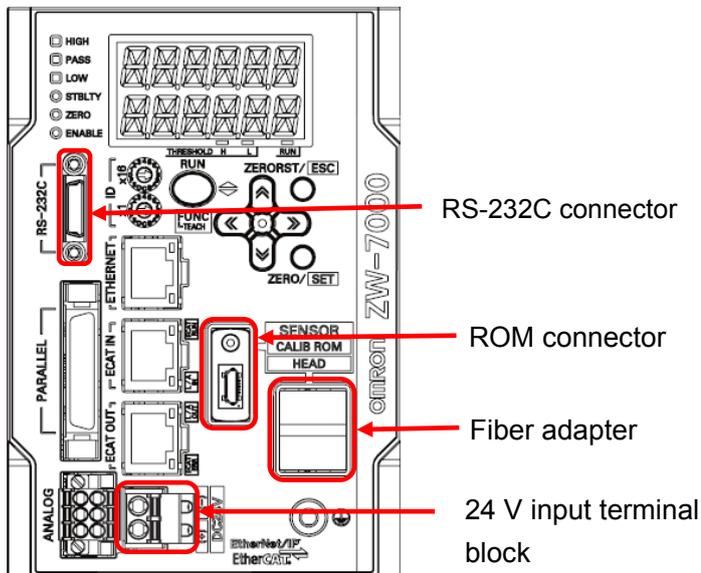
3	Connect the calibration ROM to ROM connector.
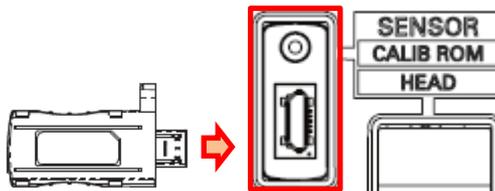
4	Connect Fiber connector on Sensor Head to Fiber adapter.
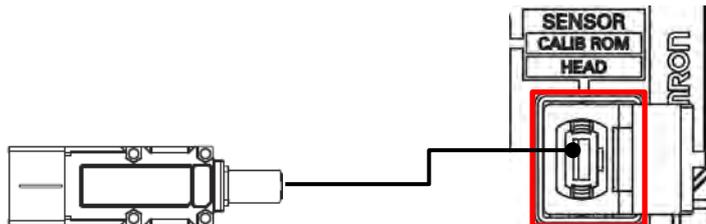
5	Connect an RS-232C cable (for PLC or programmable terminal) to RS-232C connector.	RS-232C cable (for PLC or programmable terminal)
6	Connect 24 VDC power supply to 24 V input terminal block. *For details on specifications of 24 VDC power supply available for Sensor Controller, refer to the *Displacement Sensor ZW-7000 series Confocal Fiber Type Displacement Sensor User's Manual* (Cat. No. Z362).	24 VDC power supply
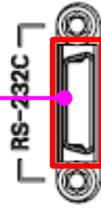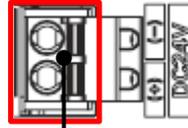
7.2.2. Parameter Settings

Set the parameters for Sensor Controller.

1	Check the positions of each keys and displays to use for parameter settings.	Main Display (White) Sub-display (Green) RUN Indicator (Green) ZERORST/ESC Key ↑ (UP) Key →(RIGHT)Key ZERO/SET Key ↓ (DOWN) Key Mode Switching Key ←(LEFT) Key
2	Turn ON Sensor Controller.	
3	The system enters the RUN mode after displaying "INIT" for a few seconds. *The RUN Indicator is lit in the RUN mode. Press and hold the **Mode Switching** Key for two seconds.	dARK 0.5000 THRESHOLD H L RUN
4	OK/CAN is displayed. Press the **ZERO/SET** Key once.	SWItCH OK/CAN
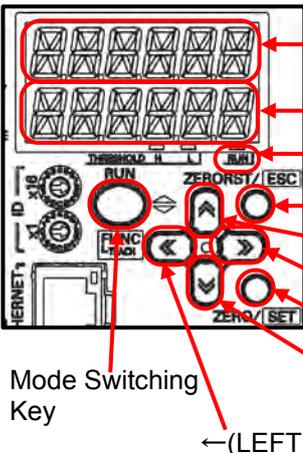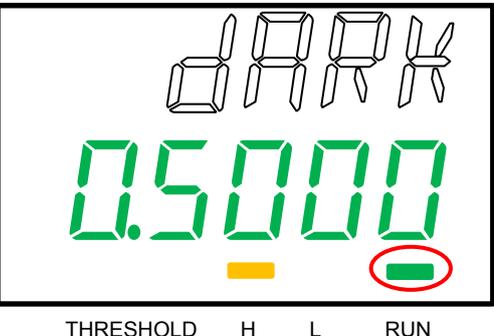
14
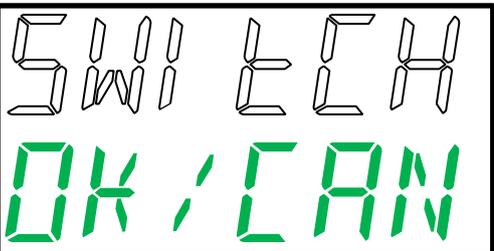
5 The operation mode is switched to the FUNC mode, and SENS is displayed on Main Display.

*The RUN Indicator goes out in the FUNC mode.

THRESHOLD   H   L   RUN
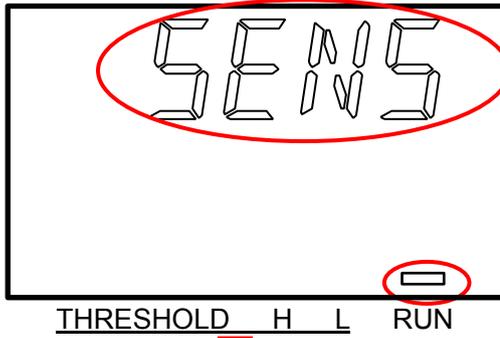
Keep pressing the →**(RIGHT)** or the ←**(LEFT)** Keys until SYSTEM is displayed.

Press the **ZERO/SET** Key once
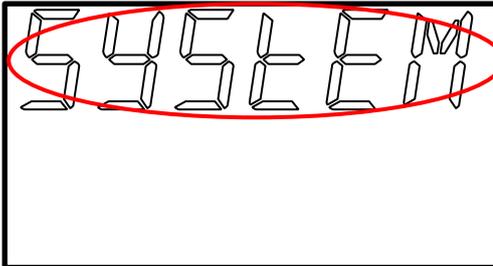
6 H.CALIB is displayed on Main Display.
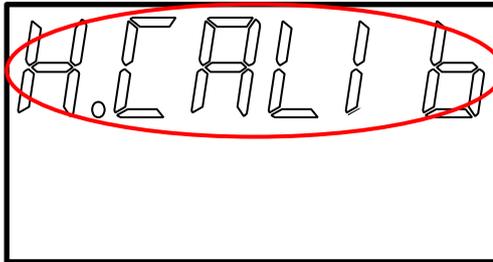
Keep pressing the →**(RIGHT)** or the ←**(LEFT)** Keys until COM is displayed.

Press the **ZERO/SET** Key once.
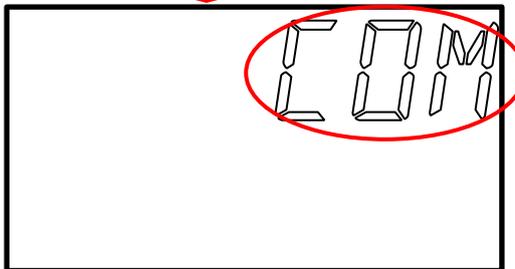
7 RS232C is displayed on Main Display.
Press the **ZERO/SET** Key once.
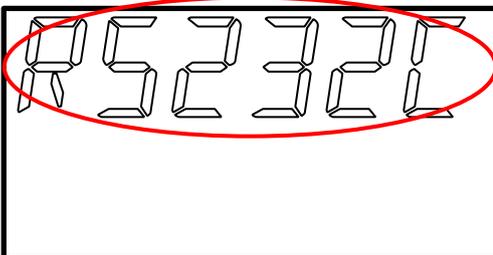
8 | DATA is displayed on Main Display.
Press the **ZERO/SET** Key once.
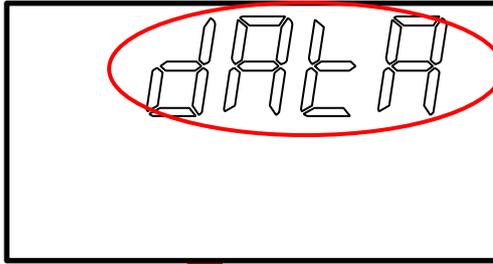
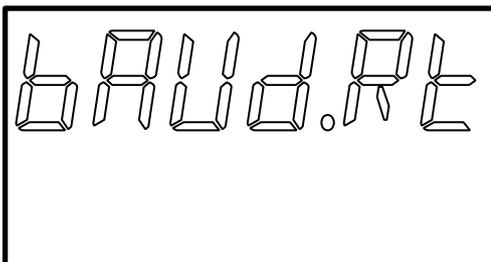Check that the following set value is displayed on Sub-display.
　Data length: 8bit (Default)

*If the value is different, change the value by pressing the ↑ **(UP)** or the ↓ **(DOWN)** Keys.
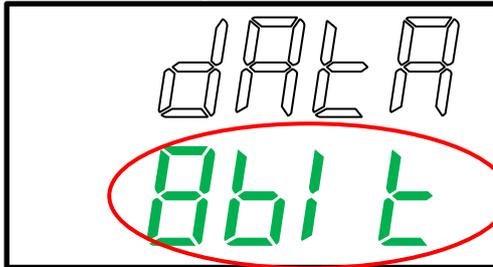
<Setting range>
8bit (Default)
/7bit

Press the **ZERORST/ESC** Key once.

The first menu shown in this step is displayed again.
Press the →**(RIGHT)** Key once.
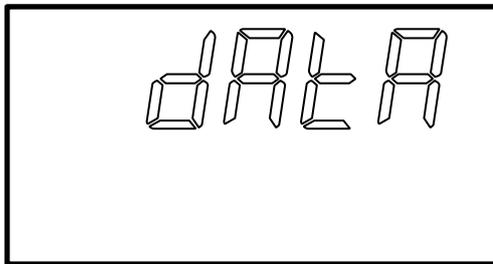
9 | PARITY is displayed on Main Display.
Press the **ZERO/SET** Key once.
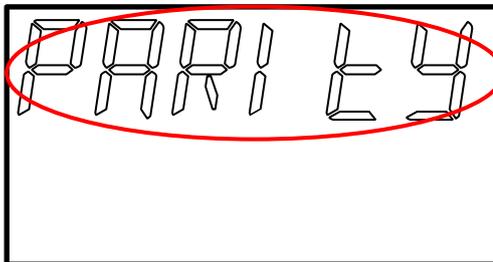
Check that the following set value is displayed on Sub-display.
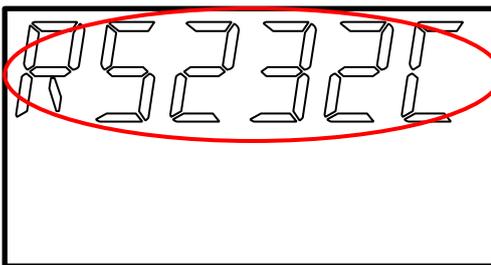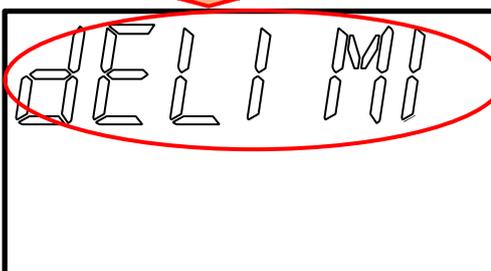　Parity: OFF (None: Default)

Press the **ZERORST/ESC** Key once.

<Setting range>
OFF (Default)
/ODD/EVEN

*If the value is different, change the value by pressing the ↑ **(UP)** or the ↓ **(DOWN)** Keys.
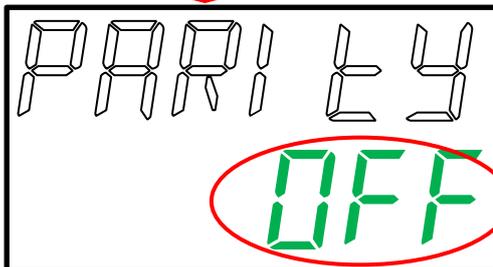
The first menu shown in this step is displayed again.
Press the →**(RIGHT)** Key once.
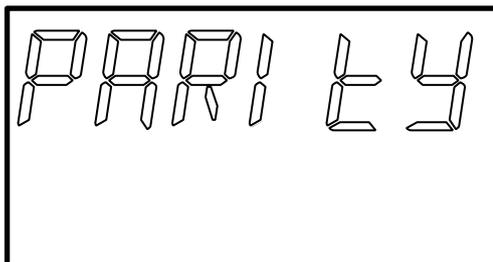
10	STOP is displayed on Main display. Press the **ZERO/SET** Key once.	![StOP display]
	Check that the following set value is displayed on Sub-display. Stop bit: 1bit (Default) Press the **ZERORST/ESC** Key once.	![StOP / 1bit display] <Setting range> 1bit (Default) /2bit
	*If the value is different, change the value by pressing the ↑ **(UP)** or the ↓ **(DOWN)** Keys. The first menu shown in this step is displayed again. Press the →**(RIGHT)** Key once.	![StOP display]
11	BAUD.RT is displayed on Main Display. Press the **ZERO/SET** Key once.	![bAUd.Rt display]
	Check that the following set value is displayed on Sub-display. Baud rate: 38400 (Default) Press the **ZERORST/ESC** Key once.	![bAUd.Rt / 38400 display] <Setting range> 9600/19200/ 38400 (Default) /57600/115200
	*If the value is different, change the value by pressing the ↑ **(UP)** or the ↓ **(DOWN)** Keys. The first menu shown in this step is displayed again. Press the →**(RIGHT)** Key once.	![bAUd.Rt display]
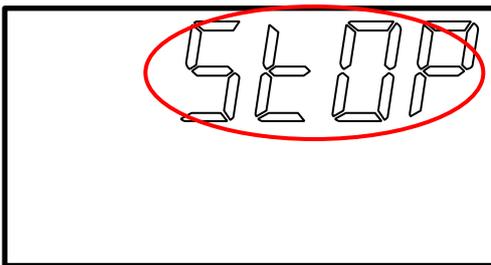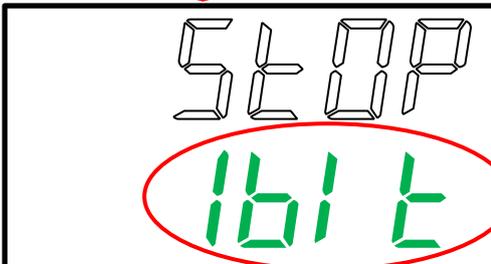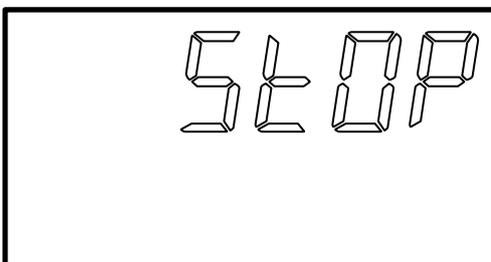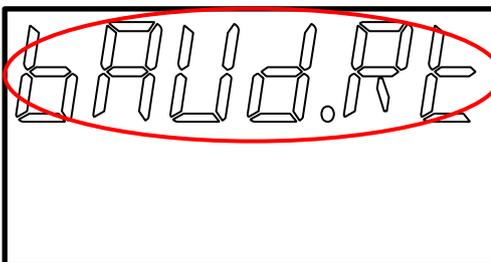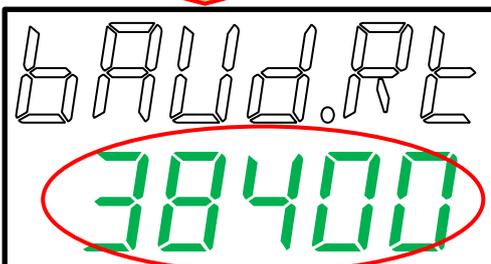
12	CS/RS is displayed on Main Display. Press the **ZERO/SET** Key once.	

_C5/R5_
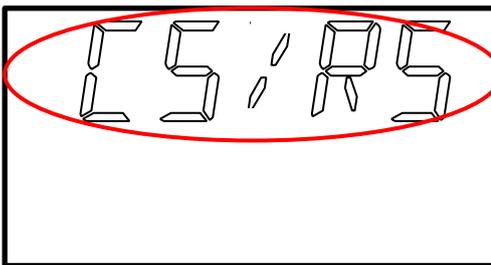
Check that the following set value is displayed on Sub-display.
   CS/RS control: OFF
       (None: Default)
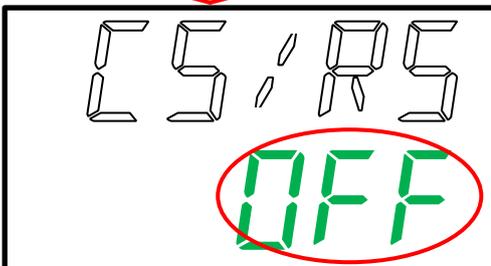
Press the **ZERORST/ESC** Key twice.

*If the value is different, change the value by pressing the ↑ **(UP)** or the ↓ **(DOWN)** Keys.

_C5/R5_
OFF

<Setting range>
OFF (Default)
/ON

13	RS232C is displayed on Main Display.

_RS232C_

Keep pressing the →**(RIGHT)** or the ←**(LEFT)** Keys until DELIMI is displayed.

Press the **ZERO/SET** Key once.

dELi Mi

14	Check that the following set value is displayed on Sub-display. Delimiter: CR (Default)
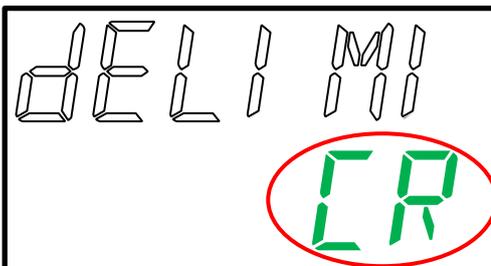
Press and hold the **Mode Switching** Key for two seconds.

