

Machine Automation Controller NJ-series

General-purpose Serial Connection Guide (RS-232C) OMRON Corporation

ZW-series Displacement Sensor

Network
Connection
Guide

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1. Related Manuals

The table below lists the manuals related to this document.

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

| Cat.No | Model | Manual name |
|--------|--------------------------|---|
| W500 | NJ501-□□□□ NJ301-□□□□ | NJ-series CPU Unit Hardware User's Manual |
| W501 | NJ501-□□□□ NJ301-□□□□ | NJ-series CPU Unit Software User's Manual |
| W494 | CJ1W-SCU□2 | CJ-series Serial Communications Units Operation Manual for NJ-series CPU Unit |
| W502 | NJ501-□□□□ NJ301-□□□□ | NJ-series Instructions Reference Manual |
| W504 | SYSMAC-SE2□□□ | Sysmac Studio Version 1 Operation Manual |
| Z322 | ZW-C1□ | Confocal Fiber Type Displacement Sensor User's Manual |
| Z332 | ZW-CE1□ | ZW Series Displacement Sensor (Confocal Fiber Type) User's Manual |



2. Terms and Definitions

| Term | Explanation and Definition |
|-----------------|---|
| No-protocol | No-protocol Mode enables you to receive or send data by using SCU Send Serial (SerialSend) or SCU Receive Serial (SerialRcv) instructions. In this mode, messages are sent/received to/from a destination device. |
| Send message | A send message is a communications frame (command) sent from the Serial Communications Unit to the destination device. This is executed by the SerialSend instruction and sent to the destination device. |
| Receive message | A receive message is a communications frame (response) sent from the destination device to the Serial Communications Unit. The SerialRcv instruction is used to read data received from the destination device. |

3. Remarks

- (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 safety circuit in order to ensure safety and minimize risks of abnormal occurrence.
- (2) To ensure system safety, always read and heed the information provided in all Safety Precautions, Precautions for Safe Use, and Precaution for Correct Use of manuals for each device used in the system.
- (3) The users are 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 of or whole part of this document without the permission of OMRON Corporation.
- (5) This document provides the latest information as of July 2013. It is subject to change without notice for improvement.

The following notation is used in this document.

| | |
|--|--|
|  WARNING | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage. |
|  Caution | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage. |



Precautions for Safe Use

Indicates precautions on what to do and what not to do to ensure using the product safely.



Precautions for Correct Use

Indicates precautions on what to do and what not to do to ensure proper operation and performance.



Additional Information

Provides useful information.

Additional information to increase understanding or make operation easier.

Symbol



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

4. Overview

This document describes the procedure for connecting OMRON Corporation's Displacement Sensor (ZW series) with OMRON Corporation's NJ-series Machine Automation Controller (hereinafter referred to as Controller) via serial communications, and describes the procedure for checking their connection.

Refer to the serial communications settings of the prepared Sysmac Studio project file and understand the setting method and key points to connect the devices via serial communications.

The user program in this project file is used to check the serial connection by executing the "VR (version information acquisition)" command on the destination device.

Prepare the latest Sysmac Studio project file beforehand. For information on how to obtain the file, contact your OMRON representative.

| Name | File name | Version |
|--|-----------------------------|----------|
| Sysmac Studio project file (extension: smc) | OMRON_ZW_SERI232C_EV101.smc | Ver.1.01 |

*Hereinafter, the Sysmac Studio project file is referred to as the "project file".

The user program in the project file is referred to as the "program".

Caution

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



5. Applicable Devices and Support Software

5.1. Applicable Devices

The applicable devices are as follows:

| Manufacturer | Name | Model | Version |
|--------------|--|--------------------------|---|
| OMRON | NJ-series CPU Unit | NJ501-□□□□ NJ301-□□□□ | Versions listed in Section 5.2 or higher versions |
| OMRON | Serial Communications Unit | CJ1W-SCU□2 | |
| OMRON | Confocal Fiber Type Displacement Sensor Controller | ZW-C1□/CE1□/CE1□T | |
| OMRON | Sensor Head | ZW-S□□ | |



Additional Information

As applicable devices above, the devices listed in Section 5.2. are actually used in this document to check the connection. When using devices not listed in Section 5.2, check the connection by referring to the procedure in this document.



Additional Information

This document describes the procedure to establish the network connection. It does not provide information about operation, installation nor wiring method of each device.

For details on the above products (other than communication connection procedures), refer to the manuals for the corresponding products or contact your OMRON representative.



Additional Information

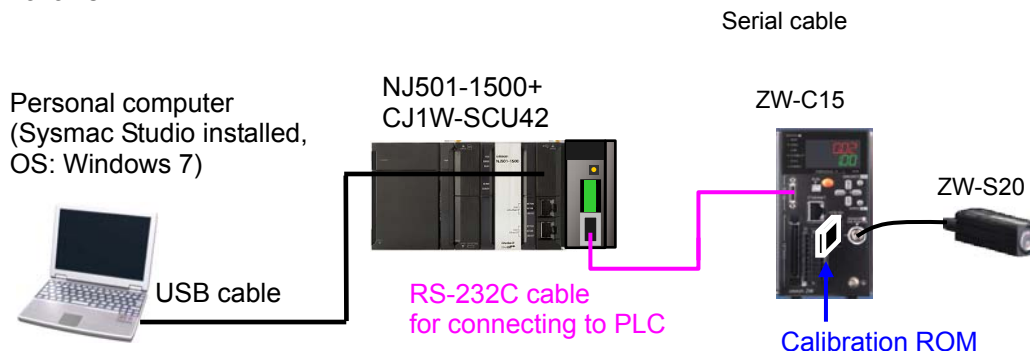
You can connect devices with the versions listed in Section 5.2 or higher versions.

For devices whose versions are not listed in Section 5.2, the versions are not managed or there is no version restriction.

To connect a device whose model number is not listed in Section 5.2, use the same version of the device that is listed.

5.2. Device Configuration

The hardware components to reproduce the connection procedure of this document are as follows:



| Manufacturer | Name | Model | Version |
|--------------|--------------------------------------|------------------------------|-----------|
| OMRON | Serial Communications Unit | CJ1W-SCU42 | Ver.2.0 |
| OMRON | NJ-series CPU Unit | NJ501-1500 | Ver.1.03 |
| OMRON | Power Supply Unit | NJ-PA3001 | |
| OMRON | Sysmac Studio | SYSMAC-SE2□□□ | Ver.1.04 |
| OMRON | Sysmac Studio project file | OMRON_ZW_SERI232C_EV101.smc | Ver.1.01 |
| - | Personal computer (OS:Windows7) | - | |
| - | USB cable (USB 2.0 type B connector) | - | |
| OMRON | RS-232C cable for connecting to PLC | ZW-XPT2 | |
| OMRON | Displacement Sensor Controller | ZW-C15 | Ver.1.000 |
| OMRON | Displacement Sensor Sensor Head | ZW-S20 | |
| OMRON | Calibration ROM | (Included with Sensor Head.) | |



Precautions for Correct Use

Prepare the latest project file in advance.

To obtain the file, contact your OMRON representative.



Precautions for Correct Use

Update the Sysmac Studio to the version specified in this section or higher version using the auto update function. If a version not specified in this section is used, the procedures described in Section 7 and subsequent sections may not be applicable. In that case, use the equivalent procedures described in the Sysmac Studio Version 1 Operation Manual (Cat.No. W504).



Additional Information

It may not be possible to reproduce the same operation with different devices or versions. Check the configuration, model and version. If they are different from your configuration. Contact your OMRON representative.



Additional Information

For information on the serial cable (RS-232C), refer to 3-3 *RS-232C and RS-422A/485 Wiring* in the *CJ-series Serial Communications Units Operation Manual for NJ-series CPU Unit* (Cat.No. W494).



Additional Information

The system configuration in this document uses USB for the connection between the personal computer and the Controller. For information on how to install the USB driver, refer to A-1 *Driver Installation for Direct USB Cable Connection* of the *Sysmac Studio Version 1 Operation Manual* (Cat.No. W504).

6. Serial Communications Settings

This section provides the specifications such as cable wiring and communications parameters that are set in this document.



Additional Information

To perform communications without using the settings described in this section, you need to modify the program. For information on the program, refer to *Section 9. Program*.

6.1. Serial Communications Settings

The settings for serial communications are shown below.

| Setting item | Serial Communications Unit | Displacement Sensor |
|----------------------------------|----------------------------|----------------------|
| Unit number | 0 | - |
| Communications (connection) port | Port 2 (RS-232C) | - |
| Serial communications mode | No-protocol | - |
| Data length | 8 bits | 8 bits (Default) |
| Stop bit | 1 bit | 1 bit (Default) |
| Parity | None | None (Default) |
| Baud rate | 38,400 bps | 38,400 bps (Default) |
| CTS control | None | OFF (Default) |
| No-protocol start code | None (Default) | - |
| No-protocol end code Terminator | Yes (16#0D) | [CR] (Default) |



Precautions for Correct Use

This document describes the procedure for setting the CJ1W-SCU42 Serial Communications Unit when the unit number 0, communications port 2 and device name J01 are used. To connect devices under different conditions, refer to *9. Program* and create a program by changing the variable names and setting values.

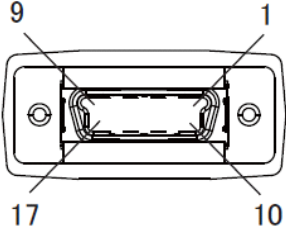
6.2. Cable Wiring Diagram

For details on the cable wiring, refer to *Section 3 Installation and Wiring* of the *CJ-series Serial Communications Units Operation Manual for NJ-series CPU Unit* (Cat. No. W494).

Check the connector configuration and pin assignment for wiring.