*If the value is different, change the value by pressing the ↑ **(UP)** or the ↓ **(DOWN)** Keys.

dELi Mi
_CR_

15	OK/CAN is displayed. Press the **ZERO/SET** Key once.	SWI tCH OK/CAN
	SAVE is displayed. Press the **ZERO/SET** Key once.	SAVE OK/CAN
	The RUN mode is displayed.	dARK 0.5000 THRESHOLD H L RUN
16	Power cycle Sensor Controller. *The saved setting data become valid after power cycling.	
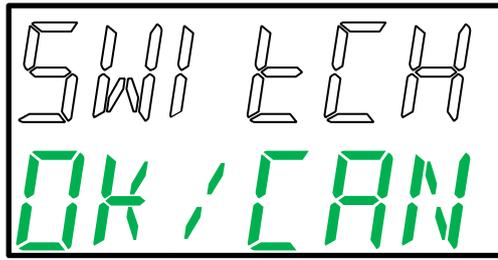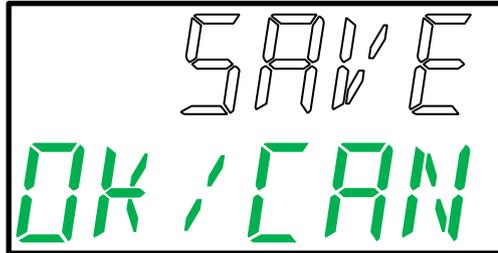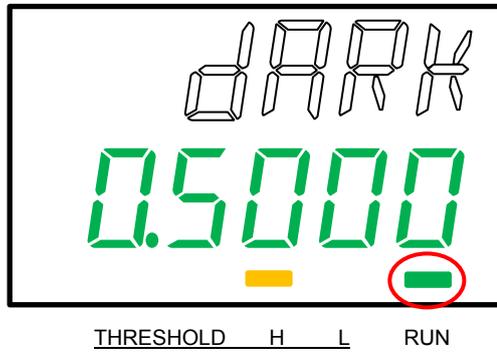
7.3. PLC Setup

Set up PLC.

7.3.1. Hardware Settings

Set the hardware switches on Serial Communications Unit and connect the cables.

Precautions for Correct Use

Make sure that the power supply is OFF when you set up.

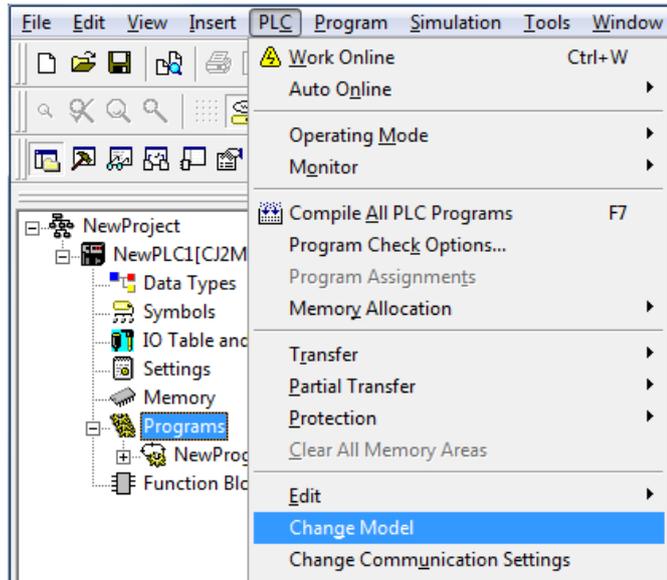|		
1	Make sure that PLC is powered OFF. *If it is ON, the settings described in the following steps and subsequent procedures may not be applicable.	
2	Check the positions of the hardware switches and Port 2 on the front of Serial Communications Unit by referring to the figure on the right.	
3	Set Unit number switch to *0*. *The unit number is set to 0 as the factory default setting.	
4	Connect Serial Communications Unit to PLC as shown on the right. Connect Port 2 on Serial Communications Unit and Sensor Controller with the RS-232C cable (for PLC or programmable terminal). Connect Personal computer to PLC with a USB cable.	
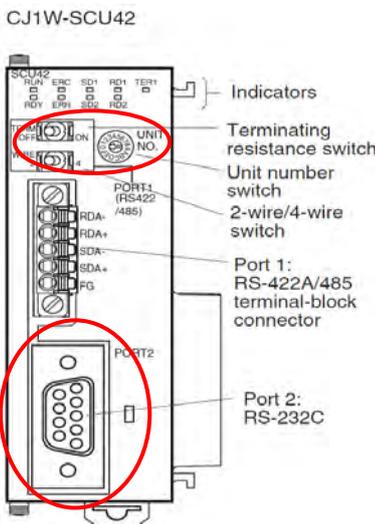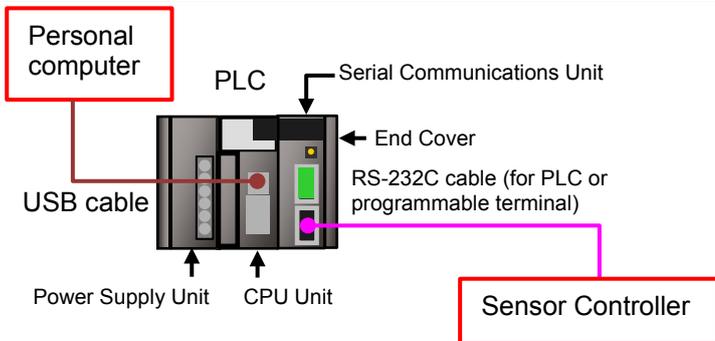
7.3.2. Opening the Project File and Connecting Online with PLC

Start CX-Programmer, open the project file, and connect online with PLC.

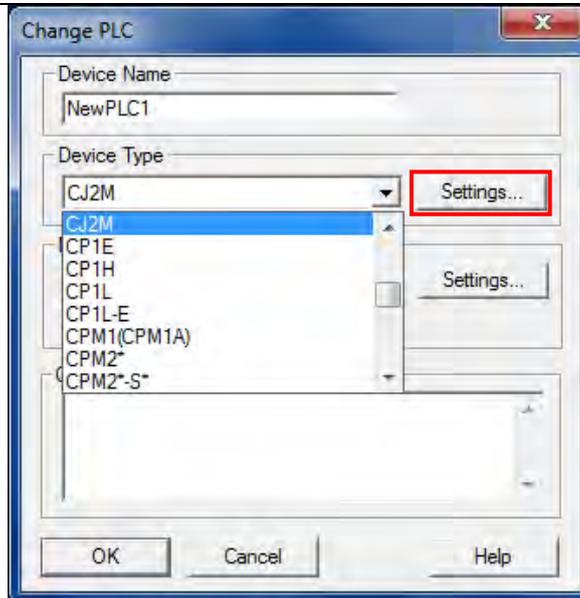Install CX-Programmer and the USB driver on Personal computer beforehand.

1	Turn ON PLC and Sensor Controller.	
2	Start CX-Programmer. *If the User Account Control Dialog Box is displayed at start, make a selection to start CX-Programmer.	
3	CX-Programmer starts.	
4	Select **Open** from the File Menu.	
5	The Open CX-Programmer Project Dialog Box is displayed. Select *P652_CJ_PMCR232C_ OMRON_ZW-7000_EV100.cxp* and click **Open**. *Obtain a project file from OMRON.	
6	After you open the project file, select **Programs** in the project workspace.	
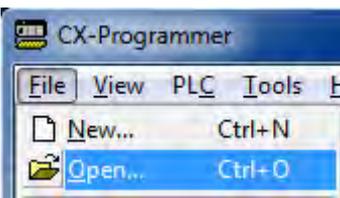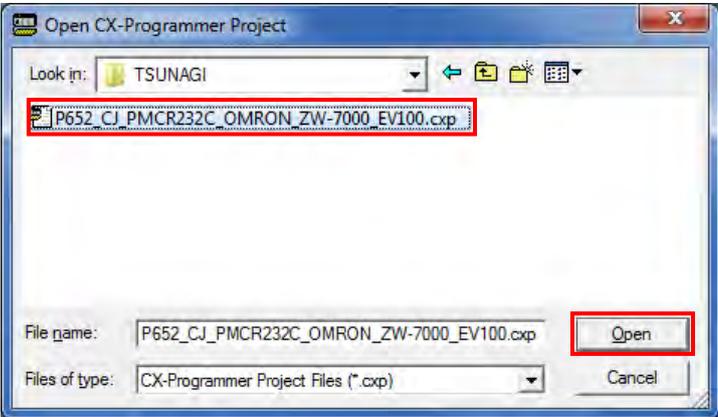
21
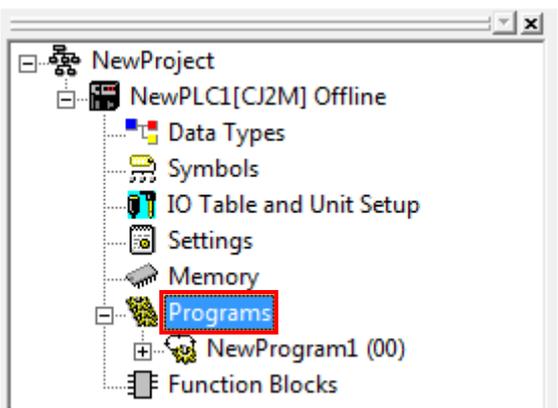
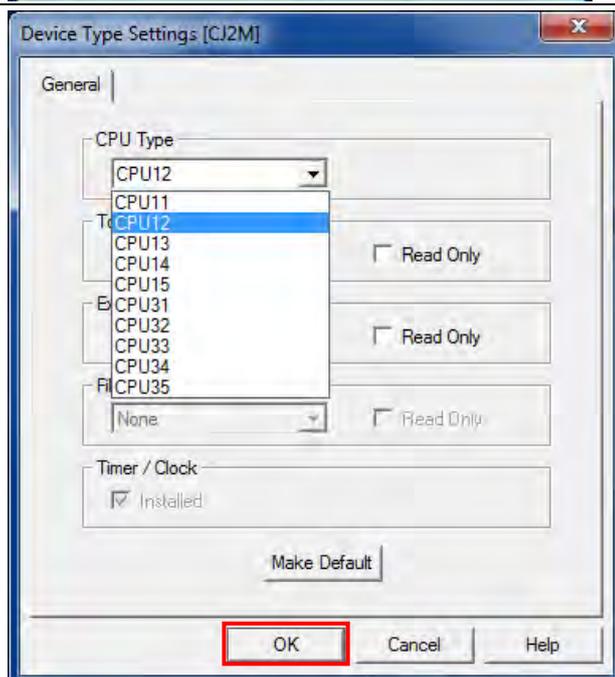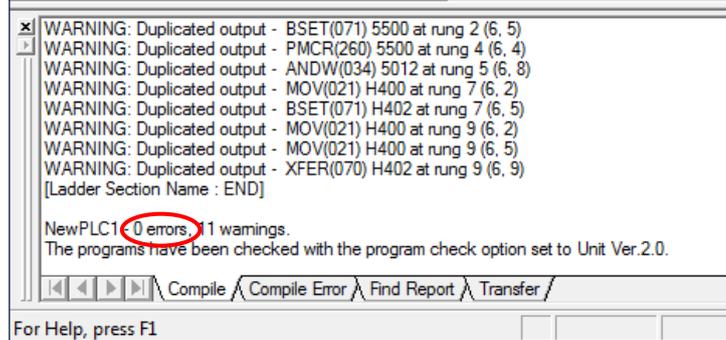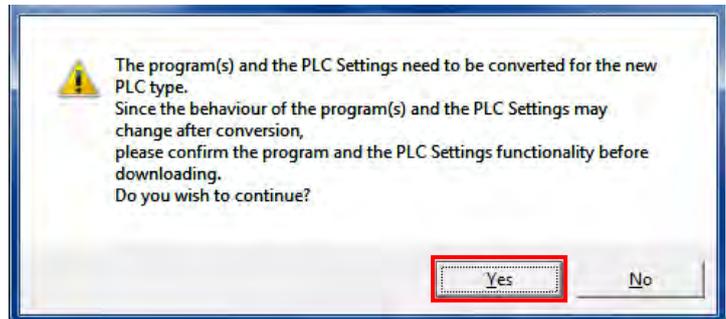| 7	Select *Change Model* from the PLC Menu.	
8	The Change PLC Dialog Box is displayed. From the pull-down list of Device Type, select the device type of PLC to use. Click **Settings**. *CJ2M is selected in this document.	
9	The Device Type Settings Dialog Box is displayed. From the pull-down list of CPU Type, select the CPU type to use. Click **OK**. *CPU12 is selected in this document.	

10

Check that USB is set as the network type in the Change PLC Dialog Box. Click **OK**.

*If USB is not set as the network type, select **USB** from the pull-down list.
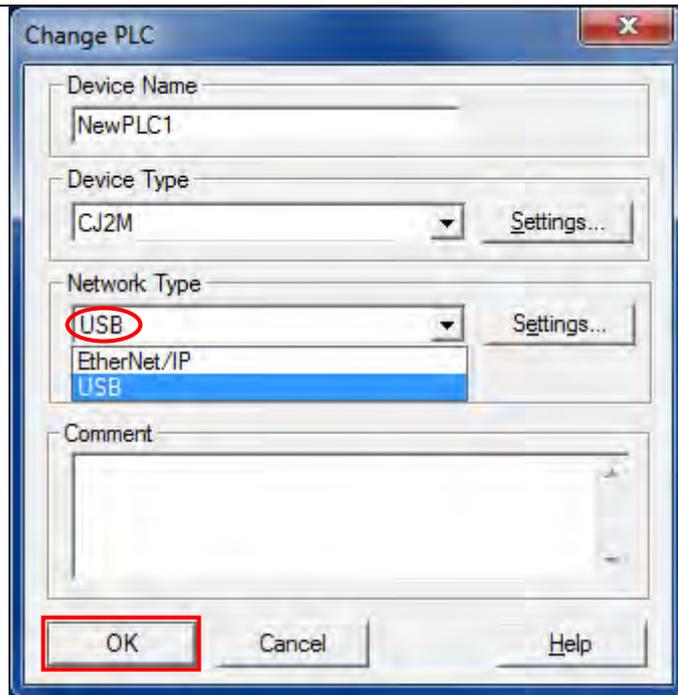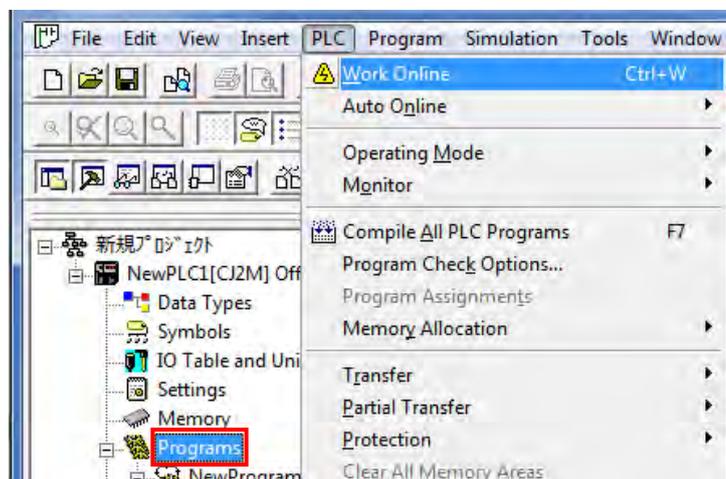

*If you changed Device Type in step 8 or CPU Type in step 9, the dialog box on the right is displayed. Confirm that there is no problem and click **Yes**. Make sure that the program was normally converted. ("0 errors" must be shown.) (Although duplicated output warnings were detected as shown on the right, they are not problems.)
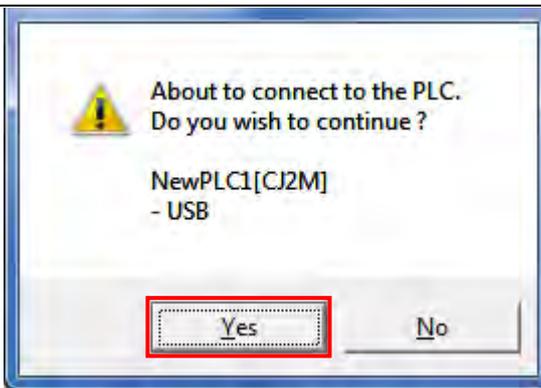

WARNING: Duplicated output - BSET(071) 5500 at rung 2 (6, 5)
WARNING: Duplicated output - PMCR(260) 5500 at rung 4 (6, 4)
WARNING: Duplicated output - ANDW(034) 5012 at rung 5 (6, 8)
WARNING: Duplicated output - MOV(021) H400 at rung 7 (6, 2)
WARNING: Duplicated output - BSET(071) H402 at rung 7 (6, 5)
WARNING: Duplicated output - MOV(021) H400 at rung 9 (6, 2)
WARNING: Duplicated output - MOV(021) H400 at rung 9 (6, 5)
WARNING: Duplicated output - XFER(070) H402 at rung 9 (6, 9)
[Ladder Section Name : END]

NewPLC1 0 errors, 11 warnings.
The programs have been checked with the program check option set to Unit Ver.2.0.

\ Compile \ Compile Error \ Find Report \ Transfer /

For Help, press F1

11

Select **Programs** in the project workspace.

Select **Work Online** from the PLC Menu.

23

12	The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**.	
13	Check that CX-Programmer and PLC are normally connected online. *The ⚠ icon is pressed down during online connection.	

📓 **Additional Information**

If PLC cannot be connected online, check the cable connection.

After you check the cable connection, return to step 6, check the settings such as the connection type in steps 7 to 9 and try again. For details, refer to *Connecting Directly to a CJ2 CPU Unit Using a USB Cable* of the *CX-Programmer OPERATION MANUAL* (Cat. No. W446).

📓 **Additional Information**

The dialog boxes explained in this document may not be displayed depending on the environmental settings of CX-Programmer. For details on the environmental settings, refer to *Options and Preferences* in *CHAPTER 3 Project Reference* in *PART 1: CX-Programmer* of the *CX-Programmer OPERATION MANUAL* (Cat. No. W446).

This document explains the setting procedures when "Confirm all operations affecting the PLC" is selected.
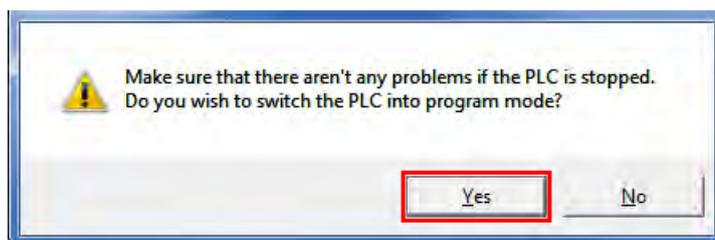
7.3.3. Creating the I/O Table

Create the I/O table for PLC.

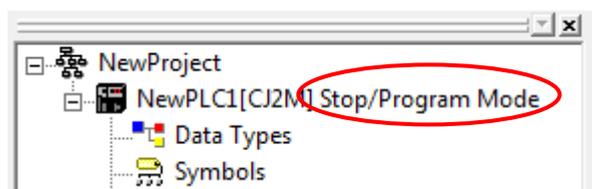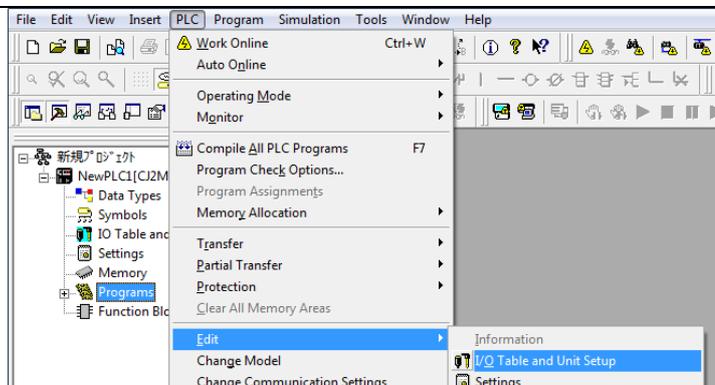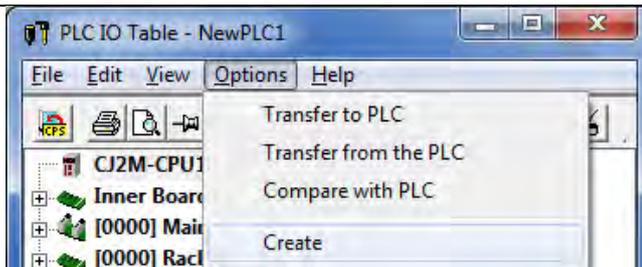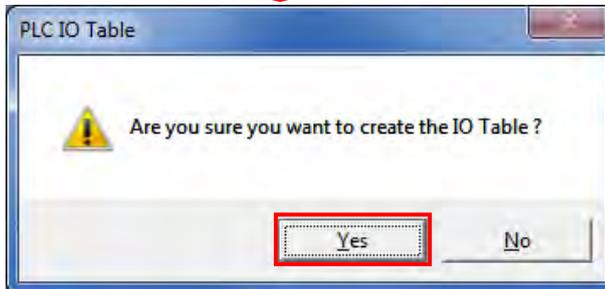|		
1	If the operating mode of PLC is Run Mode or Monitor Mode, change it to Program Mode by following the steps below. (1)Select **Operating Mode - Program** from the PLC Menu in CX-Programmer. (2)The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**. *Refer to *Additional Information* on the previous page for the settings concerning the dialog display. (3)Check that Stop/Program Mode is displayed on the right of the PLC model in the project workspace tree of CX-Programmer.	
2	Select **Edit** - **I/O Table and Unit Setup** from the PLC Menu in CX-Programmer. The PLC IO Table Window is displayed.	
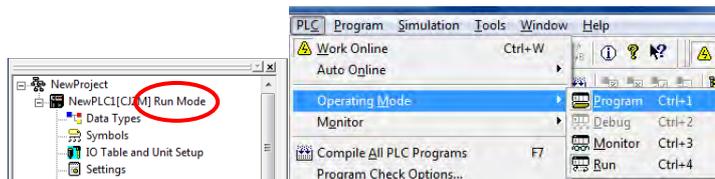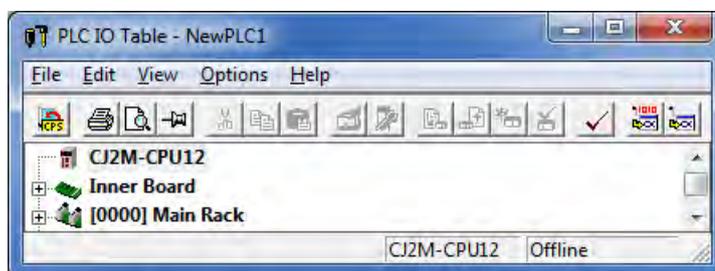
Precautions for Correct Use

The PLC is reset after creating and transferring the I/O table in step 3 and subsequent steps.

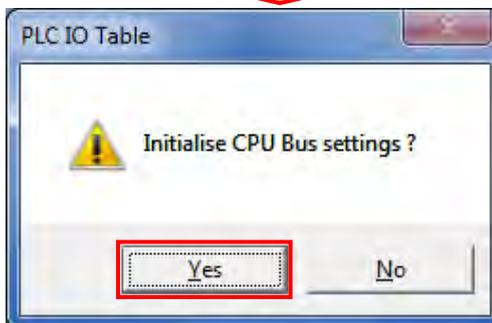Always confirm safety before creating and transferring the I/O table.

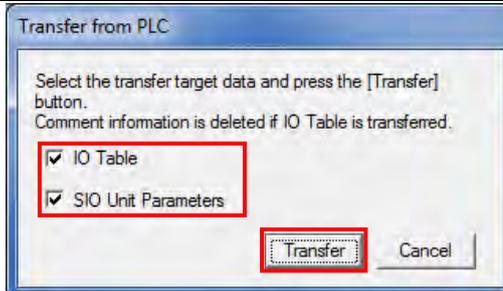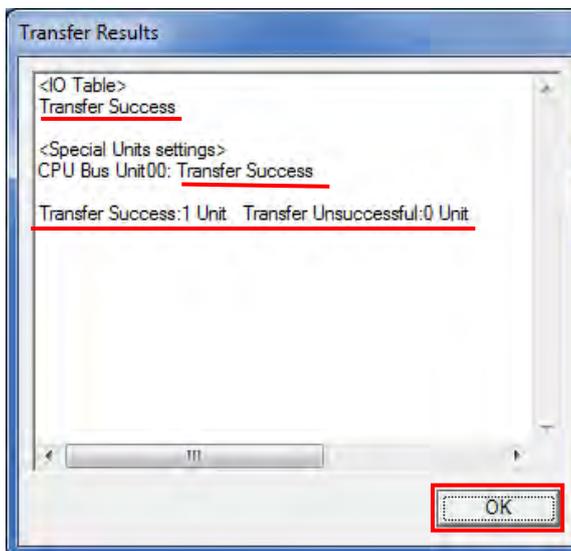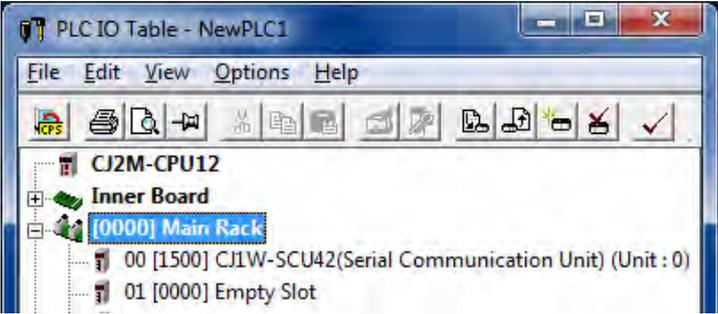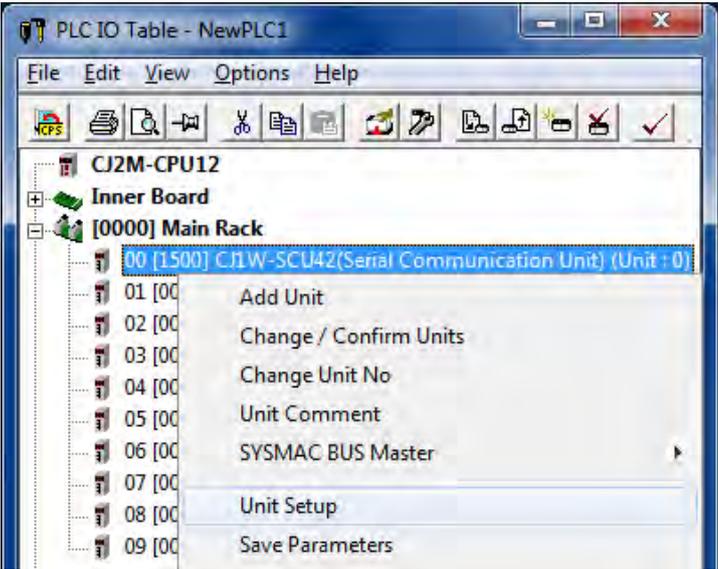|		
3	Select *Create* from the Options Menu in the PLC IO Table Window.	PLC IO Table - NewPLC1 File Edit View **Options** Help Transfer to PLC Transfer from the PLC Compare with PLC CJ2M-CPU1 Inner Board [0000] Mair Create [0000] Racl
	The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**.	PLC IO Table ⚠ Are you sure you want to create the IO Table ? [Yes] No
	The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**.	PLC IO Table ⚠ Initialise CPU Bus settings ? [Yes] No
4	The Transfer from PLC Dialog Box is displayed. Select *IO Table* and *SIO Unit Parameters*. Click **Transfer**.	Transfer from PLC Select the transfer target data and press the [Transfer] button. Comment information is deleted if IO Table is transferred. ☑ IO Table ☑ SIO Unit Parameters [Transfer] Cancel
	When the transfer is completed, the Transfer Results Dialog Box is displayed. Check that the transfer is successfully completed by referring to the message in the dialog box. When the I/O table is created normally, the dialog box displays as follows: Transfer Success: 1 Unit Transfer Unsuccessful: 0 Unit Click **OK**.	Transfer Results <IO Table> Transfer Success <Special Units settings> CPU Bus Unit00: Transfer Success Transfer Success:1 Unit Transfer Unsuccessful:0 Unit [OK]

7.3.4. Parameter Settings

Set the parameters for Serial Communications Unit.

1	Double-click **[0000] Main Rack** in the PLC IO Table Window to expand the tree.	
2	Right-click **00 [1500] CJ1W-SCU42** and select *Unit Setup*.	
3	The View Parameters Dialog Box is displayed. Select *Port2: Protocol macro Settings* from the pull-down list of Displayed Parameter. *The Port 2 on Serial Communications Unit is used in this document.	
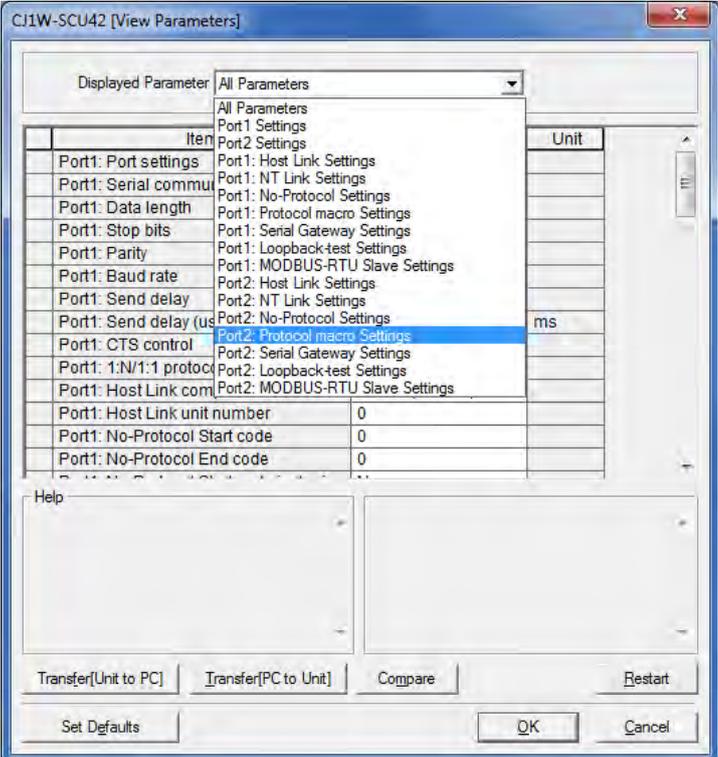
4 The setting items of Port2: Protocol macro Settings are listed as shown in the figure on the right. (The figure shows the default values.)

5 Select *User settings* for Port 2: Port settings from the pull-down list of Set Value.

6 Set the following parameters in the same way as step 5.

・Serial communications mode: *Protocol macro*

・Data length: *8 bits*

・Stop bits: *1 bit*

・Parity: *None*

・Baud rate: *38400bps*

・Protocol macro Transmission method: *Full-duplex*

*Use the default settings for other parameters.
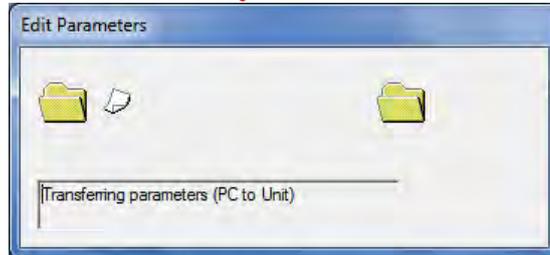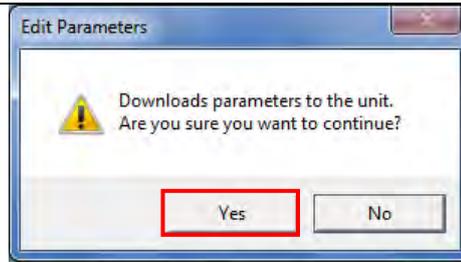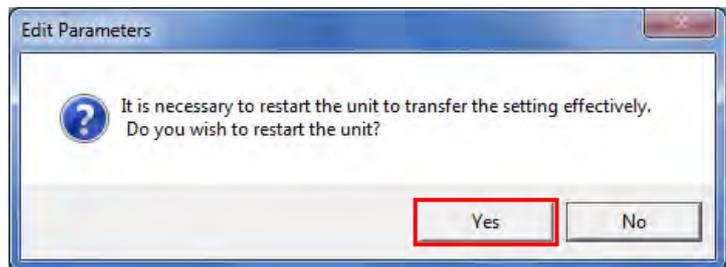
Click **Transfer[PC to Unit]**.

7	The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**.	**Edit Parameters** ⚠ Downloads parameters to the unit. Are you sure you want to continue? [**Yes**] [No]
	Check that the transfer is completed as shown on the right. Click **Close**.	**Edit Parameters** 📁 📄 📁 Transferring parameters (PC to Unit) **Edit Parameters** 📁 📁 (Transfer successful) [Close]
8	The dialog box on the right is displayed. Check the contents and click **Yes**.	**Edit Parameters** ❓ It is necessary to restart the unit to transfer the setting effectively. Do you wish to restart the unit? [**Yes**] [No]
	The Select Port Dialog Box is displayed. Select *All ports* and click **OK**.	**Select Port** Select a port to restart from the list below All ports HostLink 1 HostLink 2 [OK] [Cancel]
9	The dialog box on the right is displayed. Check the contents and click **OK**.	**Edit Parameters** ℹ The unit was restarted. [OK]
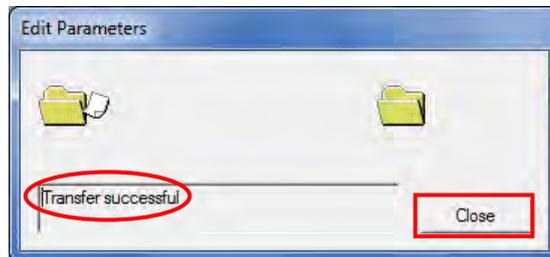
29
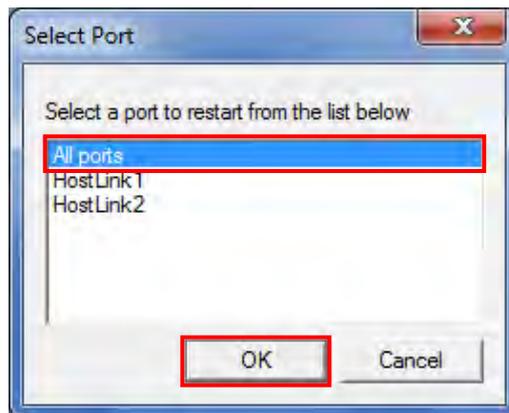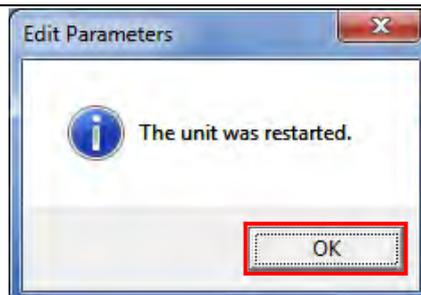
10	Click **Compare** in the View Parameters Dialog Box.	
11	Check that a message "Compare successful" is displayed in the dialog box on the right. Click **Close**.	
12	Click **OK** in the View Parameters Dialog Box.	
13	Select *Exit* from the File Menu in the PLC IO Table Window to close.	
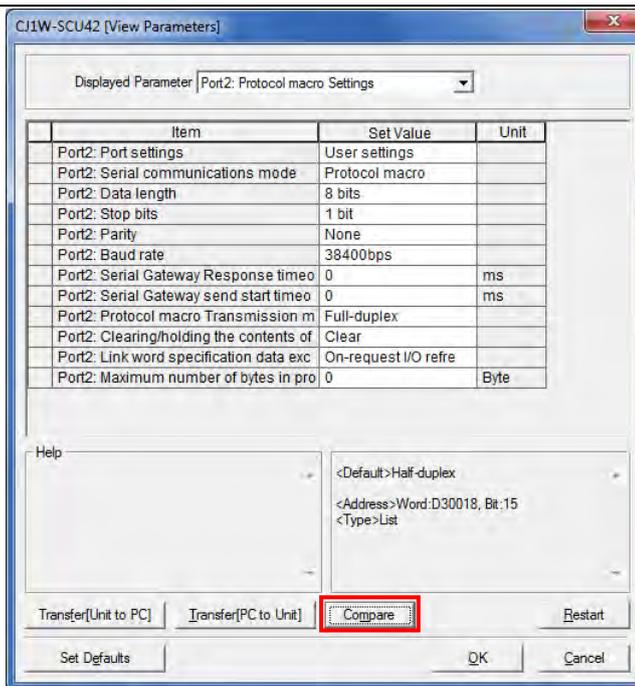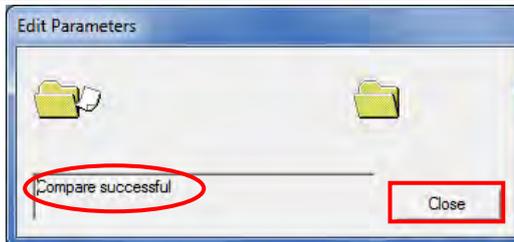
7.3.5. Transferring the Project Data

Transfer the project data to PLC.