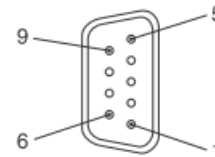
■Connector configuration and pin assignment

<OMRON ZW-C15> Applicable connector: 17-pin square connector

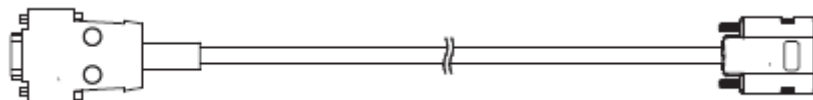
| Pin No. | Signal name |  |
|---------|-------------|---|
| 1 | GND(0V) | |
| 2 | TXD(SD) | |
| 3 | RXD(RD) | |
| 4 | RTS(RS) | |
| 5 | CTS(CS) | |
| 6 to 17 | NC | |
| Shell | FG | |

<OMRON CJ1W-SCU42> Applicable connector: D-sub 9-pin

| Pin No. | Abbreviation | Signal name | I/O |
|---------|--------------|---------------------|--------|
| 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 | --- |



■Cable/Pin arrangement (RS-232C cable for connecting to PLC: ZW-XPT2)

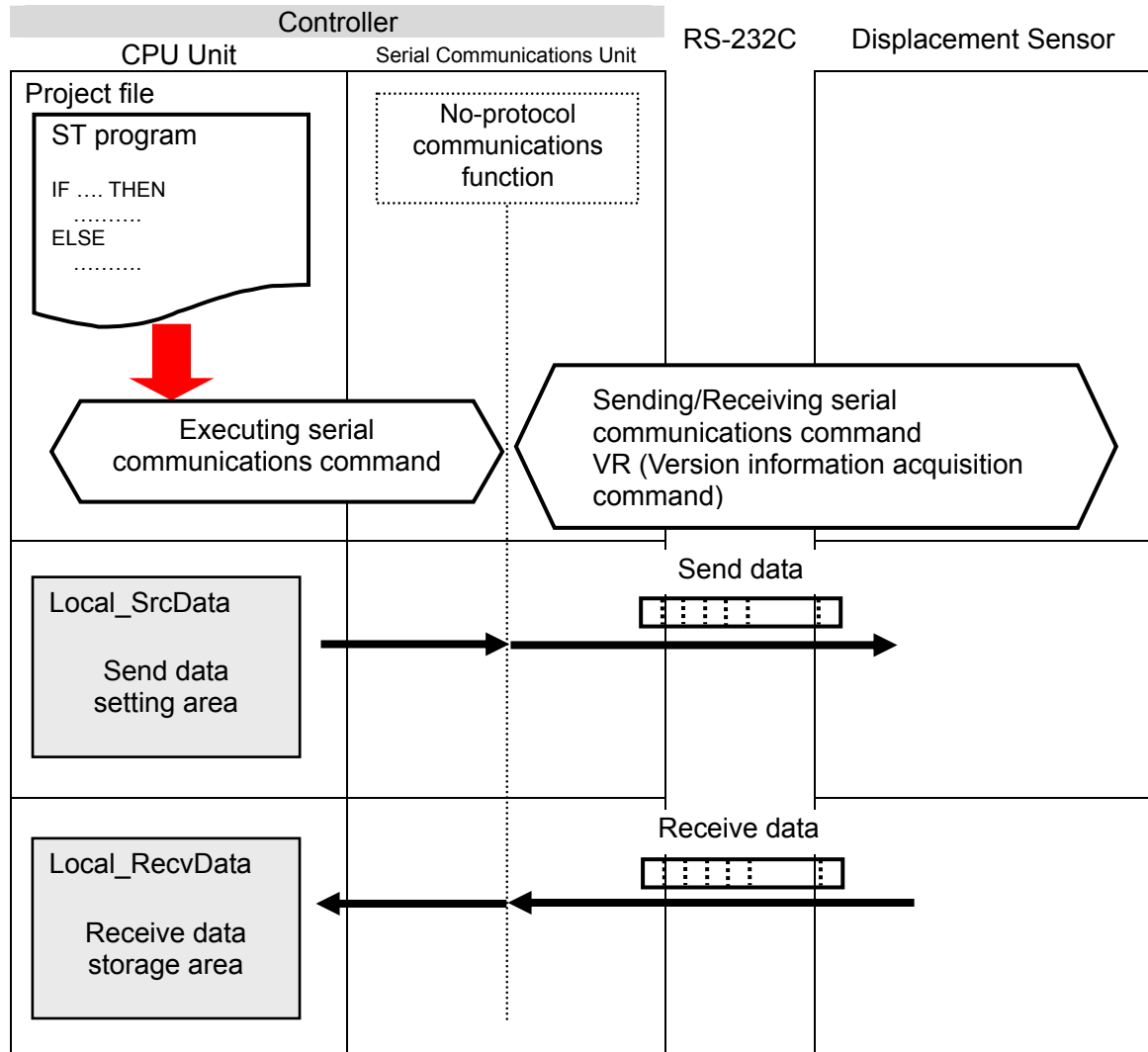


| Serial Communications Unit (CJ1W-SCU42) | | | Displacement Sensor (ZW-C15) | | |
|---|-------------|---------|---|-------------|-------------------|
| RS-232C interface | Signal name | Pin No. | Pin No. | Signal name | RS-232C interface |
| | FG | 1 | 1 | GND(0V) | |
| | SD | 2 | 2 | TXD(SD) | |
| | 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 Cable connector type: Male | | | 17-pin square connector Cable connector type: Male | | |

6.3. Example of Checking Connection

This document shows an example of an ST (structured text) program in which the Controller sends/receives a message to/from the Displacement Sensor.

The Controller and Displacement Sensor send and receive the message of "VR (version information acquisition command)". The following figure outlines the operation.



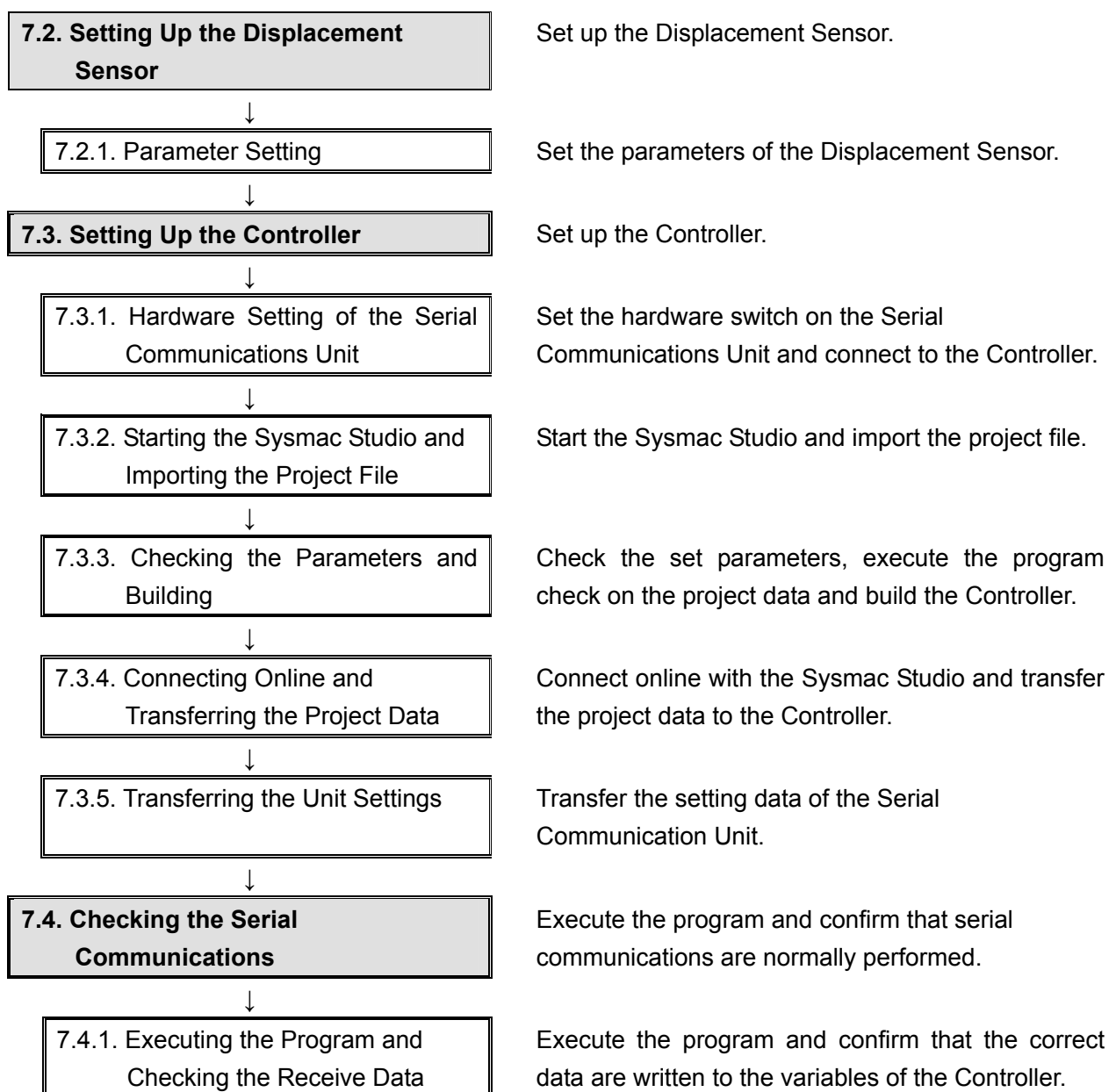
7. Connection Procedure

This section describes the procedure for connecting the Displacement Sensor to the Controller via serial communications.