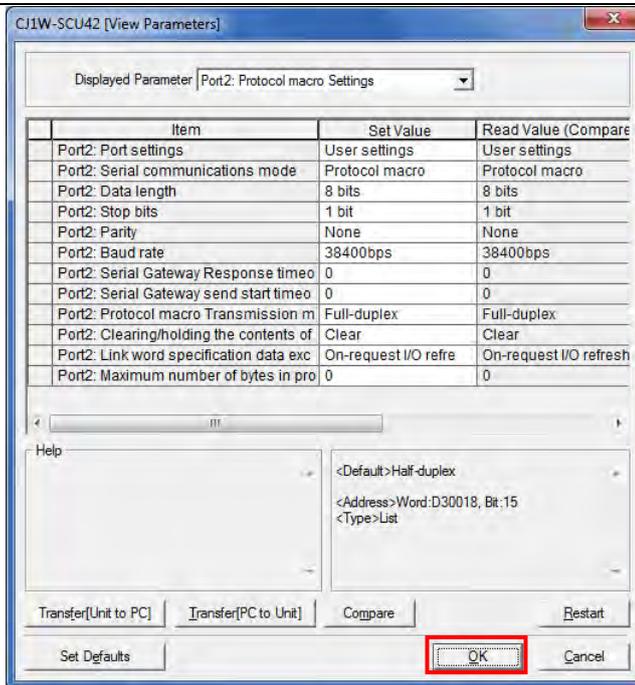|		
1	Select **Programs** in the project workspace of CX-programmer. Select **Transfer** - **To PLC** from the PLC Menu.	
2	Select *Program(s)*, *Comments*, and *Program index*. Click **OK**. *The I/O table and Special Unit Setup are unnecessary to transfer here, because they are already set in *7.3.3. Creating the I/O Table* and *7.3.4. Parameter Settings*. *The *Comments* and the *Program index* Check Boxes may not be displayed depending on the device type. In such a case, select *Program(s)* only and transfer the project data.	
3	The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**.	
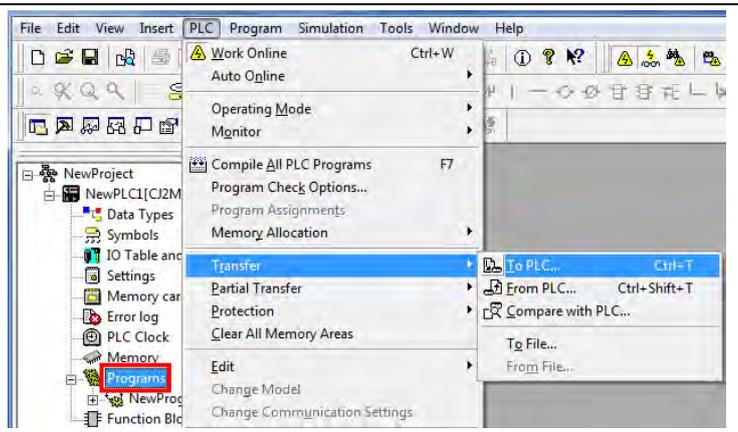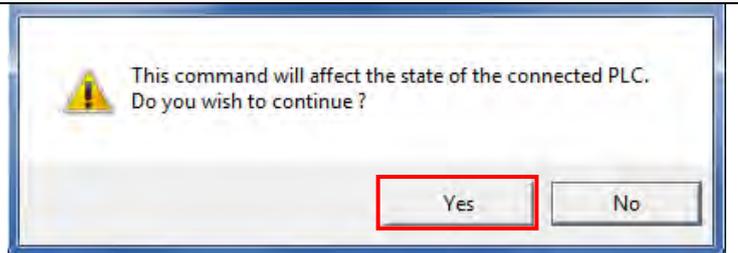
4	The dialog box on the right is displayed (stating "Download successful") when the transfer is completed. Click **OK**.	
5	Select **Programs** in the project workspace. Select *Transfer* - *Compare with PLC* from the PLC Menu.	
6	Select *Program(s)* and click **OK**.	
7	Check that a message stating "Compare successful" is displayed. Click **OK**.	
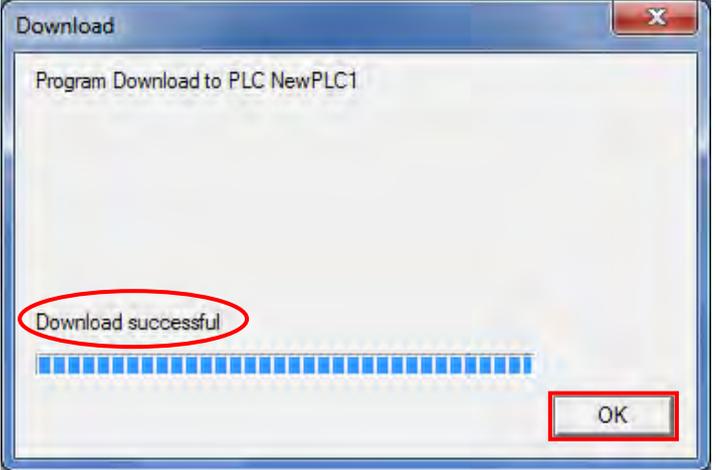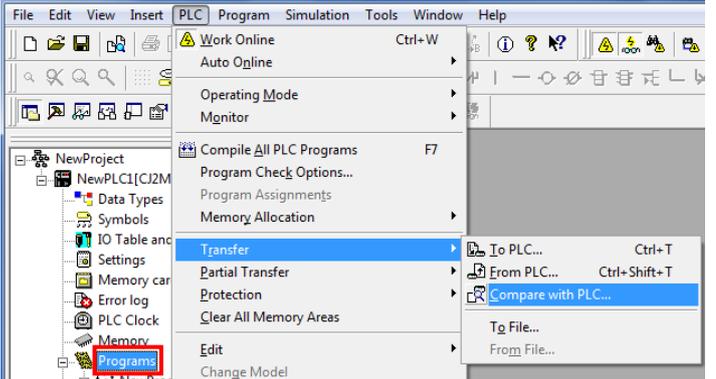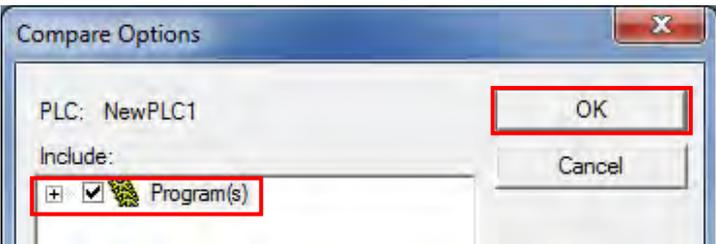
7.3.6. Starting the CX-Protocol and Opening the project file

Start CX-Protocol and open the project file.

1	Start CX-Protocol. *If the User Account Control Dialog Box is displayed at start, make a selection to start CX-Protocol.	
2	Start CX-Protocol. The following panes are displayed in this window. Top left: Project Workspace Bottom left: Output Window Right: Project Window	
3	Select **Open** from the File Menu.	
4	The Open Dialog Box is displayed. Select *P652_CJ_PMCR232C_ OMRON_ZW-7000_EV100.psw* and click **Open**. *Obtain a project file from OMRON.	
5	The project data read are displayed in the Project Workspace and in the Project Window.	
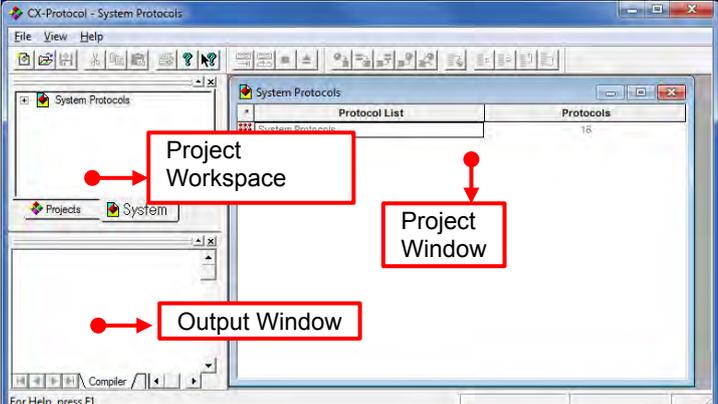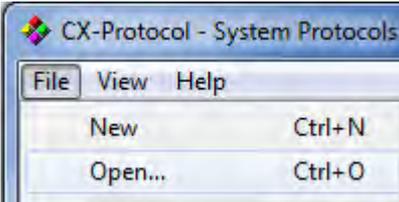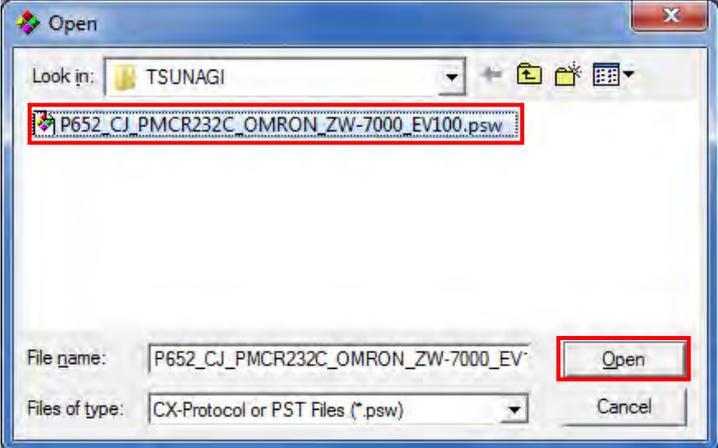
33

7.3.7. Connecting Online and Transferring the Protocol Macro Data

Connect online with CX-Protocol and transfer the protocol macro data to Serial Communications Unit.

1	Double-click **P652_CJ_PMCR232C_OMRON_ZW-7000_EV100** in the Project Workspace to display a tree.	
2	Select **Edit PC-PLC Comms Settings** from the PLC Menu.	
3	The Change PLC Dialog Box is displayed. From the pull-down list of Device Type, select the device type of PLC to use. Click **Settings**. *CJ2M is selected in this document.	
4	The Device Type Settings Dialog Box is displayed. From the pull-down list of CPU Type, select the CPU type to use. Click **OK**. *CPU12 is selected in this document.	
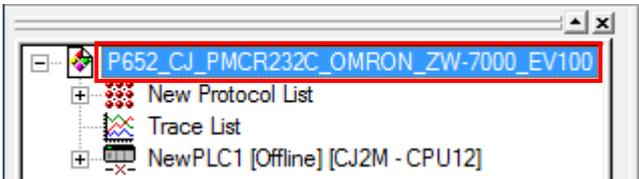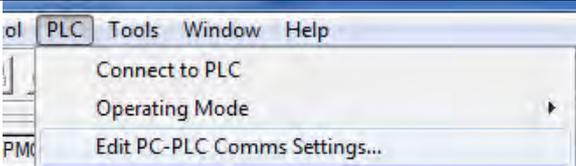
34

5	Check that USB is set as the network type in the Change PLC Dialog Box. Click **OK**. *If USB is not set as the network type, select **USB** from the pull-down list.	
6	Select **Connect to PLC** from the PLC Menu.	
7	The PLC Icon in the Project Workspace changes from Offline to Program. It means that PLC is connected online. *If Monitor or Run is displayed, change it to Program by following step 8.	
8	If the operating mode of PLC is Monitor or Run in step 7, select **Operating Mode** - **Program** from the PLC Menu. The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**. Check that the operating mode changes to Program mode as shown in step 7.	
9	Double-click **New Protocol List** in the Project Workspace to display a tree.	
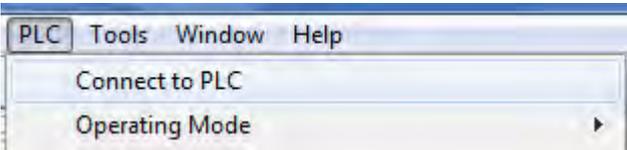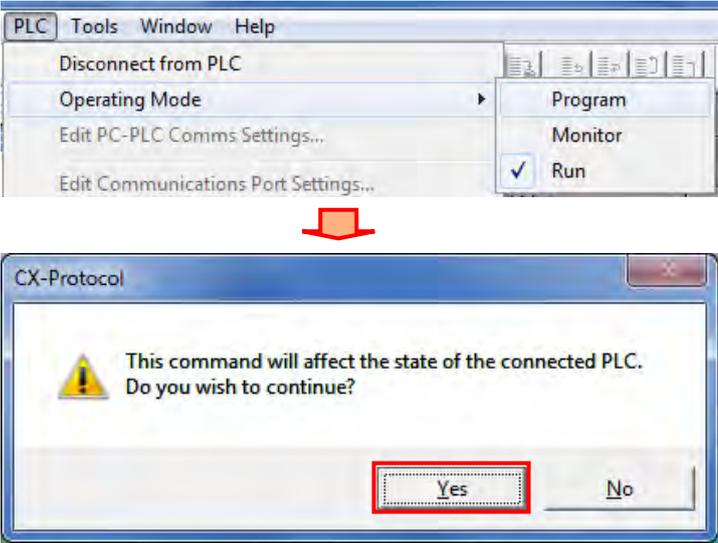
35
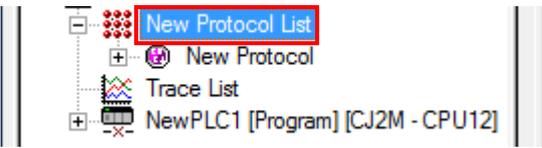
10	The Project Window on the right is displayed. Check that SCU [0] is set in the *Target* Column. *If SCU [0] is not set, select **SCU [0]** as shown on the right.	
11	Click **New Protocol List** in the Project Workspace and select **Download Protocols** from the Protocol Menu.	
12	The dialog box on the right is displayed. Select *Include Source Information* and click **Compile**.	
13	The compiling is complete when 100% is displayed in the *Complied %* Column. Check that the compiling is completed. Click **Download**.	
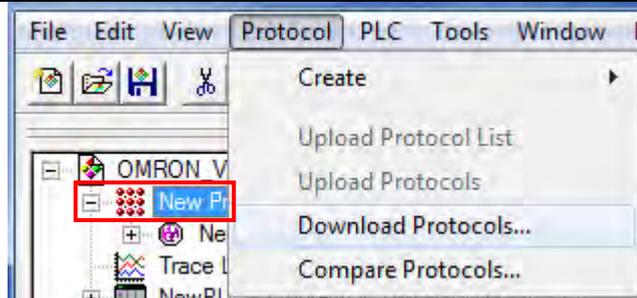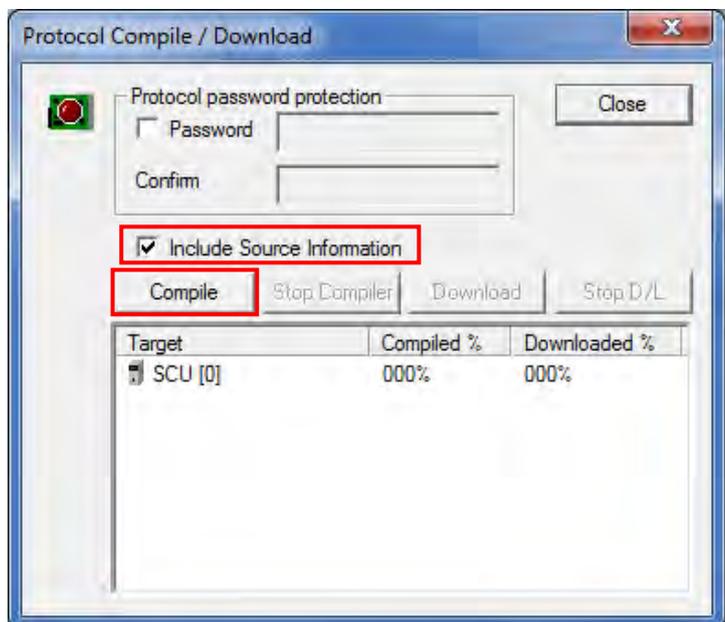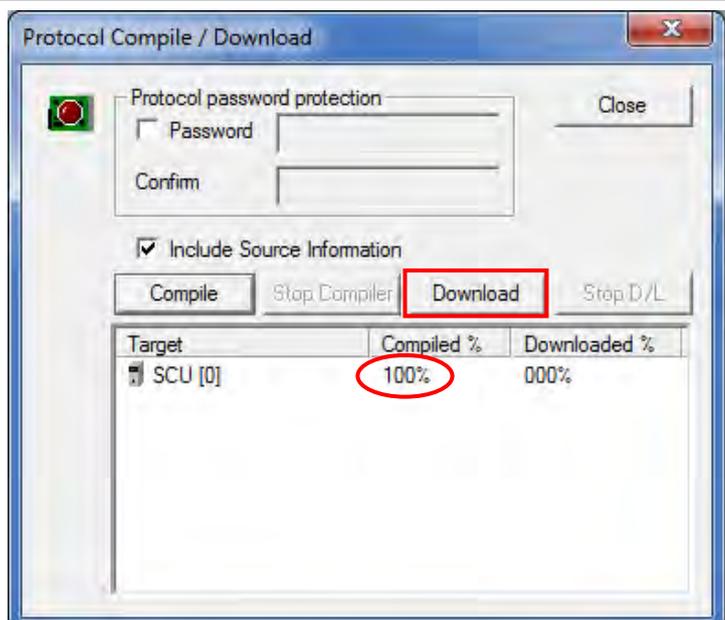
14	The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **OK**.	
15	Check that 100% is displayed in the *Downloaded %* Column as shown on the right. Click **Close**.	
16	Click **New Protocol List** and select *Compare Protocols* from the Protocol Menu.	
17	The dialog box on the right is displayed. Select *Include Source Information* and click **Compile**.	
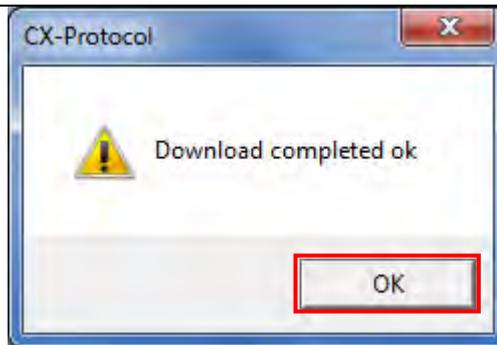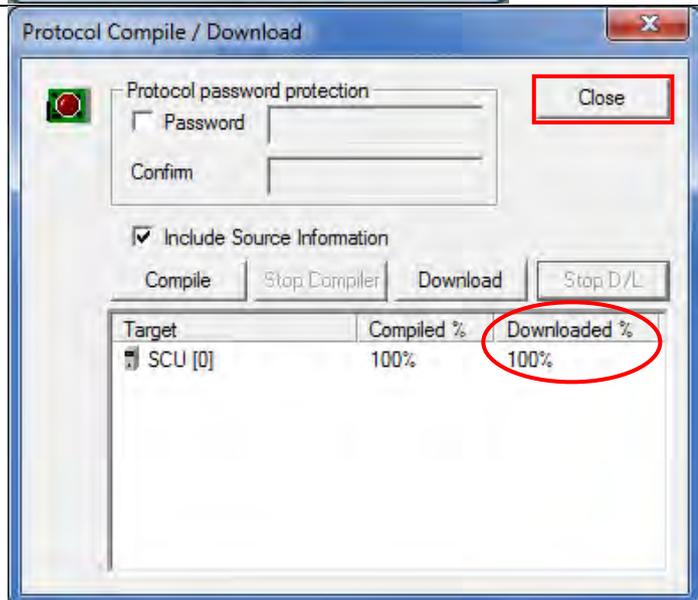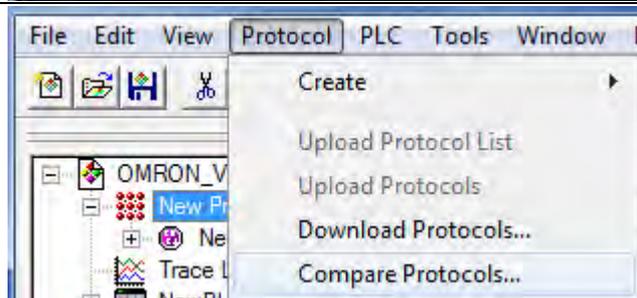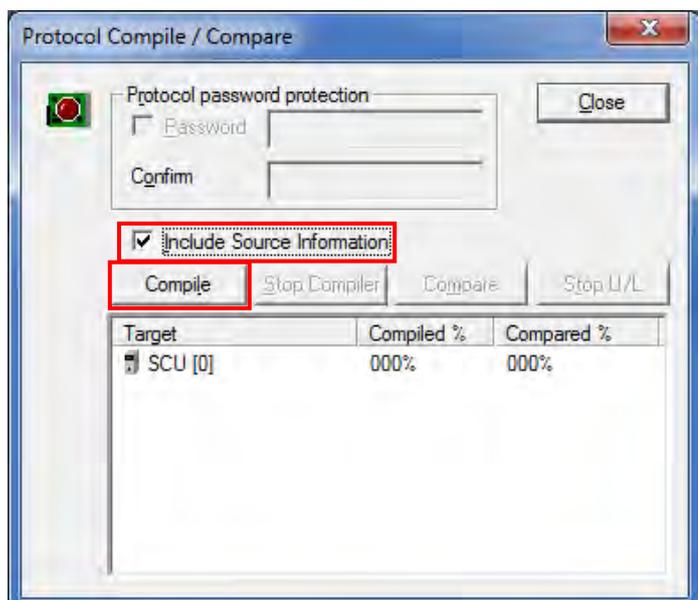
18	The compiling is complete when 100% is displayed in the *Complied %* Column. Check that the compiling is completed. Click **Compare**.	
19	The dialog box on the right is displayed. Check that Successful is displayed in the *Result* Column. Click **OK**.	
20	Check that 100% is displayed in the *Compared %* Column as shown on the right. Click **Close**.	
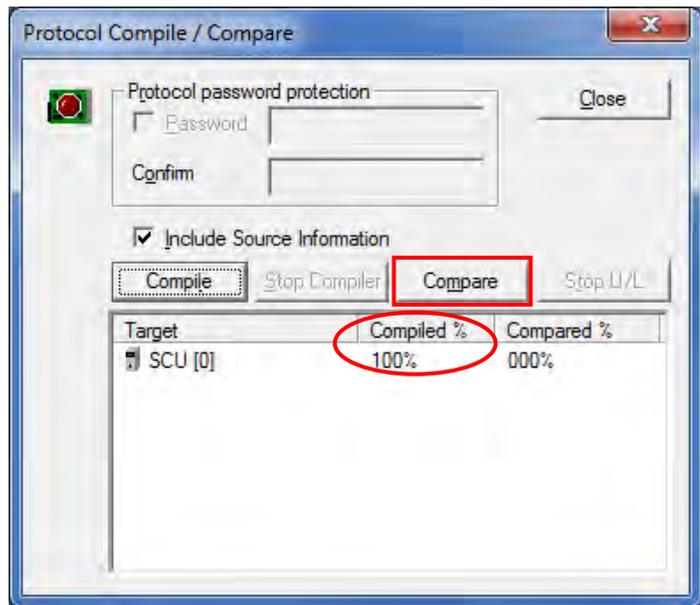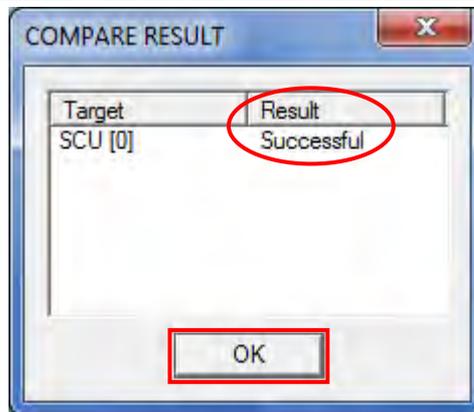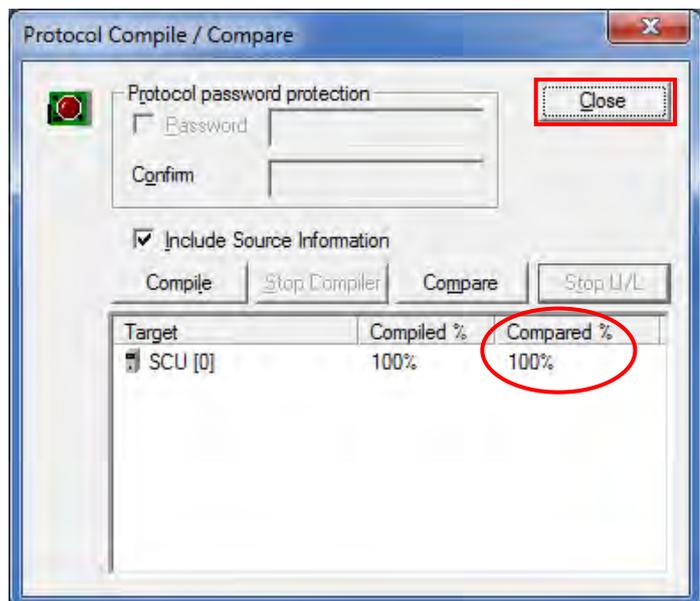
7.4. Serial Communication Status Check

Start the send/receive processing and confirm that serial communications performs normally.

⚠ Caution

If the PLC memory is changed by malfunction during monitoring power flow and present value status in the Ladder Section Window or in the Watch Window, the devices connected to output units may malfunction, regardless of the operating mode of CPU Unit.

Always ensure safety before monitoring power flow and present value status in the Ladder Section Window or in the Watch Window.

Precautions for Correct Use

Check that the serial cable is connected before performing the following procedure.
If it is not connected, turn OFF the each device, and then connect the serial cable.

7.4.1. Starting the Trace

Start tracing with CX-Protocol.

1	Select *Operating Mode* - *Monitor* from the PLC Menu.	
2	The confirmation dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**.	
3	Check that the operating mode changes to Monitor Mode. Double click ▩ **NewPLC1**.	
4	The tree under ▩ NewPLC1 expands. Select Serial Communications Unit. (SCU [0] is selected on the right).	
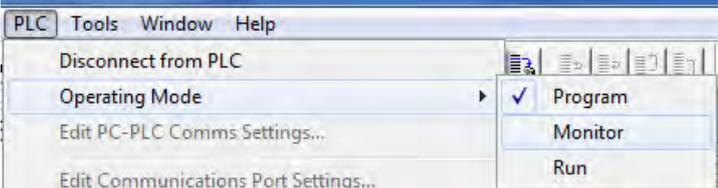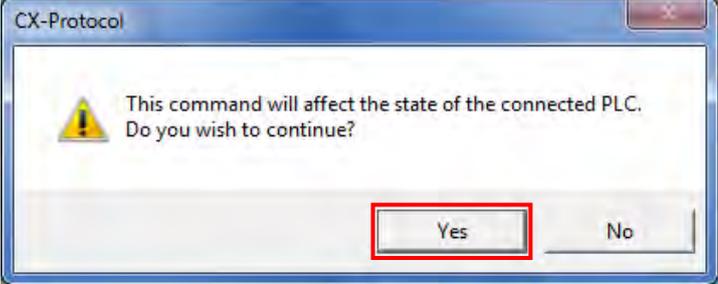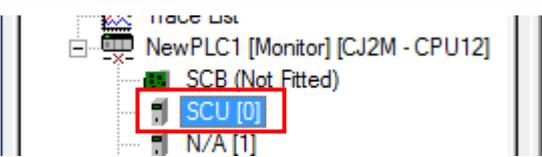
5	Select the **Trace 2** Icon ( ) in the Project Window. (Check that Trace 2 is highlighted as shown in the figure on the right.) *Trace 2 corresponds to Port 2 on Serial Communications Unit.	
6	Select *Start Trace* - *One ShotTrace* from the PLC Menu.	
7	Check that the status of Trace2 in the Project Window changes to One-shot Trace Running.	
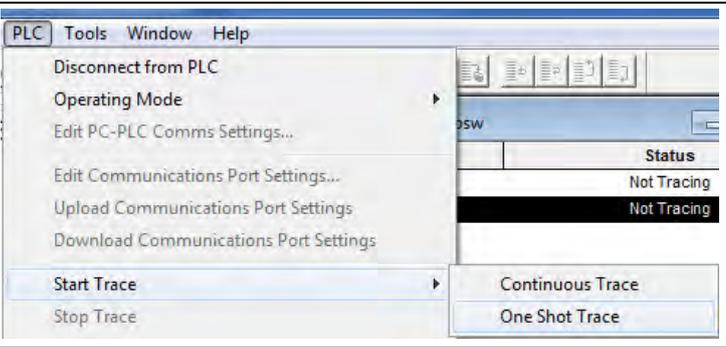
7.4.2. Executing the Communications Sequence

Execute the communications sequence using CX-Programmer.

1	Expand the Programs tree in the project workspace of CX-Programmer and double-click **Section1**. The Ladder Section Window shows the Section1 ladder program.	
2	In the Ladder Section Window, right-click *Input_Start* and select *Set* - *On*.	
3	Check that the Input_Start contact is turned ON as shown in the figure on the right.	
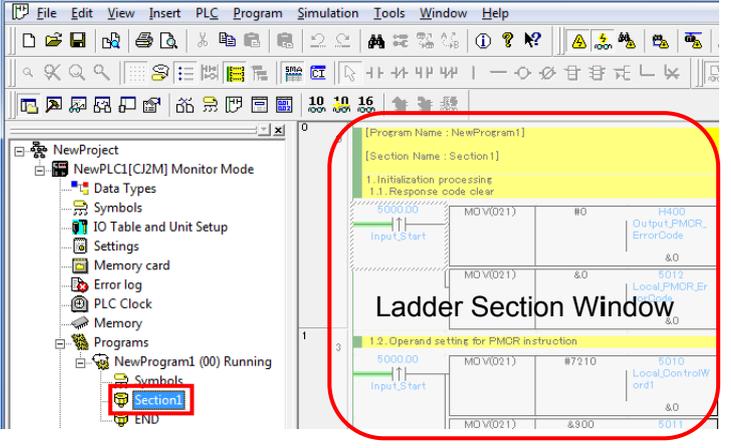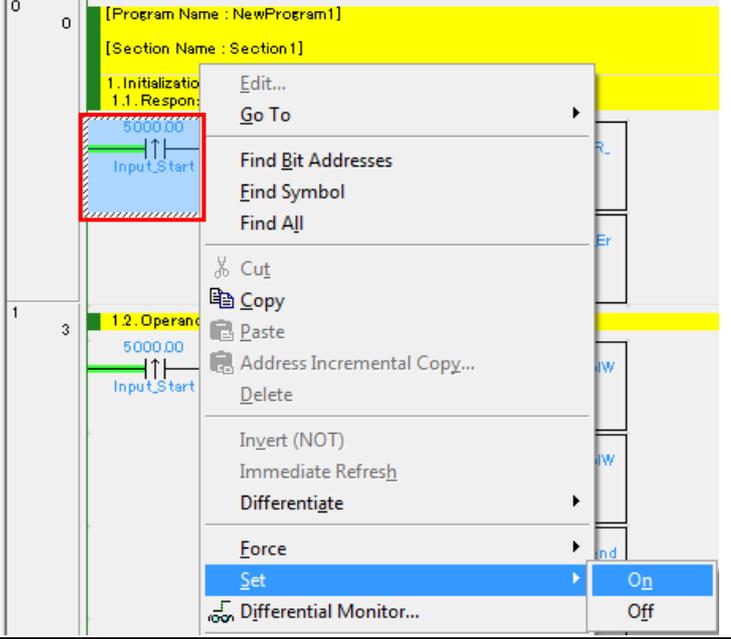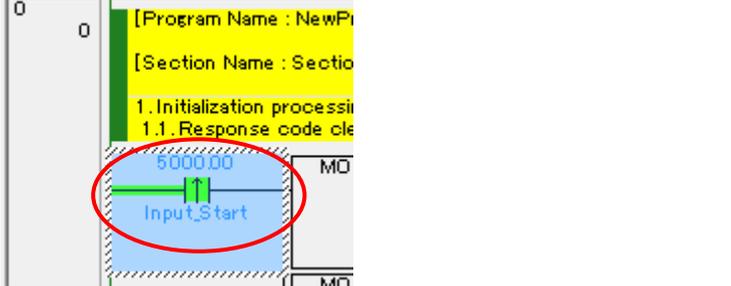
41

7.4.3. Checking the Trace Data

Check with the trace data in CX-Protocol that the correct data are sent and received.

1	Select *Upload Trace* from the PLC Menu in CX-Protocol. *Once the trace data is stored, Upload Trace becomes selectable.	PLC Tools Window Help Disconnect from PLC Operating Mode ▶ Edit PC-PLC Comms Settings... Edit Communications Port Settings... Upload Communications Port Settings Download Communications Port Settings Start Trace ▶ Stop Trace Upload Trace
2	The dialog box on the right is displayed. Check the contents and click **Yes**.	CX-Protocol A Communications Trace is in progress on this port. Do you wish to stop the Trace and proceed to upload the buffer? Yes No

3 Check the send/receive messages in the trace data file shown in the figure on the right. (In the example on the right, "VR"[0D(CR)] version information acquisition command of Sensor Controller is sent, and the version information (37 bytes) "ZW-7000␣␣␣␣␣␣␣␣␣␣ ␣Ver2.020␣2016/03/10" [0D(CR)] is received.)

*The ␣ mark above indicates a space.

*The response data and the parameter as shown on the right are given as information. For details, refer to *5. No-protocol Connection* of the *Displacement Sensor ZW-7000 series Confocal Fiber Type Displacement Sensor User's Manual for Communications Settings* (Cat. No. Z363).

*A receive message differs depending on a Sensor Controller you use.

Data continued

■VR response parameter

Item	Size
Model	Variable
Space	1 byte
Version information	Variable

7.4.4. Checking the Receive Data

Check that the correct data is written to the I/O memory of PLC using CX-Programmer.

1	Select *Edit* - *Memory* from the PLC Menu in CX-Programmer.	
2	Double-click **CIO** on the *Memory* Tab of the PLC Memory Window.	
3	Enter *5500* in the *Start Address* Field of the displayed CIO Window. Check that the start address changes to CIO5500.	
4	Select *Monitor* from the Online Menu.	
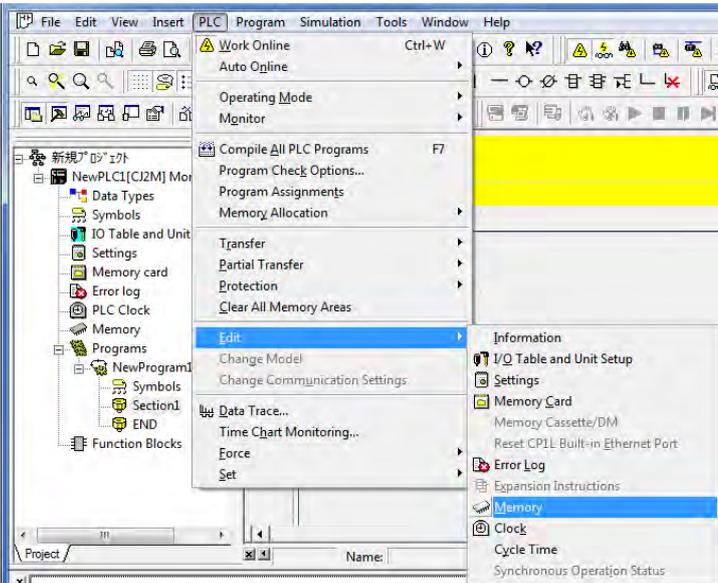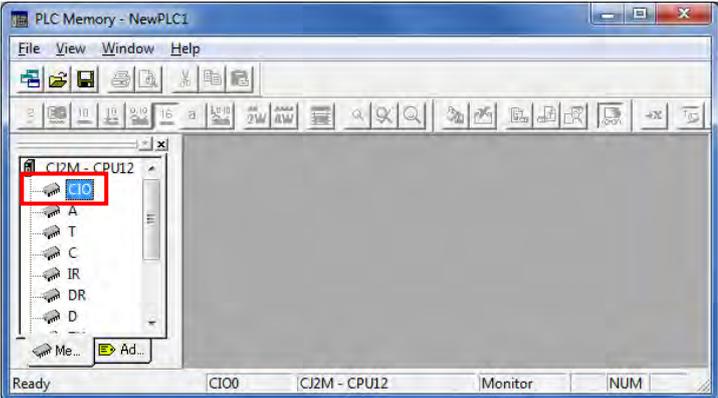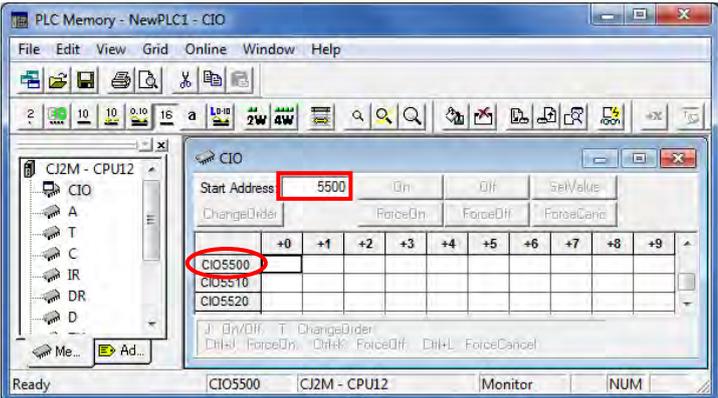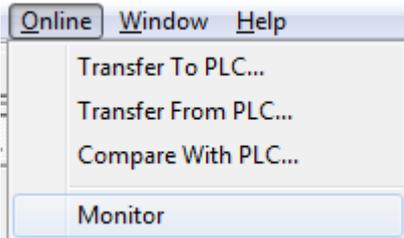
5 The Monitor Memory Areas Dialog Box is displayed.
Select *CIO* and click **Monitor**.
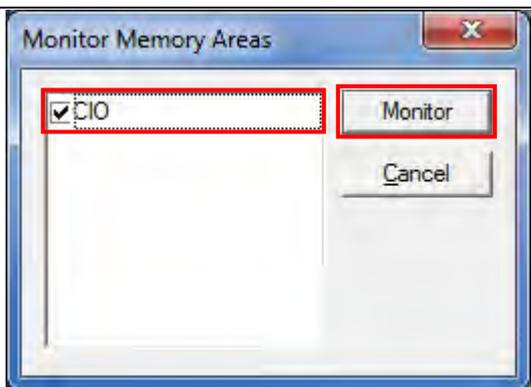
6 Check the received data (version information) in the CIO Window shown on the right.
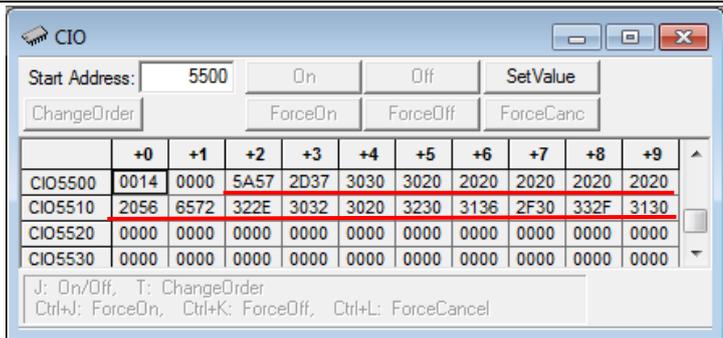
*In the example on the right, the stored data starting from CIO5502 are in hexadecimal and are described as follows:
5A57 2D37 3030 3020 2020 2020 2020 2020 2056 6572 322E 3032 3020 3230 3136 2F30 332F 3130
These values can be expressed as a string " ZW-7000␣␣␣␣␣␣␣␣␣␣ ␣Ver2.020␣2016/03/10" which is the same as the trace data described in step 3 in *7.4.3. Checking the Trace Data*.
The ␣ mark above indicates a space (20 in hexadecimal).