This document explains the procedures for setting up the Controller and Displacement Sensor from the factory default setting. For the initialization, refer to *Section 8 Initialization Method*.

7.1. Work Flow

Take the following steps to connect the Displacement Sensor to the Controller via serial communications.



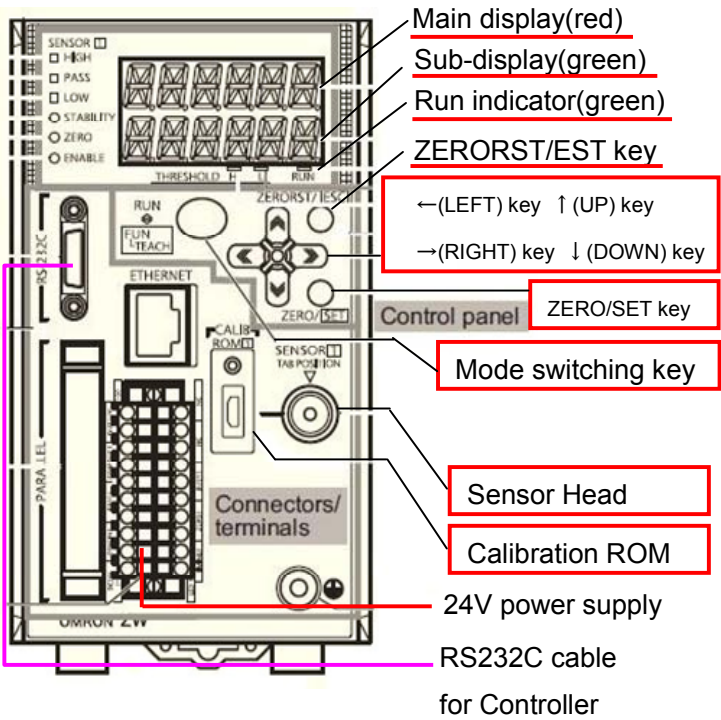
7.2. Setting Up the Displacement Sensor

Set up the Displacement Sensor.

7.2.1. Parameter Setting

Set the parameters of the Displacement Sensor.

- 1 Check the keys and display used to set parameters of the Displacement Sensor.
- Connect the Sensor Head.
- Insert the Calibration ROM.
- Connect the RS-232C cable (for connecting to PLC).
- Turn ON the power supply to the Displacement Sensor.



- 2 After the startup screen is displayed, the RUN mode screen is displayed.
- The RUN indicator is lit as shown on the right.
- Hold down the **Mode switching** Key for two seconds.



Hold down the **Mode switching** Key for two seconds.

- 3 A confirmation screen for mode switching is displayed.
- Press the **ZERO/SET** Key.



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

- 4 The FUN mode screen is displayed.
The RUN indicator is not lit as shown on the right.

Press → (RIGHT) or ← (LEFT) Key to change the main display content from SENS to SYSTEM.

Press the **ZERO/SET** Key.



Press the → (RIGHT) or ← (LEFT) Key.



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

- 5 SAVE is displayed on the main display.

Press → (RIGHT) or ← (LEFT) key to change the main display content from SAVE to COM.

Press the **ZERO/SET** Key.



Press the → (RIGHT) or ← (LEFT) Key.



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

- 6 RS232C is displayed on the main display.

Press the **ZERO/SET** Key.



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

- 7 DATA is displayed on the main display.



Press the **ZERO/SET** Key.



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

Confirm that 8bit (default value of the data length) is displayed on the sub-display.

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



<Setting range>

8bit/7bit

Default: 8bit

Press the **ZERORST/ESC** Key once. The first screen in this step is displayed again.



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

DATA is displayed.



Press the → (RIGHT) Key once.

Press the → (RIGHT) Key once.

- 8 PARITY is displayed on the main display.



Press the **ZERO/SET** Key.



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

Confirm that OFF (default value of the parity) is displayed on the sub-display.

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



<Setting range>

OFF/ODD/
EVEN

Default: OFF

Press the **ZERORST/ESC** Key once. The first screen in this step is displayed again.



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

PARITY is displayed.



Press the → (RIGHT) Key once.

Press the → (RIGHT) Key once.

- 9 STOP is displayed on the main display.



Press the **ZERO/SET** Key.

Confirm that 1bit (default value of the stop bit) is displayed on the sub-display.

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

Press the **ZERORST/ESC** Key once. The first screen in this step is displayed again.
Press the → (RIGHT) Key once.



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



<Setting range>
1bit/2bit
Default: 1bit



Press the **ZERORST/ESC** Key.

STOP is displayed.



Press the → (RIGHT) Key once.

- 10 BAUD.RT is displayed on the main display.



Press the **ZERO/SET** Key.

Confirm that 38400 (default value of the baud rate) is displayed on the sub-display.

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

Press the **ZERORST/ESC** Key once. The first screen in this step is displayed again.
Press the → (RIGHT) Key once.



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



<Setting range>
9600/19200/
38400/57600/
115200
Default:
38400 bps



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

BAUD.RT is displayed.



Press the → (RIGHT) Key once.

- 11 CS/RS is displayed on the main display.



Press the **ZERO/SET** Key.



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

Confirm that OFF (default value of the CS/RS control) is displayed on the sub-display.

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



<Setting range>

OFF/ON

Default: OFF

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



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

- 12 RS232C is displayed on the main display.



Press → (RIGHT) or ← (LEFT) Key to change the main display content to DELIMI.



Press the → (RIGHT) or ← (LEFT) Key.



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



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

- 13 Confirm that CR is displayed on the sub-display.

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



<Setting range>

CR/LF/CRLF

Default: CR

Hold down the **Mode switching** Key for two seconds.



Hold down the **Mode switching** Key for two seconds.

- 14 The confirmation screen for mode switching is displayed.



Press the **ZERO/SET** Key.

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

The save confirmation screen is displayed.



Press the **ZERO/SET** Key.

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

The RUN mode screen is displayed.



- 15 Cycle the power supply to the Displacement Sensor.

*The saved setting data will take effect after restarting.

7.3. Setting Up the Controller

Set up the Controller.

7.3.1. Setting the Hardware Settings of the Serial Communications Unit

Set the hardware switches on the Serial Communications Unit.



Precautions for Correct Use

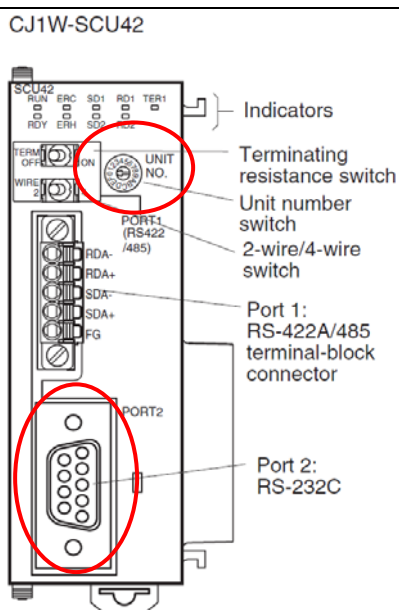
Make sure that the power supply is OFF when you perform the settings.

- 1 Make sure that the power supply to the Controller is OFF.

*If the power supply is turned ON, settings may not be applicable as described in the following procedure.

Refer to the right figure and check the each part name.

*This setting is required to use the Port 2 of Serial Communications Unit.

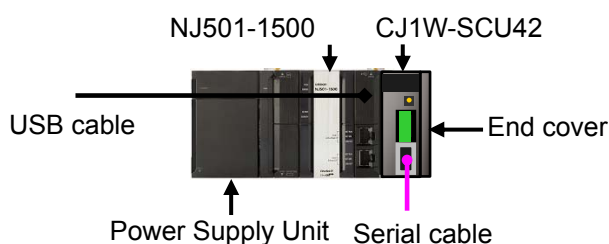


- | | |
|---|---|
| 2 | Set the Unit No. Switch to 0. (The unit number is factory-set to 0.) |
|---|---|



- 3 Connect the Serial Communications Unit to the Controller as shown on the right.

Connect the serial communications cable and USB cable



7.3.2. Starting the Sysmac Studio and Importing the Project File

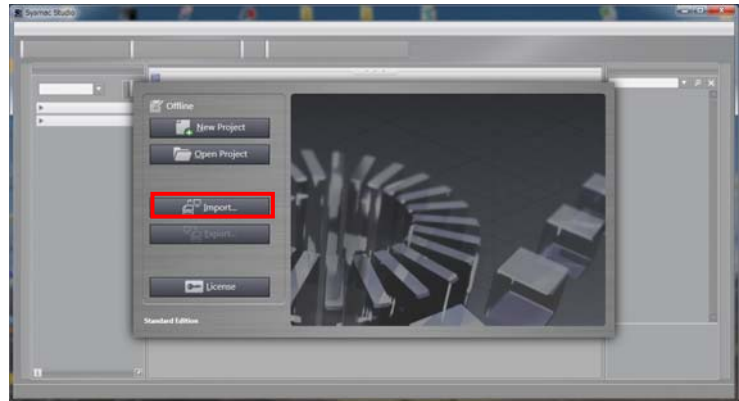
Start the Sysmac Studio and import the project file.

Install the Sysmac Studio and USB driver in the personal computer in advance.

- 1 Confirm that the personal computer and the Controller are connected with the USB cable and turn ON the power supply to the Controller.