*The number of words being used (0014 in hexadecimal, 20 in decimal) is stored in CIO5500. The receive data read are stored in, from CIO5502 to CIO5519.

*You can convert hexadecimal to string by selecting *Display* - *Text* from the View Menu.
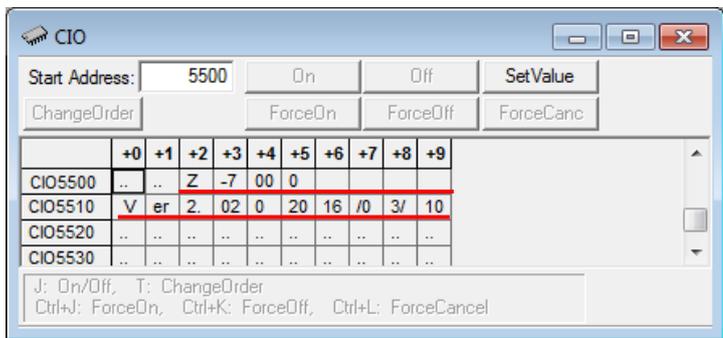
7 Perform steps 3 to 5 in *7.2.2. Parameter Settings* and display H.CALIB on Main Display.
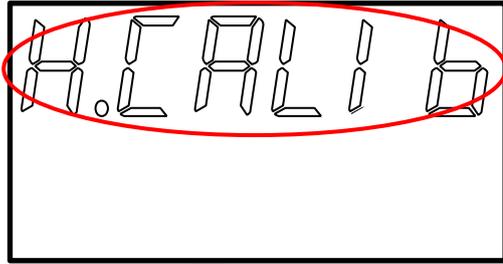
Keep pressing the →**(RiGHT)** or the ←**(LEFT)** Keys until C.INFO is displayed on Main Display.
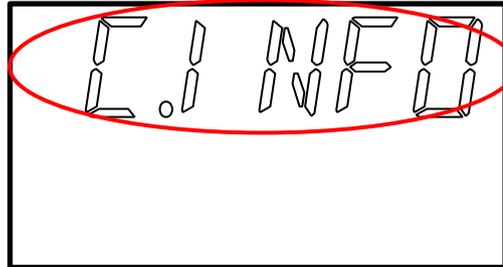
Press the **ZERO/SET** Key once.

8 VER is displayed on Main Display.
Press the **ZERO/SET** Key once.
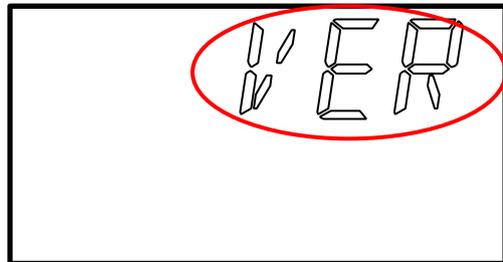
Check the Sensor Controller version displayed on Sub-display.

Version: 2.020
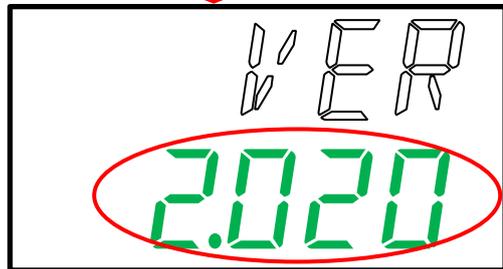
*It shows that the Sensor Controller version is the same as the one in step 6.

8. Initialization method

The setting procedures in this document are based on the factory default settings.
Some settings may not be applicable unless you use the devices with the factory default settings.

8.1. Initializing PLC

To initialize the settings of PLC, it is necessary to initialize Serial Communications Unit and CPU Unit. Change the operating mode of PLC to PROGRAM mode before the initialization.

8.1.1. Serial Communications Unit

To initialize the settings of Serial Communications Unit, select *Edit* - *I/O Table and Unit Setup* from the PLC Menu in CX-Programmer and perform the following steps.

(1) Right-click Serial Communications Unit in the PLC IO Table Window and select *Unit Setup* from the menu.
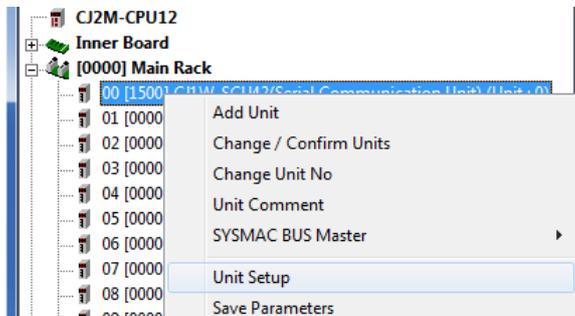
(2) In the CJ1W-SCU42 [View Parameters] Dialog Box, click **Set Defaults** first, then click **Transfer[PC to Unit]**.
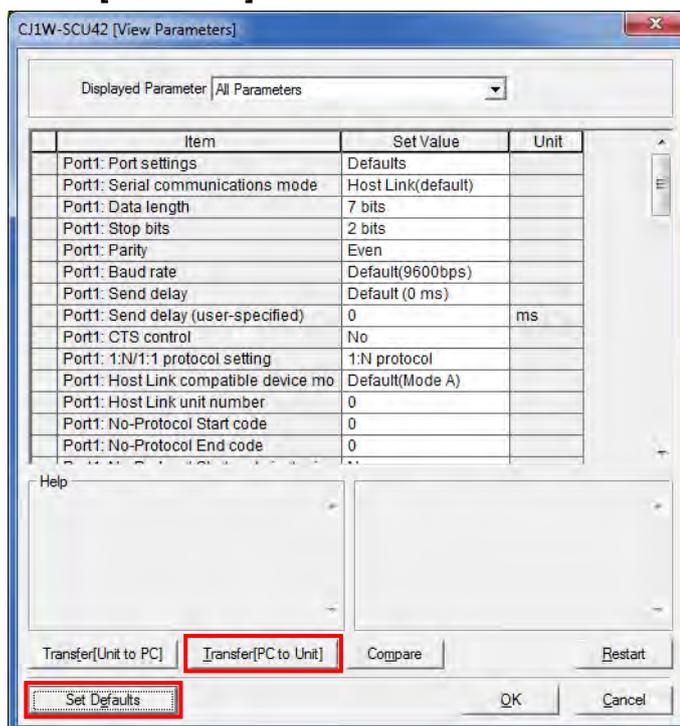
8.1.2. CPU Unit

To initialize the CPU Unit settings, select **Clear All Memory Areas** from the PLC Menu in CX-Programmer. Select *Initialize* in the Confirm All Memory Area Clear Dialog Box and click **OK**.
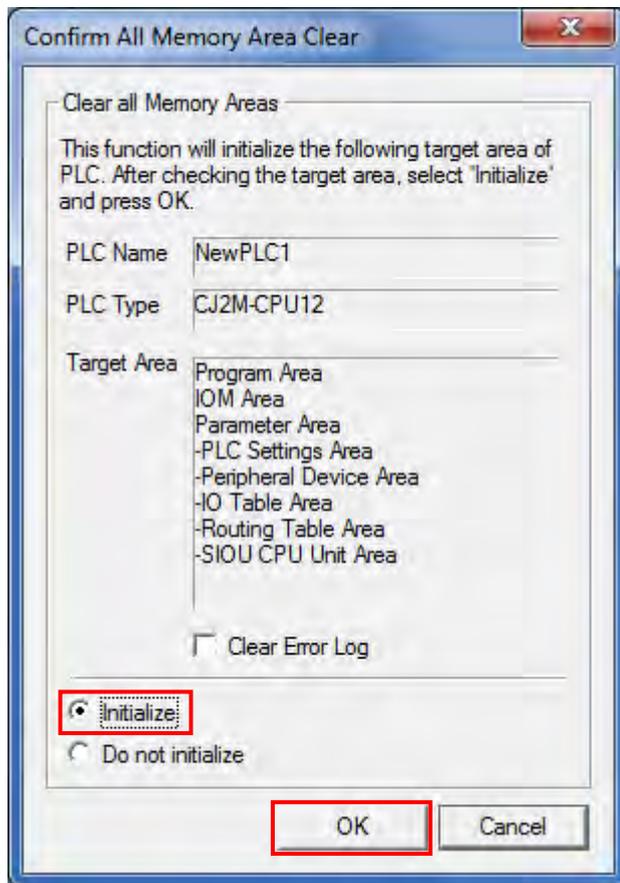
8.1. Initializing Sensor Controller

For information on how to initialize Sensor Controller, refer to *Initializing Settings* in *8-11 Setting the System* in *8. Sensor controller operations* of the *Displacement Sensor ZW-7000 series Confocal Fiber Type Displacement Sensor User's Manual* (Cat. No. Z362).

9. Program

This section describes the details on the program used in this document.

9.1. Overview

The following explains specifications and functions of the program that are used to check the connection between Sensor Controller (hereinafter referred to as Destination Device) and PLC (Serial Communications Unit (hereinafter referred to as SCU)).

This program uses the protocol macro function of SCU to send and receive the "version information acquisition" command to/from Destination Device and to detect a normal end or an error end.
A normal end of the send/receive processing means a normal end of the communications sequence.
An error end means an error end of the communications sequence and an error of Destination Device (detected with the response data from Destination Device).

Here, the "&" prefix is added to decimal data and the "#" prefix is added to hexadecimal data when it is necessary to distinguish between decimal and hexadecimal data. (e.g., "&1000" for decimal data and "#03E8" for hexadecimal data)

Additional Information

OMRON has confirmed that normal communications can be performed using this program under *5.2. Device Configuration*, however, we do not guarantee the normal operation under the disturbance such as electrical noise or the performance variation of the device.

9.1.1. Outline of Processing

The following figure shows the data flow from when PLC (SCU) issues command data to Destination Device using serial communications until PLC receives response data from Destination Device.

(1) The ladder program specifies the communications sequence No. 900 and executes the PMCR instruction.

(2) The PLC receives the response data from Sensor Controller according to receive messages defined by the communications sequence No. 900 and stores them in the response data storage area.

(3) The Sensor Controller executes the command by receiving the command data from PLC, and returns response data to PLC.

(4) The PLC receives the response data from Sensor Controller according to the receive messages defined by the communications sequence No. 900, and stores them in the response data storage area.
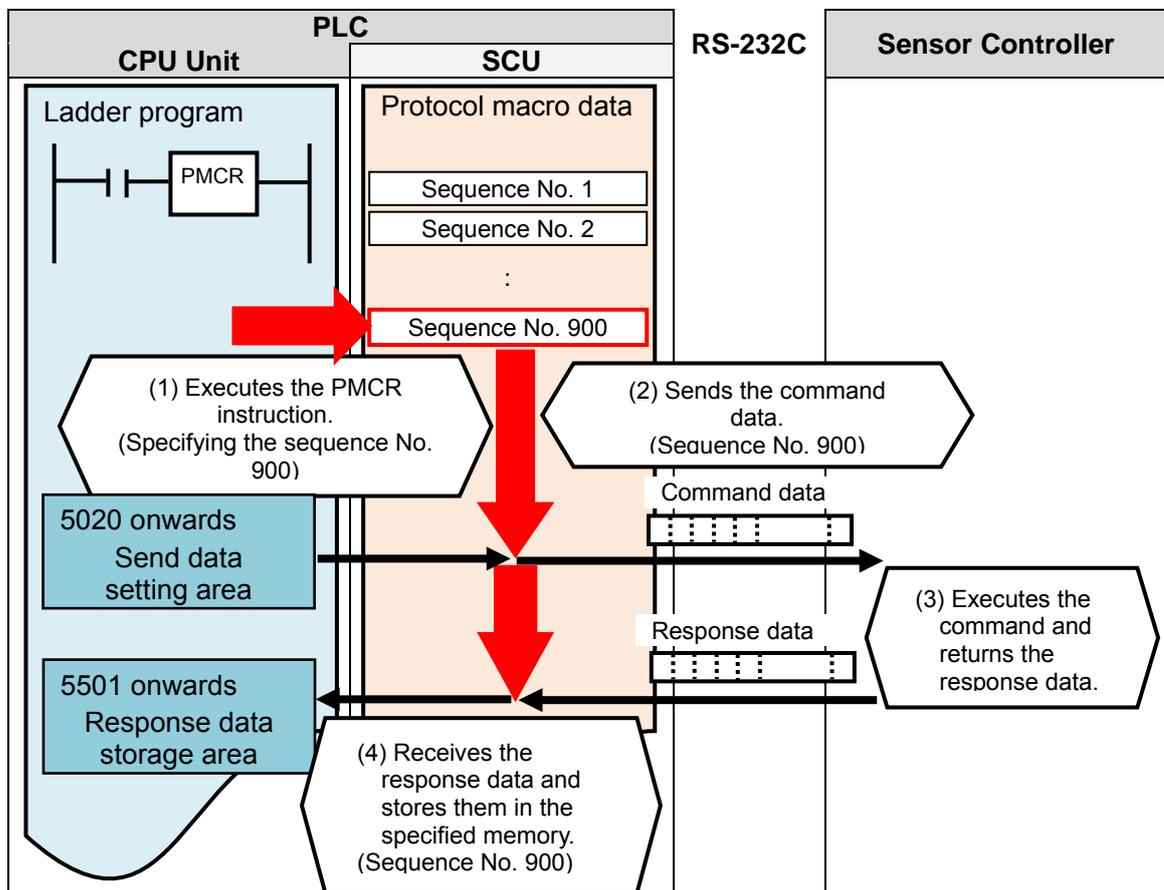
9.1.2. PMCR Instruction and Send/Receive Messages

The following describes the basic operations to execute the PMCR instruction and to send and receive messages.

📑 **Additional Information**

For details, refer to *Serial Communications Instructions (PMCR)* in *SECTION 3 Instructions* of the *CJ Series Programmable Controllers INSTRUCTIONS REFERENCE MANUAL* (Cat. No. W474).

●PMCR instruction operand data

Instruction	Mnemonic	Variations	Function code	Function
PROTOCOL MACRO	PMCR	@PMCR	260	Starts a communications sequence (protocol data) that is registered in a Serial Communications Board (CS Series only) or Serial Communications Unit.

	PMCR
Symbol	PMCR(260) C1 C1: Control word 1 C2 C2: Control word 2 S S: First send word R R: First receive word

[C1: Control word 1]

The following three items are set for SCU.

・ Communications port No. (internal logical port): #0 to #7
・ Serial port number (physical port): #1 or #2 (#1: PORT1, #2: PORT2)
・ Unit address of Destination Device: # unit number + #10
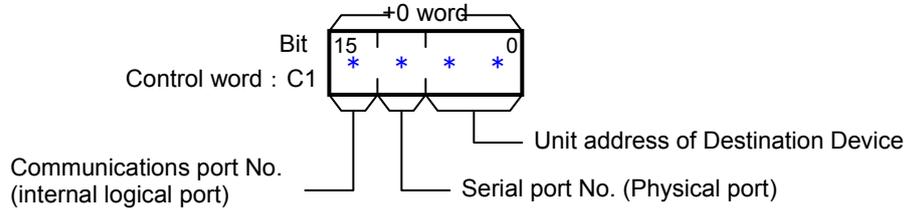
[C2: Control word 2]

The communications sequence number is set, which is registered as protocol macro data. For information on the communications sequence number registered in this protocol macro data, refer to 9.2.1 Communications Sequence Number.
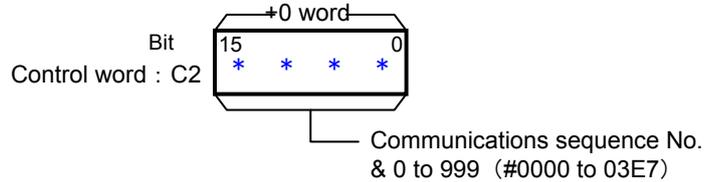
[S: First send word (send area specification)]

The first word of the words (n) required to send the data is set to S. (Including the S word) Between #0000 and #00FA (n=&0 and &250) words can be set.

The send data (assigned to a variable) are entered in the words from S+1 to S+(n-1).

If there is no operand specified in the execution sequence, such as a direct or linked word, set constant #0000 for S.
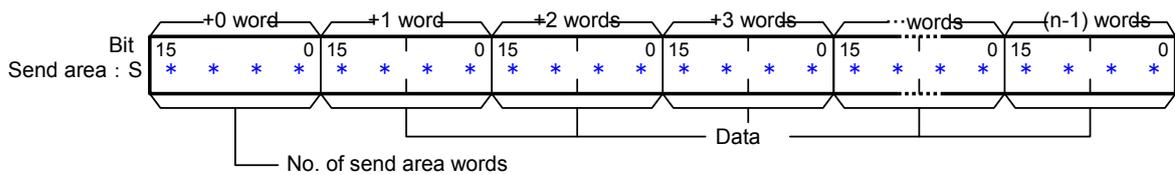
[D: First receive word (receive area specification)]

The number of the received data words (m) is stored in D. (Including the D word) The received data is stored in the words from D+1 to D+(m-1).

(m=&0 to &250 or #0000 to #00FA)
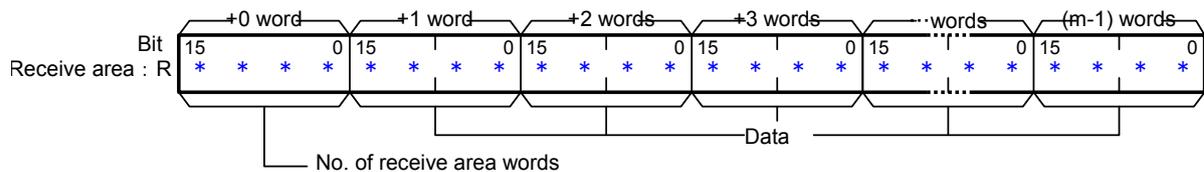
●Send/Receive messages

[Frames of send/receive messages]

Send message	*	*	*	*	*	*	CR	LF

PLC

Destination Device

Data — Terminator

Receive message	*	*	*	*	*	*	CR	LF

Data — Terminator

[Relation between send area S (PMCR instruction operand) and send messages]

CPU ->SCU Send area : S

Bit

+0 word	+1 word	+2 words	+(n-1) words
15 * * * * 0	15 * * * * 0	15 * * * * 0	15 * * * * 0

No. of send area words

SCU -> Destination Device Send message

*	*	*	*	*	*	CR	LF

Data — Terminator
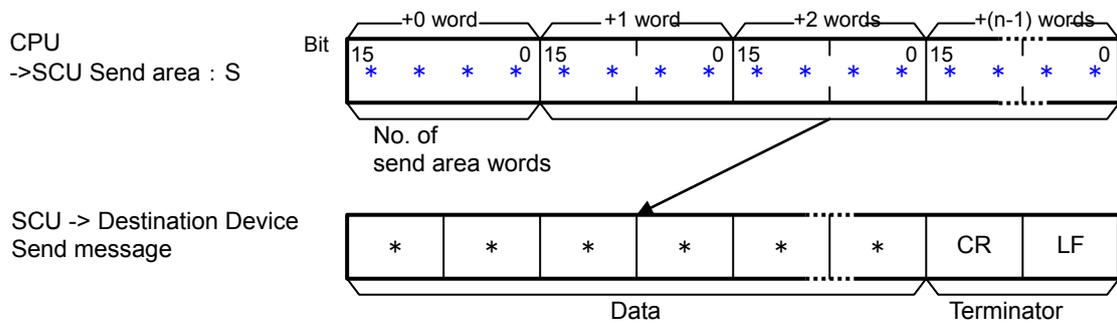
[Relation between receive messages and receive area D (PMCR instruction operand)]

Destination Device -> SCU Receive message

*	*	*	*	*	*	CR	LF

Data — Terminator

No. of receive area words

SCU ->CPU Receive area : D

Bit

15 * * * * 0	15 * * * * 0	15 * * * * 0	15 * * * * 0
+0 word	+1 word	+2 words	+(n-1) words
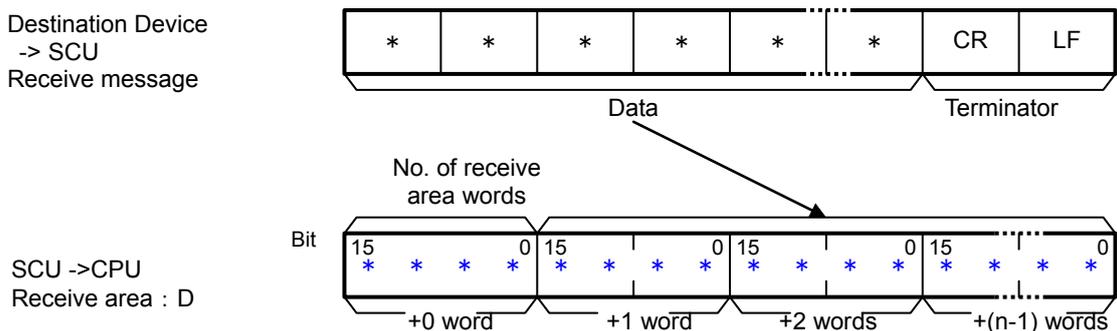
9.2. Communications Sequence

The following explains the communications sequence that can be used for the PMCR instruction in this program.

9.2.1. Communications Sequence Number

A communications sequence that is registered in SCU is identified by a communications sequence number. The PLC executes a corresponding command on Destination Device by specifying a communications sequence number in the PMCR instruction.
This protocol macro data includes the following communications sequence.

No.	Command name	Description
900	Version information acquisition	Acquires version information of Destination Device.

9.2.2. PMCR Instruction Operand Settings

The PMCR instruction operands of the communications sequence No. 900 (#0384)" version information acquisition" are shown below.

・Control word C1 setting (C1: CIO 5010)

CH	Description (data type)	Data (description)
C1	Communications port No. (1-digit hex)	#7210 (Communications port No. 7, Serial port No.2, #Unit number + #10)
	Serial port No. (1-digit hex)	
	Unit address of Destination Device (2-digit hex)	

・Control word C2 setting (C2: CIO 5011)

CH	Description (data type)	Data (description)
C2	Communications sequence No.	&900 (Version information acquisition)

・First send word S setting (S: CIO 5020)

CH	Description (data type)	Data (description)
S	Number of send data words (4-digit hex)	#0000: (No variable in send messages of protocol macro data)

・First receive word D setting (D: CIO 5500)

CH	Description (data type)	Data (description)
D	Number of receive data words (4-digit hex)	Stores the number of words used, including the D word.
D+1	Receive data [0] (4-digit hex)	Stores acquired version information.
D+2	Receive data [1] (4-digit hex)	
:	:	
D+50	Receive data [49] (4-digit hex)	

9.2.3. Receive Data Format

The following shows the receive data format of version information that is acquired from Destination Device using the version information acquisition command.

The information below is stored in order from D+1. (D: CIO 5500)

Item	Size
Model	Variable
Space	1 byte
Version infromation	Variable

9.3. Error Detection Processing

In this program, the error detection processing performs with regard to the following areas (1) to (3). For error codes, refer to *9.8. Error Processing.*
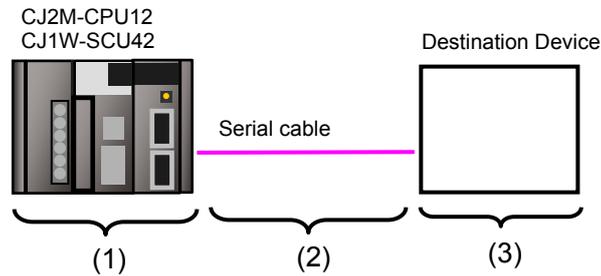
(1)Errors when executing the PMCR instruction (PMCR instruction error)

An incorrect communications sequence number and an incorrect memory address, which prevent the execution of the PMCR instruction, are detected as PMCR instruction errors. An error can be detected with error codes (1519.00 to 03) of the port operating status in the CIO area allocated to the SCU.

(2)Errors when communicating with Destination Device (Communications error)

Errors that occur in communications with Destination Device such as character corruption and transmission errors caused by unmatched baud rate setting are detected as communications errors. An error can be detected with error code (1519.10) of the sequence abort completion in the CIO area allocated to the SCU.

(3)Errors in Destination Device (Destination Device errors)

Destination Device errors include a command error, a parameter error, a data error, and an execution failure in Destination Device. An error is detected with the response data which is returned from Destination Device. In this program, an error is detected by comparing difference in formats between a receive message in normal operation (hereinafter referred to as "normal message") and a receive message in error (hereinafter referred to as "error message"). (For details, refer to *9.6.6. Receive Message Settings.*)

📖 **Additional Information**

For information on the CIO area allocated to SCU, refer to *9.4.2 Lists of Allocations.*

9.4. Memory Maps

The memory maps of this program are shown below.

9.4.1. Lists of Addresses

The tables below list the addresses necessary to execute this program.

You can change the allocations below to any addresses.

📝 **Precautions for Correct Use**

Make sure that there is no duplicated address when changing the addresses.

●Input memory

The address below is used to operate this program.

Address	Data type	Variable name	Description
5000.00	BOOL	Input_Start	Starts the send/receive processing when this flag changes from OFF to ON.

●Output memory

The execution results of the program are stored in these addresses.

Address	Data type	Variable name	Description
5000.02	BOOL	Output_NormalEnd	Turns ON when the send/receive processing ends normally.
5000.03	BOOL	Output_ErrorEnd	Turns ON when one or more of the following errors occur. (1) PMCR instruction error (2) Communications error (3) Destination Device error
5501	WORD	ReceiveData[0] (4-digit hex)	Stores the 1st and 2nd bytes of the data received from Destination Device.
5502	WORD	ReceiveData[1] (4-digit hex)	Stores the 3rd and 4th bytes of the data received from Destination Device.
:	:	:	:
5550	WORD	ReceiveData[49] (4-digit hex)	Stores bytes the 99th and 100th bytes of the data received from Destination Device.
H400	UINT	Output_PMCR_ErrorCode	Stores an error code when a PMCR instruction error or a communications error occurs.
H402	UINT	Output_DestinationDeviceErrorCode	Stores an error code when an error occurs in Destination Device.

●Internal memory

These addresses are used to operate this program only.

Address	Data type	Variable name	Description
5000.01	BOOL	Local_PMCRExecuting	Indicates the PMCR instruction execution status. Turns ON when the PMCR instruction is being executed, and turns OFF when the PMCR instruction is not executed.
5000.04	BOOL	Local_PMCRNormalEnd	Turns ON when the PMCR instruction ends normally.
5000.05	BOOL	Local_PMCRErrorEnd	Turns ON when a communications error (such as a transmission error) occurs.
5000.06	BOOL	Local_DestinationDevice Error	Turns ON when a Destination Device error occurs.
5000.07	BOOL	Local_PMCRErrorCode	Turns ON when a PMCR instruction error (either of the following three errors) occurs. (1) Sequence No. error (2) Data read/write area exceeded error (3) Protocol data syntax error
5010	UINT	Local_ControlWord1	Execution parameter of PMCR instruction
5011	UINT	Local_ControlWord2	Execution parameter of PMCR instruction
5012	UINT	Local_PMCR_ErrorCode	Stores an error code when a PMCR instruction error occurs.
5020	UINT	Local_FirstSendWord	Sets the number of send message words of the PMCR instruction.
5500	UINT	Local_FirstReceiveWord	Stores the number of message words received from Destination Device.

9.4.2. Lists of Allocations

The tables below list the addresses necessary to execute this program.

●CIO area

They are the fixed addresses determined by the unit address (unit number) that is set for SCU.

Unit number 0 is used in this program.

Address	Data type	Variable name
1519.10	BOOL	SequenceAbortCompletion_SCU_0_P2
1519.11	BOOL	SequenceEndCompletion_SCU_0_P2
1519.15	BOOL	ProtocolMacroExecuting_SCU_0_P2
1519	UINT	ProtocolMacroErrorCode_SCU_0_P2

Additional Information

For details on the CIO area allocated to SCU, refer to *2-3-2. CIO Area* of the *CJ Series Serial Communications Units OPERATION MANUAL* (Cat. No. W336).

●Related auxiliary area

They are the fixed addresses determined by the communications port number (internal logical port) specified in the program (PMCR instruction operands).

This program uses the communications port No. 7.

Address	Data type	Variable name
A202.07	BOOL	CommPortEnabledFlag_P7

Additional Information

For information on the related auxiliary area for the PMCR instruction, refer to *Related Auxiliary Area Words and Bits* in *Serial Communications Instructions (PMCR)* in *SECTION 3. Instructions* of the *CJ Series Programmable Controllers INSTRUCTIONS REFERENCE MANUAL* (Cat. No. W474).

9.5. Ladder Program

9.5.1. Functional Components of the Ladder Program

The functional components of this program are shown below.

Major classification	Minor classification	Description
1. Initialization processing	1.1. Response code clear 1.2. Operand setting for PMCR instruction 1.3. Send/receive symbol setting	The area of use is cleared, and the initialization setting is performed as a preparation for communications.
2. PMCR instruction execution management	2.1. PMCR instruction executing 2.2. PMCR instruction execution processing 2.3. Normal/error detection processing	The communications sequence registered in SCU is identified and executed. A normal end or an error end is detected based on the related flags and receive data.
3. Normal end state management	3.1. Normal end processing 3.2. Response code setting	The normal completion flag is turned ON. The response code for a normal end is set.
4. Error end state management	4.1. Error end processing 4.2. Response code setting	The error end flag is turned ON. The response code corresponding to the error cause is set.

9.5.2. Detailed Description of Each Functional Component

The program configured for this document is shown below.

●1. Initialization processing
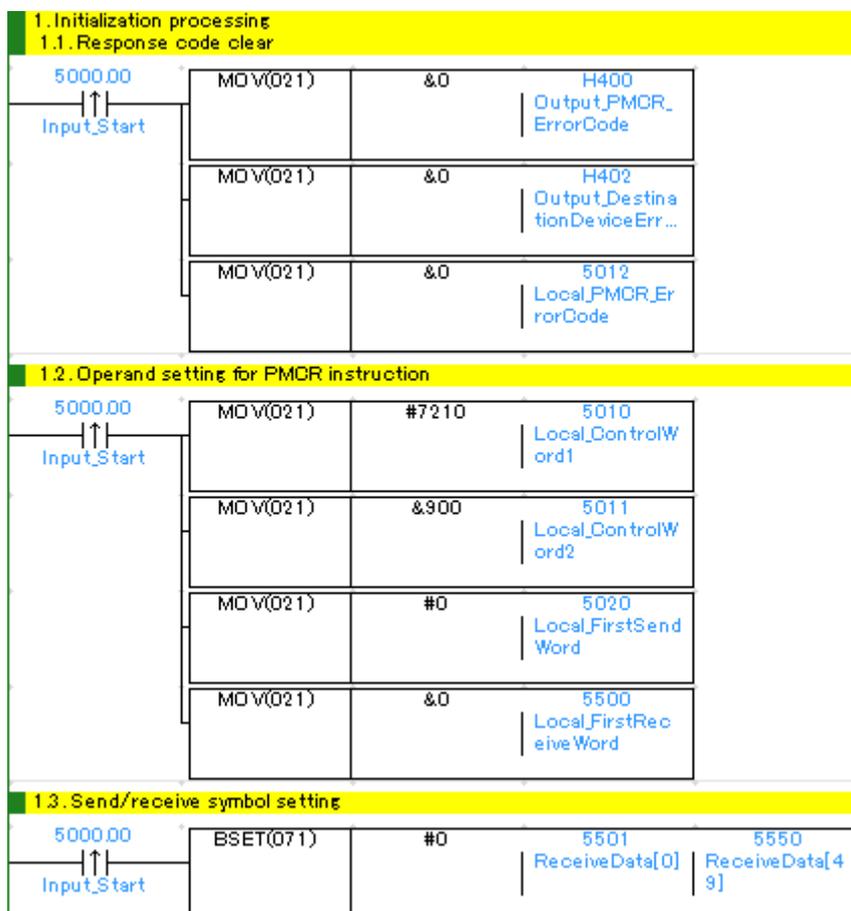
No.	Outline	Description
1.1.	Response code clear	Clears the error code storage area to 0.
1.2.	Operand setting for PMCR instruction	Sets execution parameters (operands) of the PMCR instruction.
1.3.	Send/receive symbol setting	Initializes the receive data storage area.

●2. PMCR instruction execution management
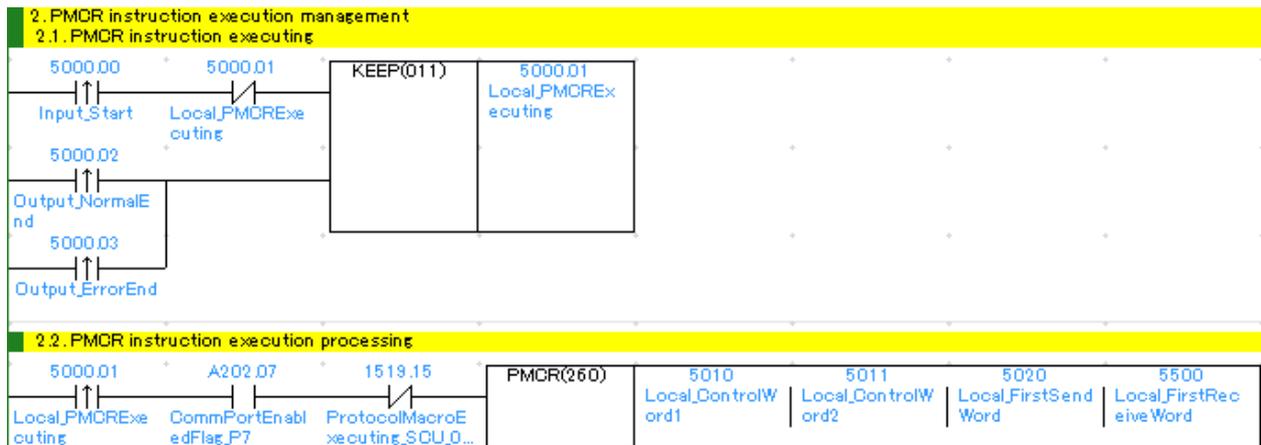
No.	Outline	Description
2.1.	PMCR instruction executing	Enters the PMCR instruction executing status. The executing state is reset at a normal end or an error end of the send/receive processing.
2.2.	PMCR instruction execution processing	Executes the PMCR instruction under the following conditions. - Communications port No.7 can be used. - CMND instruction is not being executed.

Point on safety

Thoroughly check the overall program before specifying the area to store the receive data of the PMCR instruction. Otherwise, the data may be written to an unintended memory area.

Precautions for Correct Use

This program uses the communications port No.7.

Do not use the communications port No.7 for other purposes. If you have no choice but to use the communications port No. 7, check that Communications Port Enabled Flag (A202.07) is ON.

2.3. Normal/error detection processing

No.	Outline	Description
2.3.	Normal/error detection processing	Detects a normal end or an error end of the result of send/receive processing. It is considered as a normal end when all the following conditions are satisfied. (1)Normal end of PMCR instruction (No PMCR instruction error) (2)Normal end of communications sequence (No communications error) (3)Normal messages received from Destination Device (No Destination Device error) If any of the errors are detected under the conditions above, a corresponding error flag will turn ON.