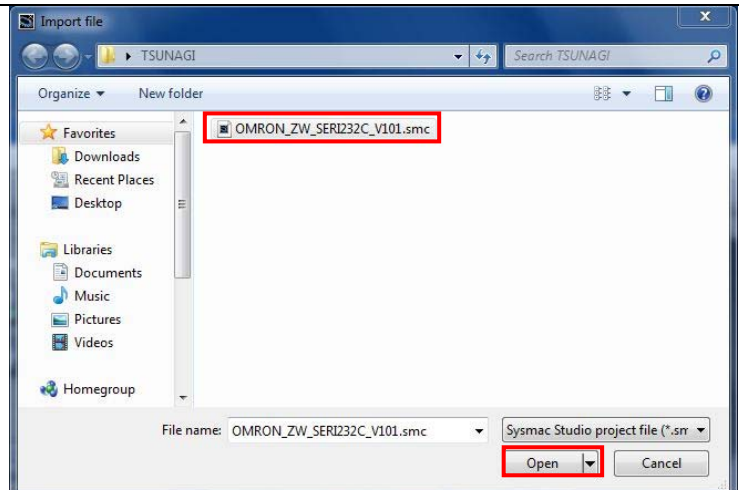
Start the Sysmac Studio.
Click the **Import** Button.

*If a dialog box is displayed at start confirming the access right, select an option to start.



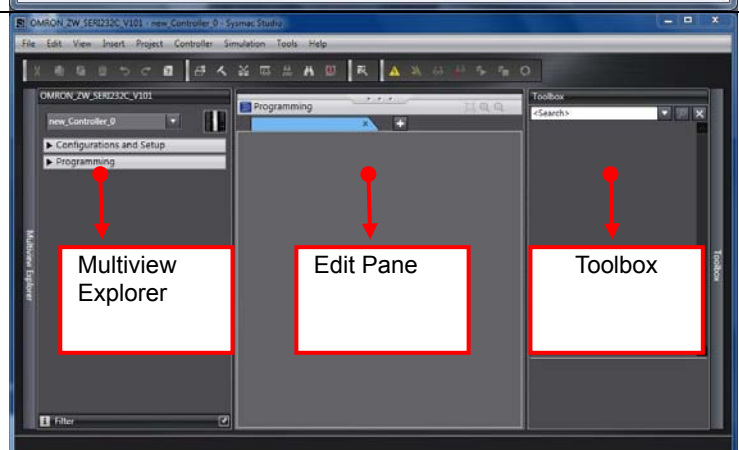
- 2 The Import file Dialog Box is displayed. Select OMRON_ZW_SERI232C_EV10 1.smc and click the **Open** Button.

*Obtain the project file from OMRON.



- 3 OMRON_ZW_SERI232C_EV10 1 project is displayed. The left pane is called Multiview Explorer, the right pane is called Toolbox and the middle pane is called Edit Pane.

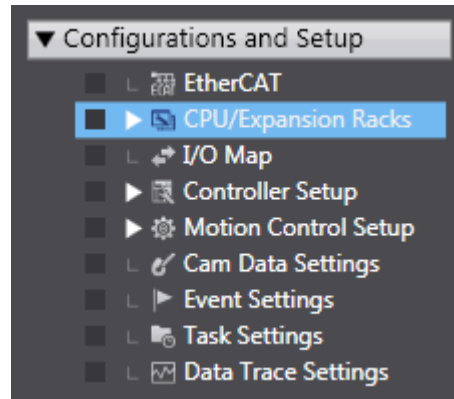
*If an error message is displayed stating "Failed to Load Descendants", change the version of the Sysmac Studio to any version specified in 5.2. Device Configuration or higher version.



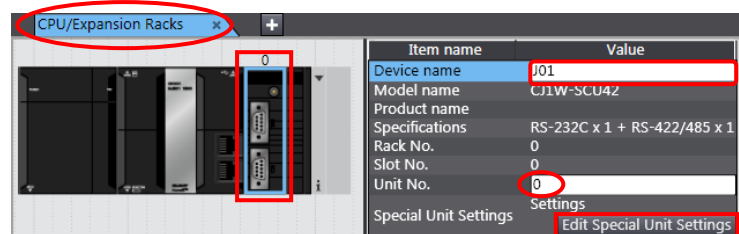
7.3.3. Checking the Parameters and Building

Check the set parameters, execute the program check on the project data and build the Controller.

- 1 Double-click **CPU/Expansion Racks** under **Configurations and Setup** in the Multiview Explorer.



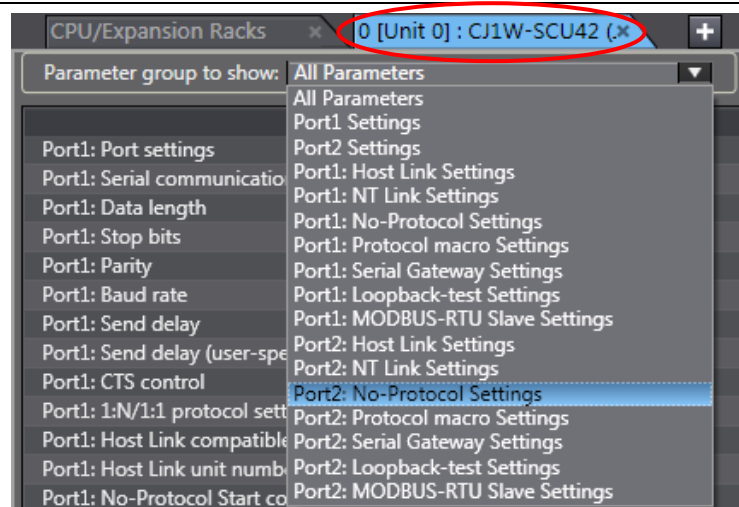
- 2 The CPU/Expansion Racks Tab is displayed on the Edit Pane. Select the Serial Communications Unit icon as shown on the right. Confirm that CJ1W-SCU42 is displayed, the device name is J01, and the unit number is 0.



*If the setting value is different from above, change the value.

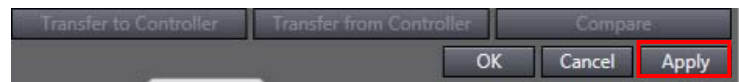
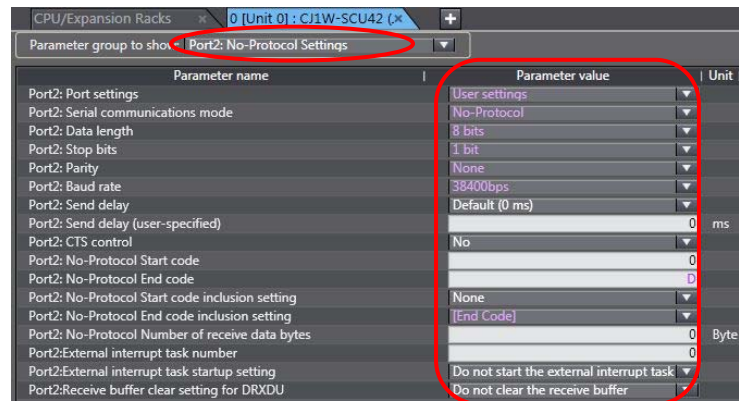
Click **Edit Special Unit Settings**.

- 3 The 0 [Unit 0]: Tab is displayed. Select *Port2: No-Protocol Settings* from the pull-down list of Parameter group to show.

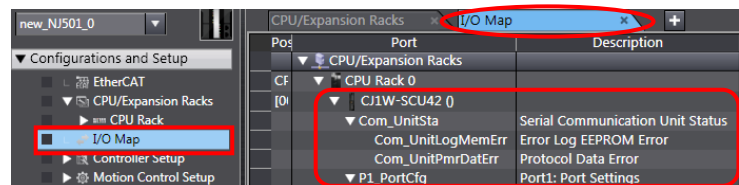


- 4 Parameter group to show is set to *Port2: No-Protocol Settings*.
The setting items for Port2: No-Protocol Settings are shown.
Confirm that the *Port2: Port Settings* is set to *User settings* and other settings are the same as those listed in Section 6.1.

*If the settings are different from the above, change the values from the pull-down list. After changing the values, click the **Apply** Button.



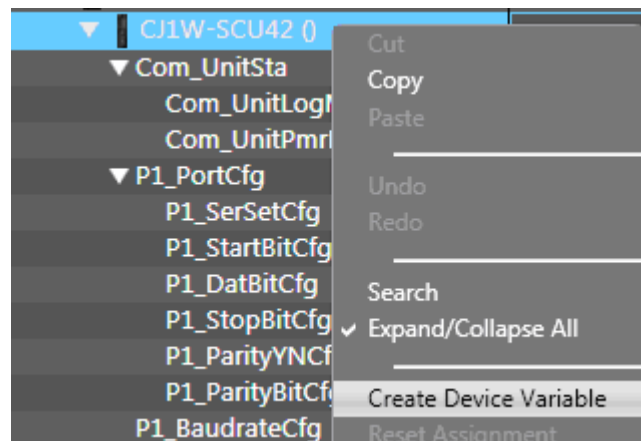
- 5 Double-click **I/O Map** under **Configurations and Setup** on the Multiview Explorer.
The I/O Map Tab is displayed and then the parameters for the Unit are listed.



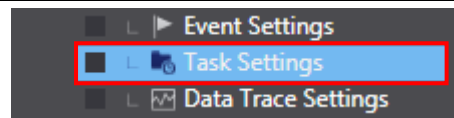
- 6 Confirm that data in the Variable Columns start with J01 and the Global Variable is set in each Variable Type Column.

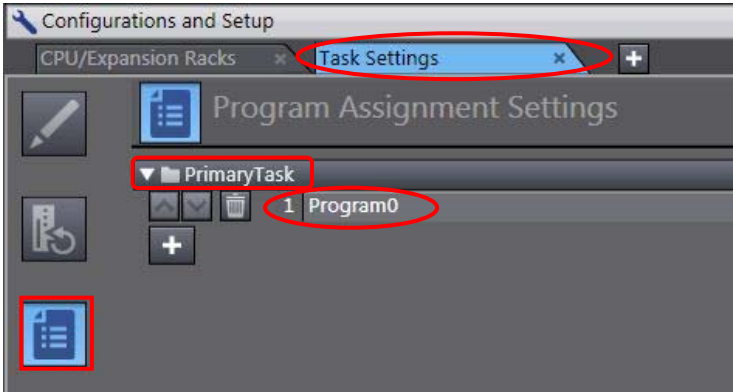
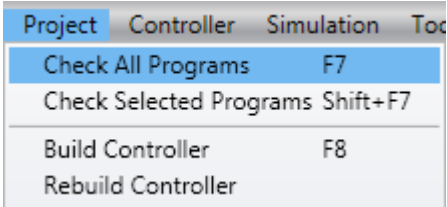
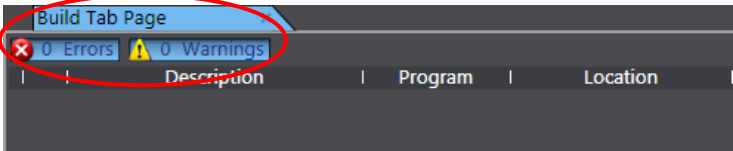
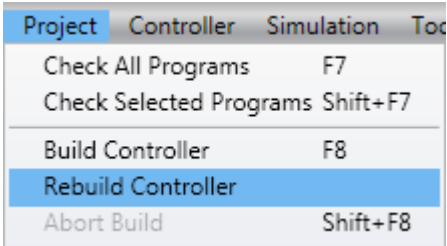

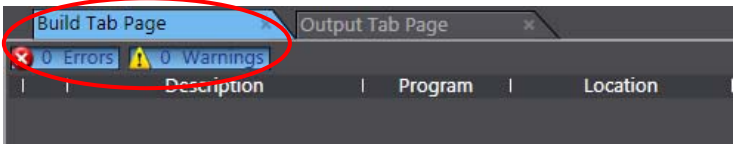
*If the settings are different from the above, right-click on **CJ1W-SCU42** and select **Create Device Variable**.

| Pos | Port | Description | R/W | Data Type | Variable | Variable Comment | Variable Type |
|-----|--------------------------|----------------------------------|-----|-----------|------------------|------------------|------------------|
| CF | CPU/Expansion Racks | | | | | | |
| 0 | CPU Rack 0 | | | | | | |
| 0 | CJ1W-SCU42 (Serial Commu | | | | | | |
| | Com_UnitSta | Serial Communication Unit Status | R | WORD | J01_Com_UnitSta | | Global Variables |
| | Com_UnitLogMemErr | Error Log EEPROM Error | R | BOOL | J01_Com_UnitLo | | Global Variables |
| | Com_UnitPmrDatErr | Protocol Data Error | R | BOOL | J01_Com_UnitPm | | Global Variables |
| | P1_PortCfg | Port1: Port Settings | RW | WORD | J01_P1_PortCfg | | Global Variables |
| | P1_SerSetCfg | Port1: User-specified Set | RW | BOOL | J01_P1_SerSetCf | | Global Variables |
| | P1_StartBitCfg | Port1: Start Bits | RW | BOOL | J01_P1_StartBitC | | Global Variables |
| | P1_DatBitCfg | Port1: Data Length | RW | BOOL | J01_P1_DatBitCf | | Global Variables |
| | P1_StopBitCfg | Port1: Stop Bits | RW | BOOL | J01_P1_StopBitC | | Global Variables |



- 7 Double-click the **Task Settings** under **Configurations and Setup** in the Multiview Explorer.



- 8 The Task Settings Tab Page is displayed in the Edit Pane. Click the **Program Assignment Settings** Button and confirm that Program0 is set under PrimaryTask.
- 
- 9 Select **Check All Programs** from the Project Menu.
- 
- 10 The Build Tab Page is displayed in the Edit Pane. Confirm that "0 Errors" and "0 Warnings" are displayed.
- 
- 11 Select **Rebuild Controller** from the Project Menu.
- 
- A screen is displayed indicating the conversion is being performed.
- 
- 12 Confirm that "0 Errors" and "0 Warnings" are displayed in the Build Tab Page.
- 

7.3.4. Connecting Online and Transferring the Project Data

Connect online with the Sysmac Studio and transfer the project data to the Controller.

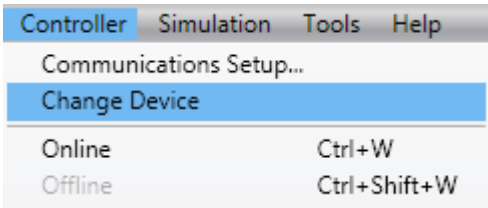


Caution

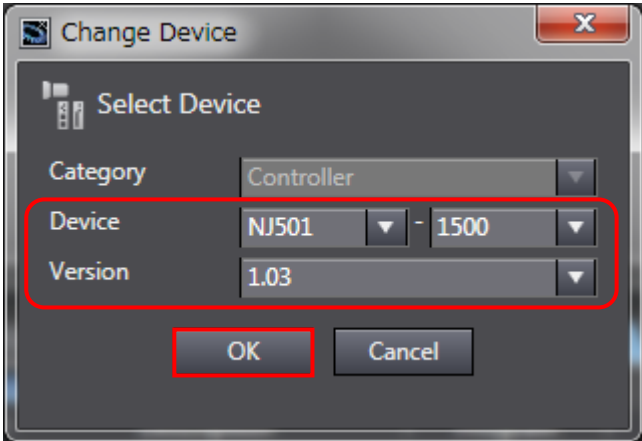
Always confirm safety before you reset the Controller or any components.



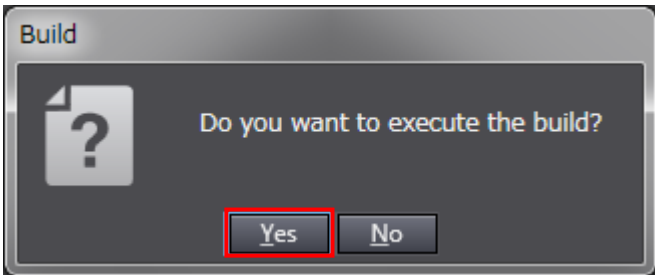
- 1 Select **Change Device** from the Controller Menu.

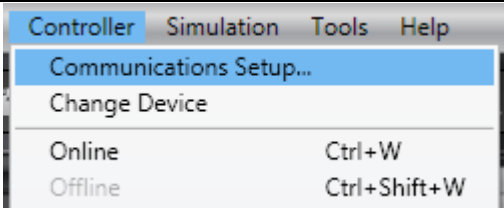

- 2 The Change Device Dialog Box is displayed. Confirm that the Device and Version are set as shown on the right and click the **OK** Button.

*If the settings are different, change the values from the pull-down list.


- 3 If settings were changed in Step 2, the Build Dialog Box is displayed. Click the **Yes** Button.

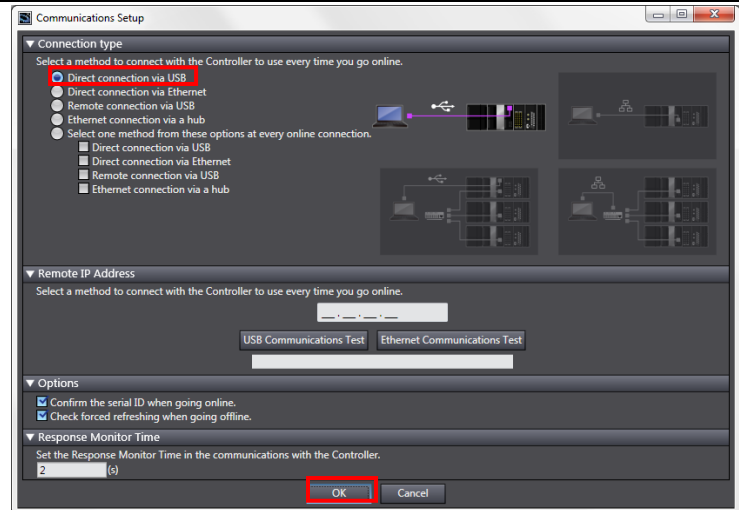
*This dialog box is not displayed if no change was made.


- 4 Select **Communications Setup** from the Controller Menu.

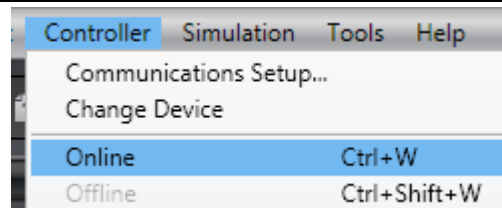


- 5 The Communications Setup Dialog Box is displayed.
Select the *Direct connection via USB* Option in the Connection Type Field.

Click the **OK** Button.

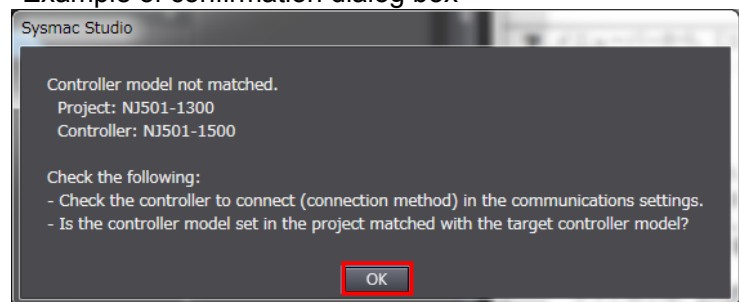


- 6 Select **Online** from the Controller Menu.

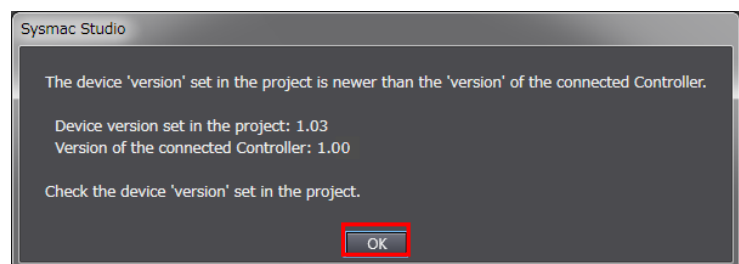


*If the dialog on the right is displayed, the model or version of the Controller does not match that of the project file. Check the device settings of the project file, return to step 1 and try again.
Click the **OK** Button to close the dialog box.

*Example of confirmation dialog box



*The model and version displayed on the confirmation dialog box differ depending on the Controller used and the device settings of the project file.



7

A confirmation dialog is displayed. Click the **Yes** Button.

*The displayed dialog differs depending on the status of the Controller used. Select the **Yes** Button to proceed with the processing.

*The displayed serial ID differs depending on the device.

Sysmac Studio

The CPU Unit has no name.
Do you want to write the project name [new_NJ501_0] to the CPU Unit name? (Y/N)

Yes

No

Sysmac Studio

Serial ID not matched.

Project:
Name: [new_NJ501_0]
Serial ID: [R01-07X11-0555]

Controller:
Name: [new_NJ501_0]
Serial ID: [R01-07X11-0550]

Do you want to continue the connection processing? (Y/N)

Yes

No

Sysmac Studio

Do you want to change the Serial ID in the project to the controller's Serial ID? (Y/N)
(It will be used at the ID check of next online connection.)

Yes

No



Additional Information

For details on online connections to a Controller, refer to *Section 5 Going Online with a Controller* in the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

8

When an online connection is established, a yellow bar is displayed on the top of the Edit Pane.

Configurations and Setup

9

Select **Synchronization** from the Controller Menu.

ControllerSimulationToolsHelp

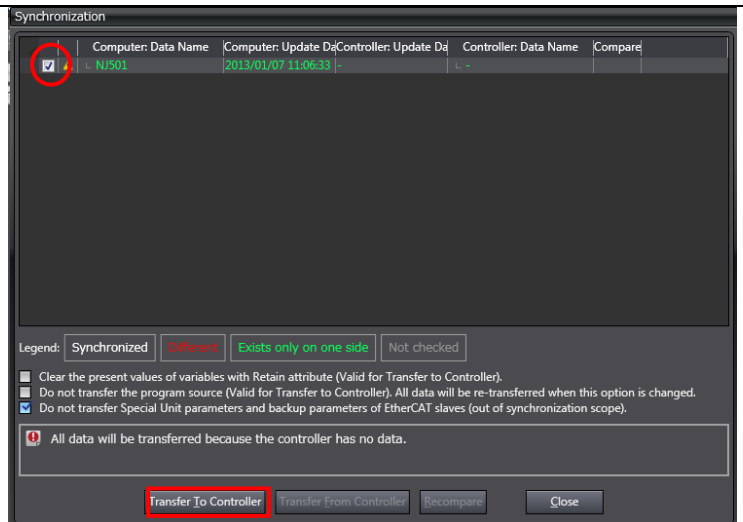
Communications Setup...
Change Device

OnlineCtrl+W
OfflineCtrl+Shift+W
SynchronizationCtrl+M

10 The Synchronization Dialog Box is displayed.

Confirm that the data to transfer (NJ501 in the right figure) is selected. Then, click the **Transfer to Controller** Button.

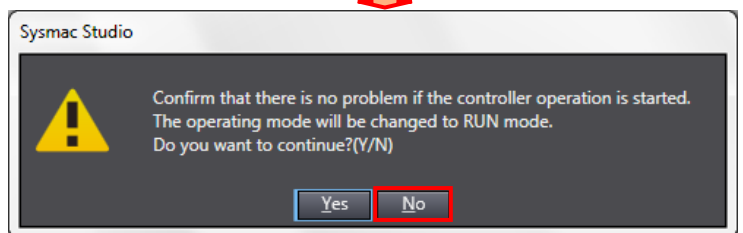
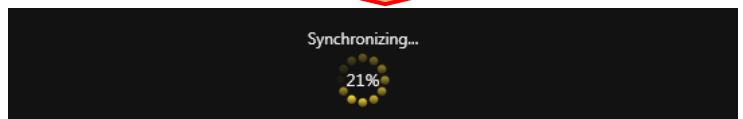
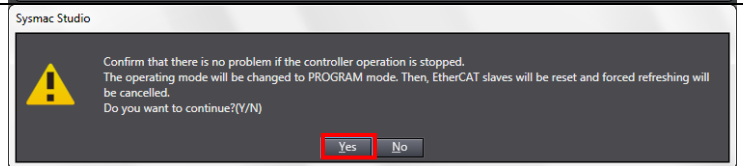
*After executing **Transfer to Controller**, the Sysmac Studio project data is transferred to the Controller and the data are compared.



11 A confirmation dialog is displayed. Click the **Yes** Button.

A screen stating "Synchronizing" is displayed.

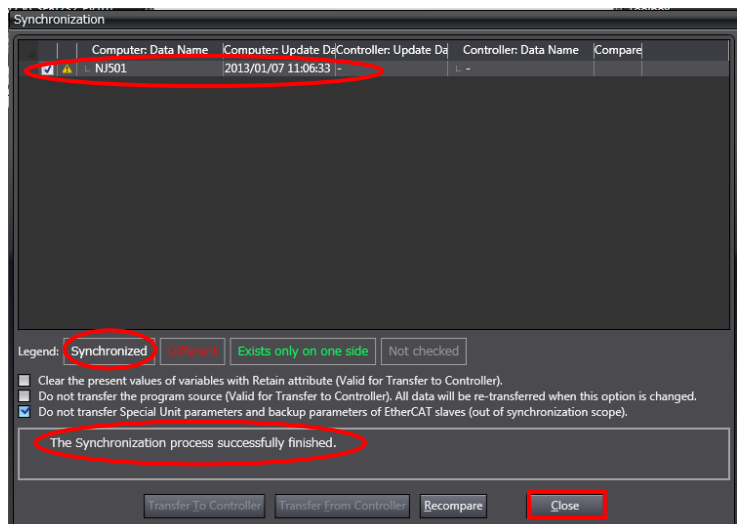
A confirmation dialog box is displayed. Click the **No** Button.



12 Confirm that the synchronized data is displayed with the color specified by "Synchronized" and that a message is displayed stating "The synchronization process successfully finished". If there is no problem, click the **Close** Button.

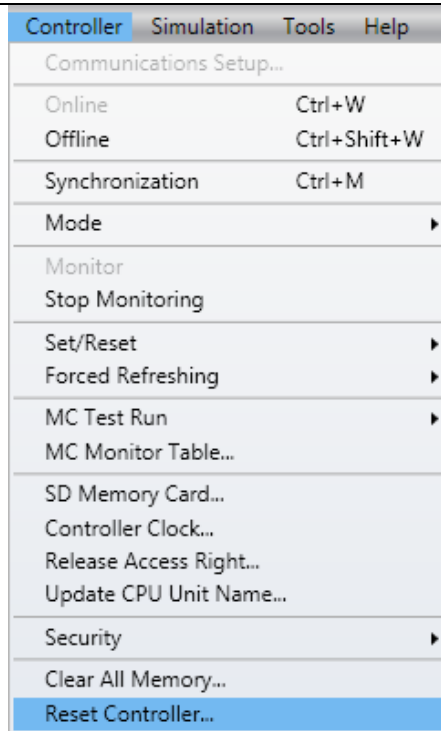
*A message stating "The synchronization process successfully finished" means that the project data of Sysmac Studio matches that of the Controller.

*If the synchronization fails, check the wiring and repeat the procedure described in this section.

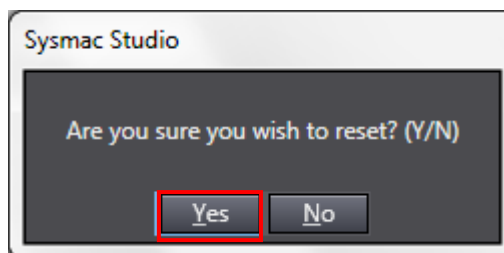
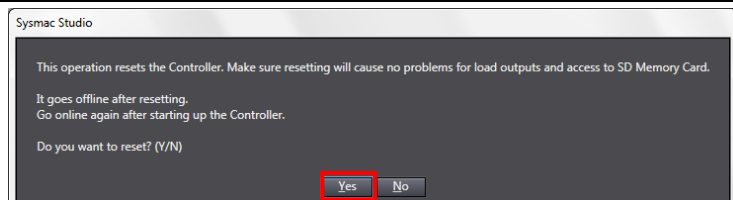


- 13 Select **Reset Controller** from the Controller Menu.

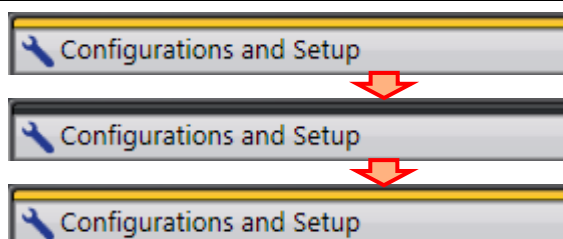
*When Mode is set to RUN Mode, Reset Controller cannot be selected. In this case, select **Mode - PROGRAM Mode** from the Controller Menu to change to PROGRAM mode and perform the procedure in this step.



- 14 A confirmation dialog box is displayed several times. Click the **Yes** Button.



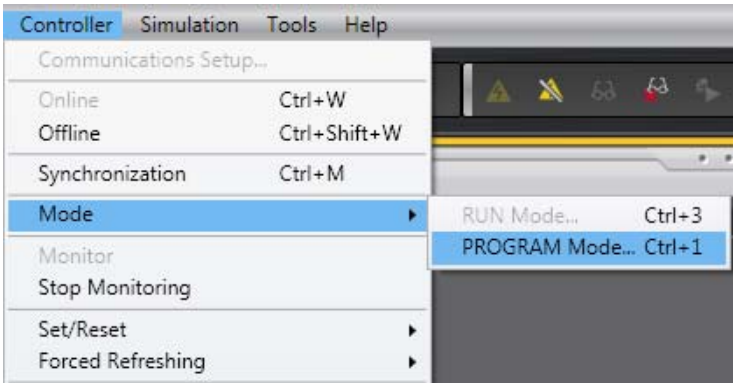
- 15 The Controller is reset, and Sysmac Studio goes offline. The yellow bar on the top of the Edit Pane disappears. Use steps 6 to 8 to go online again.

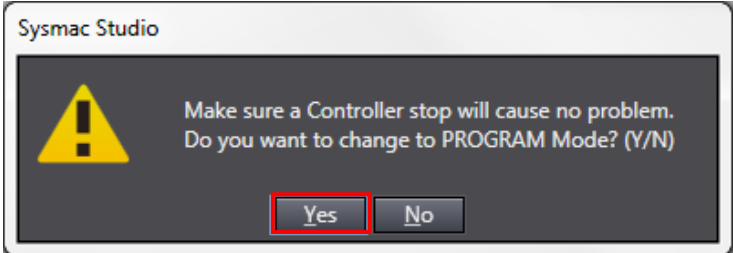


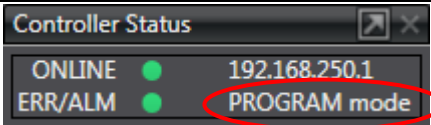
7.3.5. Transferring the Unit Settings

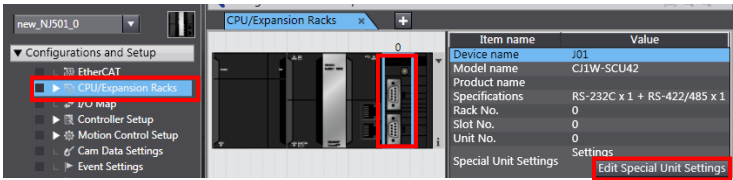
Transfer the setting data of the Serial Communication Unit.

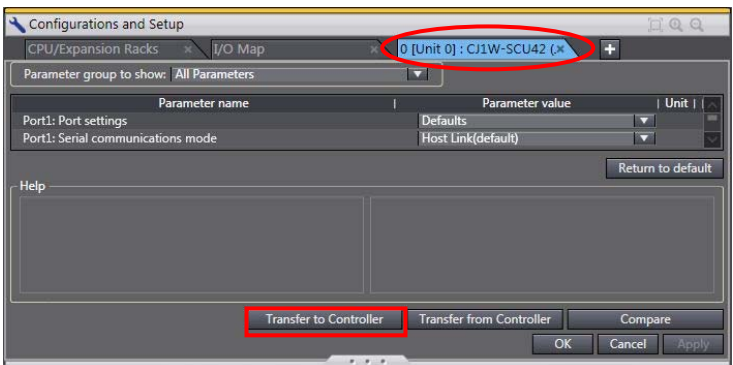
- 1 Select **Mode - PROGRAM Mode** from the Controller Menu.


- 2 A confirmation dialog box is displayed. Click the **Yes** Button.

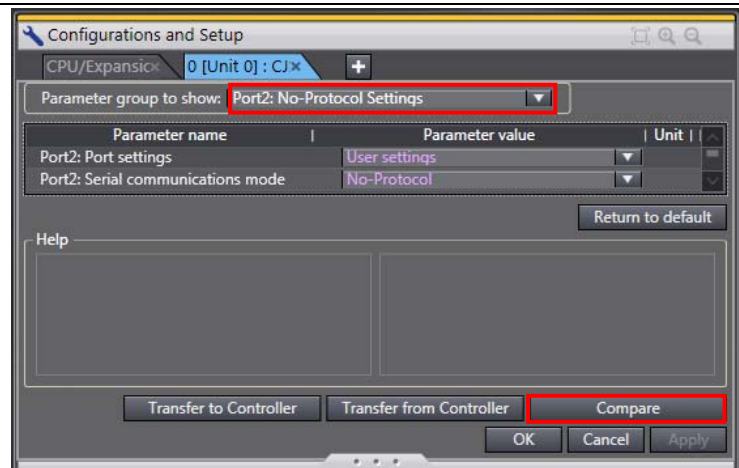
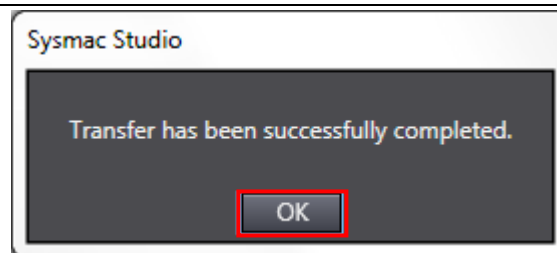
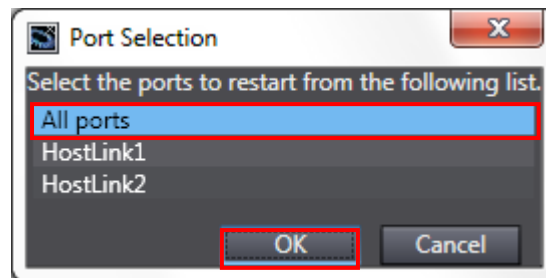
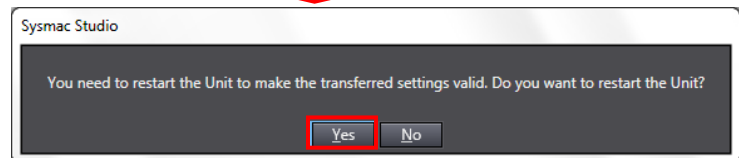
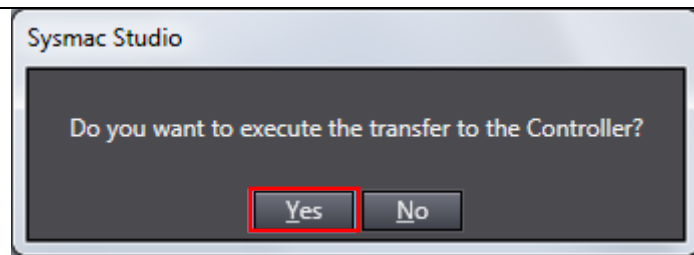

- 3 PROGRAM mode is displayed on the Controller Status Pane.


- 4 Double-click **CPU/Expansion Racks** under **Configurations and Setup** in the Multiview Explorer. Select the Serial Communications Unit icon. Click **Edit Special Unit Settings**.


- 5 The 0 [Unit 0]: Tab is displayed. Click the **Transfer to Controller** Button.



- 6 A confirmation dialog box is displayed.
Click the **Yes** Button.
- A dialog box is displayed indicating transferring is being performed, and a confirmation dialog box is displayed.
Click the **Yes** Button.
- 7 The Port Selection Dialog Box is displayed.
Select **All ports** and click the **OK** Button.
- 8 A confirmation dialog box is displayed.
Click the **OK** Button.
- 9 Select *Port2: No-Protocol Settings* from the pull-down list of Parameter group to show.
Click the **Compare** Button.
- 10 Confirm that “≠” (mismatch) is not shown in the red frame on the right.



| Parameter name | Parameter value | Compare results | Unit |
|---|--|-----------------|------|
| Port2: Port settings | User settings | User settings | |
| Port2: Serial communications mode | No-Protocol | No-Protocol | |
| Port2: Data length | 8 bits | 8 bits | |
| Port2: Stop bits | 1 bit | 1 bit | |
| Port2: Parity | None | None | |
| Port2: Baud rate | 38400bps | 38400bps | |
| Port2: Send delay | Default (0 ms) | Default (0 ms) | |
| Port2: Send delay (user-specified) | 0 | 0 | ms |
| Port2: CTS control | No | No | |
| Port2: No-Protocol Start code | 0 | 0 | |
| Port2: No-Protocol End code | 0 | 0 | |
| Port2: No-Protocol Start code inclusion setting | None | None | |
| Port2: No-Protocol End code inclusion setting | [End Code] | [End Code] | |
| Port2: No-Protocol Number of receive data bytes | 0 | 0 | Byte |
| Port2: External interrupt task number | 0 | 0 | |
| Port2: External interrupt task startup setting | Do not start the external interrupt task | Do not start t | |
| Port2: Receive buffer clear setting for DRXDU | Do not clear the receive buffer | Do not clear r | |

7.4. Checking the Serial Communications

Execute the program and confirm that serial communications are performed normally.

Caution

Sufficiently confirm safety before you change the values of variables on a Watch Tab Page when the Sysmac Studio is online with the CPU Unit. Incorrect operation may cause the devices that are connected to Output Units to operate regardless of the operating mode of the Controller.

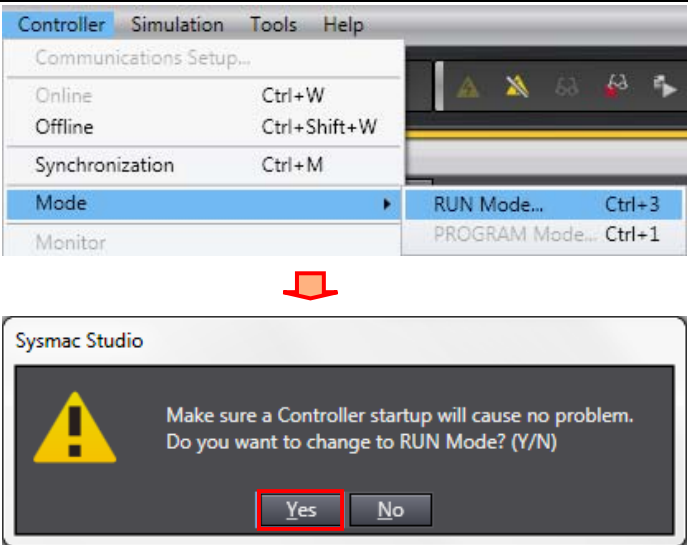
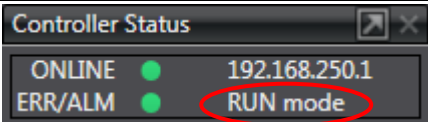
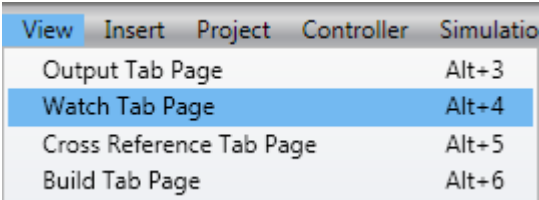


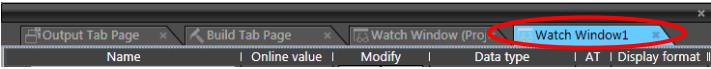
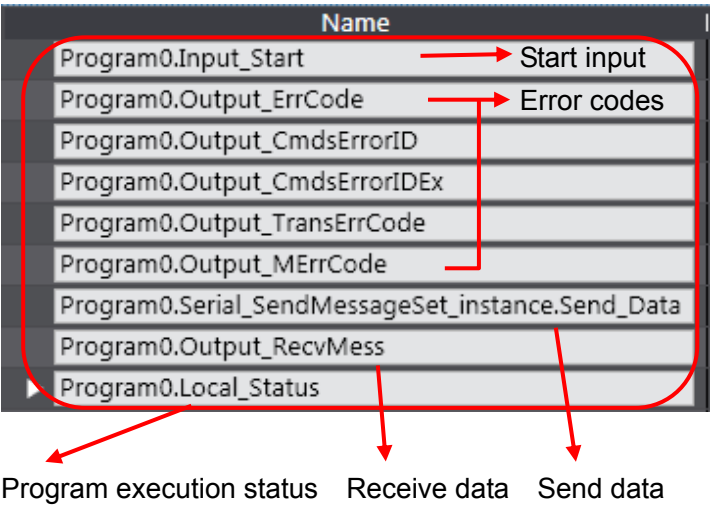
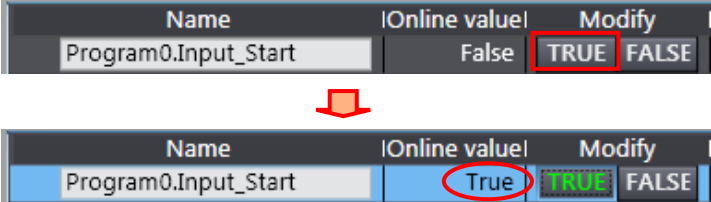
Precautions for Correct Use

Please confirm that the serial cable is connected before proceeding to the following steps.
If it is not connected, turn OFF the power of the devices, and then connect the serial cable.

7.4.1. Executing the Program and Checking the Receive Data

Execute the program and confirm that the correct data are written to the variables of the Controller.

| | |
|--|--|
| <p>1 Select Mode - RUN Mode from the Controller Menu.</p> <p>A confirmation dialog box is displayed. Click the Yes Button.</p> |  <p>Sysmac Studio</p> <p>Make sure a Controller startup will cause no problem. Do you want to change to RUN Mode? (Y/N)</p> <p>Yes No</p> |
| <p>2 RUN mode is displayed on the Controller Status Pane.</p> |  |
| <p>3 Select Watch Tab Page from the View Menu.</p> |  |

| | | |
|---|---|---|
| 4 | The Watch Tab Page 1 is displayed in the lower section of the Edit Pane. |  |
| 5 | <p>Confirm that the variables shown on the right are displayed in the Name Columns.</p> <p>*To add a variable, click <i>Input Name...</i></p> <p>*Program0 of the Name is omitted from the following descriptions.</p> |  |
| 6 | <p>Click TRUE on the Modify Column of <i>Input_Start</i>.</p> <p>The online value of <i>Input_Start</i> changes to True.</p> <p>The program is operated and serial communications are performed with the destination device.</p> |  |

| 7 | <p>When the communications ends normally, each error code changes to 0.</p> <p>*In the case of error end, the error code corresponding to the error is stored. For details on error codes, refer to 9.7 <i>Error Process</i>.</p> <p>The online value of <i>Local_Status.Done</i>, which indicates the program execution status, changes to True. In the case of error end, <i>Local_Status.Error</i> changes to True.</p> <p>*When <i>Input_Start</i> changes to FALSE, each <i>Local_Status</i> variable also changes to False. For details, refer to 9.6 <i>Timing Charts</i>.</p> | <table> <tr> <th>Name</th><th>Online value</th><th>Modify</th></tr> <tr> <td>Program0.Input_Start</td><td>True</td><td><input checked="" type="checkbox"/> TRUE <input type="checkbox"/> FALSE</td></tr> <tr> <td>Program0.Output_ErrCode</td><td>0000</td><td></td></tr> <tr> <td>Program0.Output_CmdsErrorID</td><td>0000</td><td></td></tr> <tr> <td>Program0.Output_CmdsErrorIDEx</td><td>0000 0000</td><td></td></tr> <tr> <td>Program0.Output_TransErrCode</td><td>0000</td><td></td></tr> <tr> <td>Program0.Output_MErrCode</td><td>0000 0000</td><td></td></tr> </table> <table> <tr> <th>Name</th><th>Online value</th><th>Modify</th></tr> <tr> <td>▼ Program0.Local_Status</td><td></td><td></td></tr> <tr> <td>Busy</td><td>False</td><td><input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE</td></tr> <tr> <td>Done</td><td>True</td><td><input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE</td></tr> <tr> <td>Error</td><td>False</td><td><input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE</td></tr> </table> | Name | Online value | Modify | Program0.Input_Start | True | <input checked="" type="checkbox"/> TRUE <input type="checkbox"/> FALSE | Program0.Output_ErrCode | 0000 | | Program0.Output_CmdsErrorID | 0000 | | Program0.Output_CmdsErrorIDEx | 0000 0000 | | Program0.Output_TransErrCode | 0000 | | Program0.Output_MErrCode | 0000 0000 | | Name | Online value | Modify | ▼ Program0.Local_Status | | | Busy | False | <input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE | Done | True | <input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE | Error | False | <input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE |
|---|---|---|------|---|--------------------------|----------------------|------|---|-------------------------|------|--|-----------------------------|------|--|-------------------------------|-----------|--|------------------------------|------|--|--------------------------|-----------|--|------|--------------|--------|-------------------------|--|--|------|-------|---|------|------|---|-------|-------|---|
| Name | Online value | Modify | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Program0.Input_Start | True | <input checked="" type="checkbox"/> TRUE <input type="checkbox"/> FALSE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Program0.Output_ErrCode | 0000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Program0.Output_CmdsErrorID | 0000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Program0.Output_CmdsErrorIDEx | 0000 0000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Program0.Output_TransErrCode | 0000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Program0.Output_MErrCode | 0000 0000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Name | Online value | Modify | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ▼ Program0.Local_Status | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Busy | False | <input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Done | True | <input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Error | False | <input type="checkbox"/> TRUE <input checked="" type="checkbox"/> FALSE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | <p>The response data received from the destination device is stored in <i>Output_RecvMess</i>. (<i>Serial_SendMessageSet_instance.Send_Data</i> is the send command.) Specify an area where you want to reference in the Watch Tab Page1 as shown in the right figure.</p> <p>*The response data differs depending on the device used.</p> <p>*Refer to 9.2. <i>Destination Device Command</i> for details on the command.</p> | <table> <tr> <th>Name</th></tr> <tr> <td>Program0.Serial_SendMessageSet_instance.Send_Data</td></tr> <tr> <td>Program0.Output_RecvMess</td></tr> </table> <div> <div>VR</div> <div>ZW-C15 Ver1.000 2012/02/09</div> </div> <p>Receive data</p> <p>•Version information</p> <p>Product type: ZW-C15</p> <p>Blank: (2 characters)</p> <p>Version: Ver1.000</p> <p>Blank: (1 character)</p> <p>Release date: 2012/02/09</p> | Name | Program0.Serial_SendMessageSet_instance.Send_Data | Program0.Output_RecvMess | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Program0.Serial_SendMessageSet_instance.Send_Data | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Program0.Output_RecvMess | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

8. Initialization Method

This document explains the setting procedure from the factory default setting.

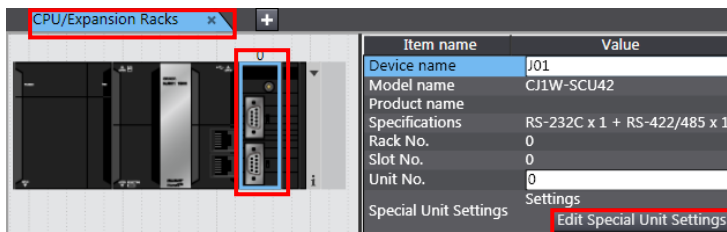
If the device settings are changed from the factory default setting, some settings may not be applicable as described in this procedure.

8.1. Initializing the Controller