●3. Normal end state management
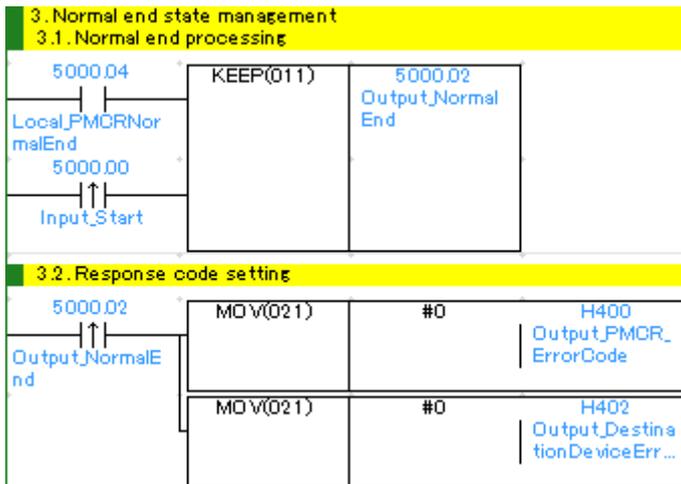
No.	Outline	Description
3.1.	Normal end processing	Turns ON the normal end flag if it is detected in 2.3. Normal/error detection processing that the send/receive processing ends normally.
3.2.	Response code setting	Sets response code "#0000" for a normal end in the response code storage area.

●4. Error end state management
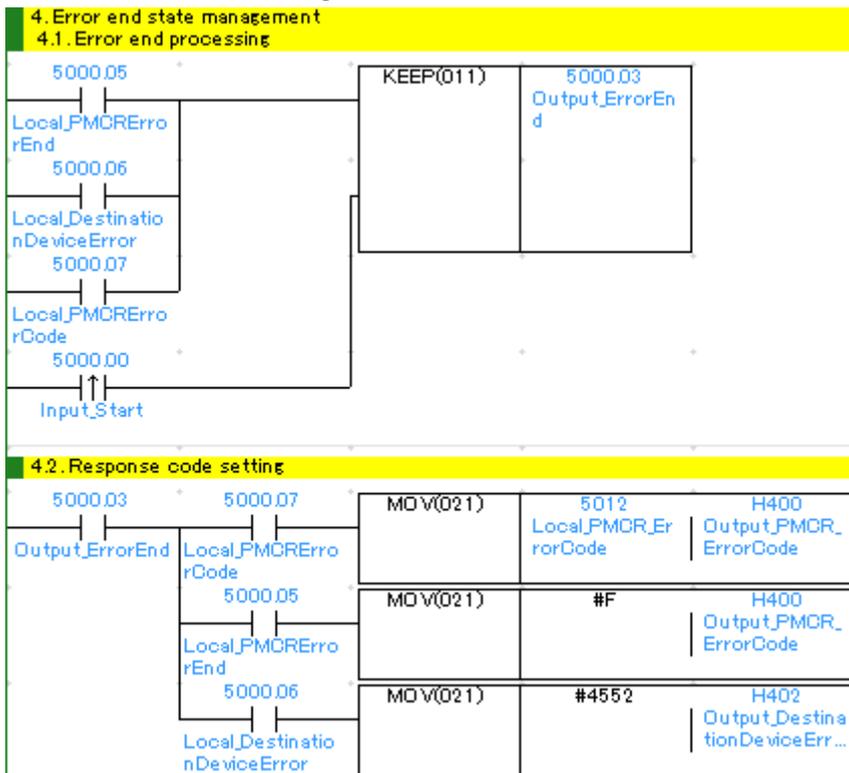
No.	Outline	Description
4.1.	Error end processing	Turns ON the error end flag if it is detected in 2.3. Normal/error detection processing that the send/receive processing ends in an error.
4.2.	Response code setting	Sets the response code corresponding to the error in the response code storage area when an error occurs.

📖 **Additional Information**

Refer to *9.8 Error Processing* in this document for details on the response codes.

9.6. Protocol Macro Data

The protocol macro data consists of sequence, step, send/receive message, and receive matrix. Its composition is described as follows:

●When there is only one receive message format for a step (send/receive once)
  ・Set one each of receive and send messages for the step.

Sequence No. 900		Step No. 00	Send message 00	Receive message 00
		Step No. yy	Send message yy	Receive message yy
Sequence No. xxx		xxx: 999 max./ yy: 15 max		

●When there are several types of receive message formats for a step (send/receive once)
  ・Set the send message and the receive matrix for the step.
  ・Store several types of receive message formats in the reception matrix case numbers 00 to 14. (In the case number 15, "Other" is automatically stored.)

Sequence No.900		Step No.00	Send message 00	< Receive matrix >	
				Case No. 00	Receive message 00
		Step No. yy			
		yy: 15 max	zz: 14 max	Case No. zz	Receive message zz
Sequence No. xxx		xxx: 999 max	Automatically stores in the case No. 15.	Case No. 15	Other

9.6.1.   Composition of Protocol Macro Data

In the protocol macro data, there are three different types of receive message formats (normal and error messages) for the send message (SD_VR). Therefore, the following composition is used with the receive matrix (Mat_VR).

Sequence No. 900	Step No. 00	SD_VR	<Mat_VR>	
			Case No .00	RV_VR
			Case No .01	RV_ER
			Case No .15	Other

  *Normal message for receiving: RV_VR
   Error message for receiving: RV_ER, Other
  (For details, refer to *9.6.6. Receive Message Settings*.)

9.6.2. Protocol Macro Data Processing Procedure

The processing procedure of protocol macro data is shown below.

1.	[Step No.00] Issuing send message (SD_VR)

↓

2.	When step No.00 ends normally	When step No.00 ends in error

↓ ↓

3.	Next Process: Receive matrix Executes the case No. 00, 01, 15, and terminates the communications sequence as an End.	Error Process: [Abort] Interrupts the step and terminates the communications sequence.

↓ ↓

(End) **(End)**
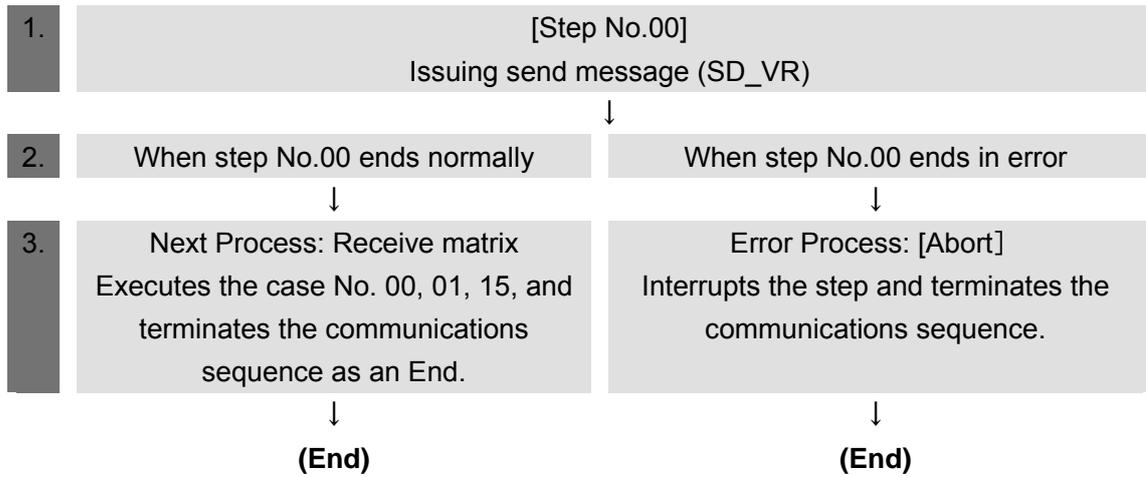
9.6.3. Sequence Settings

The protocol macro data performs the version information acquisition using the communications sequence No. 900.

Set the timeout periods for the communications sequence.

📑 **Additional Information**

For details on sequence settings, refer to *3-2 Sequence Attributes (Common to All Steps)* of the *CX-Protocol OPERATION MANUAL* (Cat. No. W344).

●Timeout period setting

The following describes the contents of the timeout periods (Timer Tr, Tfr, and Tfs) which are set for the sequence.

[Screenshot of communications sequence setting]

	*	#	Communication Sequence	Link Word	Control	Response	Timer Tr	Timer Tfr	Timer Tfs
		900	New Sequence	---	Set	Scan	3 sec	3 sec	3 sec

P652_CJ_PMCR232C_OMRON_ZW-7000_EV100
New Protocol List
New Protocol
New Sequence

<Settings>

Item	Description	Explanation
Timer Tr	Receive wait monitoring time	Monitors the time from when the receive command of the step in the sequence is recognized until the first byte (header) is received. This timer is set to 3 seconds in this protocol macro data.
Timer Tfr	Receive finish monitoring time	Monitors the time from reception of the first byte to reception of the last byte of the data in the step in the sequence. This timer is set to 3 seconds in this protocol macro data.
Timer Tfs	Send finish monitoring time	Monitors the time from transmission of the header to transmission of the last byte of the data.

📑 **Additional Information**

For the calculation method of monitoring time, refer to *4-5 Calculation Method of Monitoring Time* of the *CX-Protocol OPERATION MANUAL* (Cat. No. W344).

9.6.4. Step Settings

The following describes the contents of step settings for the communications sequence No. 900. The settings include retry count, send/receive messages (message names), next process, and error process. The sequence of this protocol macro data is composed of the step No. 00 only.

> 📓 **Additional Information**
>
> For details on step settings, refer to *3-3 Step Attributes* of the *CX-Protocol OPERATION MANUAL* (Cat. No. W344).

● Retry count setting

   The following describes the contents of retry count setting for the step.

   The step is repeated the number of designated times (0 to 9 times) when an error occurs.

   If the error still remains after the designated number of retry repetitions, the system goes to the error process.

   The retry count can be set only for the step in which Send&Receive command is set.

   < Screenshot of step settings>

<Setting>

Step No.	Retry count
00	3

● Send/Receive message (massage name) setting

   The following describes the setting contents of send/receive messages for the step.

   The settings are made by using both the send message and receive matrix names mentioned in *9.6.1. Composition of Protocol Macro Data*.

   < Screenshot of step settings >

<Setting>

Step No.	Send message	Receive message
00	SD_VR	＜Mat_VR＞

* The receive matrix is indicated with a pair of marks < > at the beginning and end of the receive message.

   The receive matrix is set when more than one receive message format exists.

●Next process and error process settings

The following describes the setting contents of the next process and error process for the step. The process set in the *Next* Column is executed when the step execution ends normally. If a communications error occurs, the process set in the *Error* Column is executed.

< Screenshot of step settings >

<Setting>

Step No.	Next process	Error process
00	Matrix	Abort

<Process list>

Process	Description
End	Ends the communications sequence.
Next	Goes to the next step number.
Abort	Interrupts the step and ends the communications sequence.
Goto	Goes to a designated step number.
Matrix	Uses the settings of the receive matrix.

70

9.6.5. Send Message Settings

The following describes the contents of send message settings.

📝 **Additional Information**

For details on send message settings, refer to *3-4 Communication Message Attributes* of the *CX-Protocol OPERATION MANUAL* (Cat. No. W344).

[Screenshot of send message settings]

●SD_VR send message setting

<Setting>

"VR"+<t>
  (1)   (2)

No.	Code	Description
(1)	"VR"	Constant ASCII (Version information acquisition command)
(2)	<t> (Terminator)	Type: Code, Data: CR

<Send message command format>

This is the command format of the message that is sent from SCU to Destination Device according to the SD_VR send message setting.

"VR"	CR

Command	Number of bytes	Remarks
"VR"	2	Fixed: "VR" (Version information acquisition command)
Terminator	1	CR(#0D) is used for this protocol macro data.

9.6.6. Receive Message Settings

The following describes the contents of receive message settings.

The receive message compatible with the response formats of normal and error messages are set.

📝 **Additional Information**

For details on receive message settings, refer to *3-4 Communication Message Attributes* of the *CX-Protocol OPERATION MANUAL* (Cat. No. W344).

[Screenshot of receive message settings]

●Normal and error message identification

In the protocol macro data, the normal and error messages are identified using the receive message data.

・Error message: Receive messages with 2 characters beginning with E

・Normal message: Receive messages except for the above

(A receive message is identified using a receive matrix.)

: All the other messages except for the above

●RV_VR receive message setting (Normal message)

<Setting>

(W(2),*)+<t>

  (1)   (2)

No.	Code	Description
(1)	(W(2),*)	W(2),*: Stores data with the desired size in the first receive word + 2 words that is specified by the PMCR instruction operand.
(2)	<t> (Terminator)	Type: Code, Data: CR

72

<Response format of normal message>

  This is the response format of the normal message received by SCU from Destination
  Device according to the RV_VR receive message setting.

Version information (Size: variable)	CR

Command	Number of bytes	Remarks
Version information	Variable	Variable: (version, date)
Terminator	1	CR(#0D) is used for this protocol macro data.

●RV_ER receive message setting (Error message)

<Setting>

  "E"+(W(1),1)+<t>
  (1)   (2)   (3)

No.	Code	Description
(1)	"E"	Constant ASCII (E is fixed when receiving the response.)
(2)	&(W(2),2)	(W(1),1): Stores 1 byte of data in the first receive word + 1 word that is specified by the PMCR instruction operand.
(3)	<t > (Terminator)	Type: Code, Data: CR

<Response format of error message>

  This is the response format of the message received by SCU from Destination Device
  according to the RV_ER receive message setting.

"ER"	CR

Command	Number of bytes	Remarks
"ER"	2	Fixed: "ER" (Error code when a Destination Device error occurs.)
Terminator	1	CR(#0D) is used for this protocol macro data.

9.6.7. Receive Matrix Settings

The following describes the contents of receive matrix settings.

The Mat_VR is set for the receive matrix.

📑 **Additional Information**

For details on receive matrix settings, refer to *3-5 Creating Matrices* of the *CX-Protocol OPERATION MANUAL* (Cat. No. W344).

[Screenshot of receive matrix settings]

*The above screenshot shows that three cases are set for the Mat_VR receive matrix.

●Mat_VR receive matrix setting

The following shows that three case numbers 00, 01, and 15 are set.

[Screenshot of case number setting]

\<Setting\>

The table below shows the contents of the receive message and next process setting for each case number.

Case No.	Receive message	Next process
00	RV_ER	End
01	RV_VR	End
15	Other	End

*The receive matrix performs a comparison from the receive message most meeting the specified condition of response format in accordance with RV_ER (error message), RV_VR (normal message), and Other (other message) in that order.
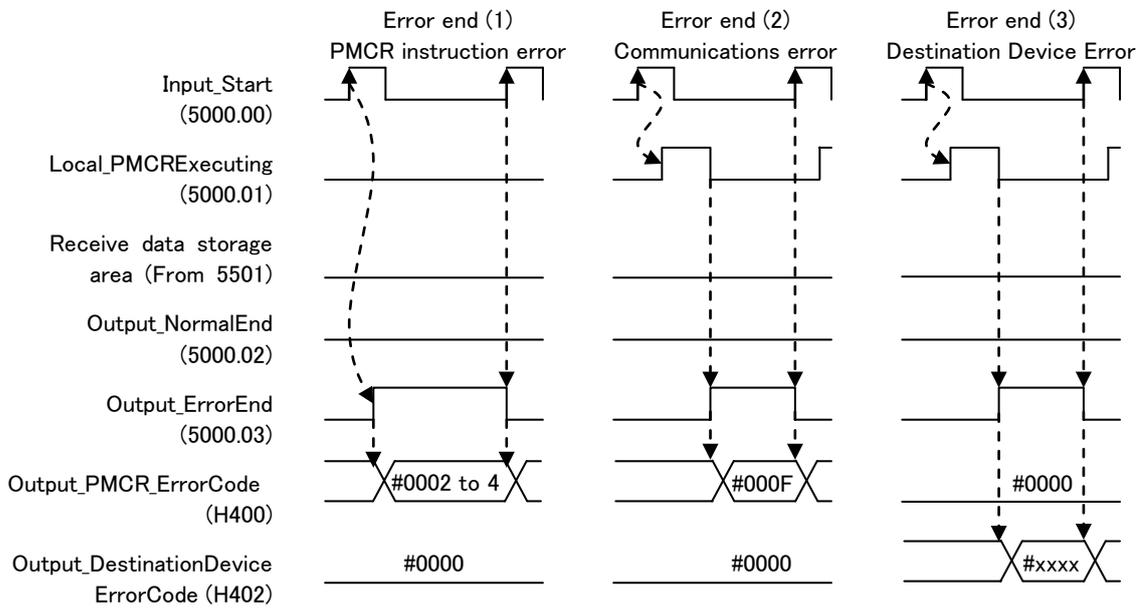
9.7. Timing Chart

The timing charts are shown below.

● Normal end

Input_Start (5000.00)	
Local_PMCRExecuting (5000.01)	
Receive data storage area (From 5501)	Normal response / Normal response
Output_NormalEnd (5000.02)	
Output_ErrorEnd (5000.03)	
Output_PMCR_ErrorCode (H400)	#0000
Output_DestinationDevice ErrorCode (H402)	#0000

● Error end

	Error end (1) PMCR instruction error	Error end (2) Communications error	Error end (3) Destination Device Error
Input_Start (5000.00)			
Local_PMCRExecuting (5000.01)			
Receive data storage area (From 5501)			
Output_NormalEnd (5000.02)			
Output_ErrorEnd (5000.03)			
Output_PMCR_ErrorCode (H400)	#0002 to 4	#000F	#0000
Output_DestinationDevice ErrorCode (H402)	#0000	#0000	#xxxx

9.8. Error processing

The following gives the details of errors that may occur during the program execution.

9.8.1. Protocol Macro Error Code

The SCU detects an error by monitoring the macro operation.

The error codes include (1) PMCR instruction error or (2) Communications error (transmission error, etc.) and are stored in H400 *Output_PMCR_ErrorCode*.

[Error code list]

Error code	Name	Classification	Description
#0002	Sequence No. error	(1)PMCR instruction error	The sequence number specified by the PMCR instruction does not exist in Unit.
#0003	Data Read/Write Area Exceeded Error	(1)PMCR instruction error	When data is written or read to CPU Unit, the specified area range is exceeded.
#0004	Protocol Data Syntax Error	(1)PMCR instruction error	A code that cannot be executed occurs while the protocol macro is being executed. (Example: A header occurs after a terminator.)
#000F	Transmission error	(2)Communications error	Communications cannot perform due to an error in the transmission path, etc.

📝 **Additional Information**

For details and troubleshooting on the protocol macro errors, refer to *12-3 Troubleshooting* of the *CJ Series Serial Communications Units OPERATION MANUAL* (Cat. No. W336).

9.8.2. Destination Device Error Code

The Destination Device detects an error when executing the command on Destination Device.

The error code is stored in H402 *Output_DestinationDeviceErrorCode*.

[Error code list]

Error code	Description
"ER" (#4552)	An error is detected on Destination Device.

📝 **Additional Information**

For details and troubleshooting on the Destination Device error, refer to *6. Troubleshooting* of the *Displacement Sensor ZW-7000 series Confocal Fiber Type Displacement Sensor User's Manual for Communications Settings* (Cat. No. Z363).

10. Revision History

Revision code	Date of revision	Description of revision
01	June 2, 2016	First edition

Authorized Distributor: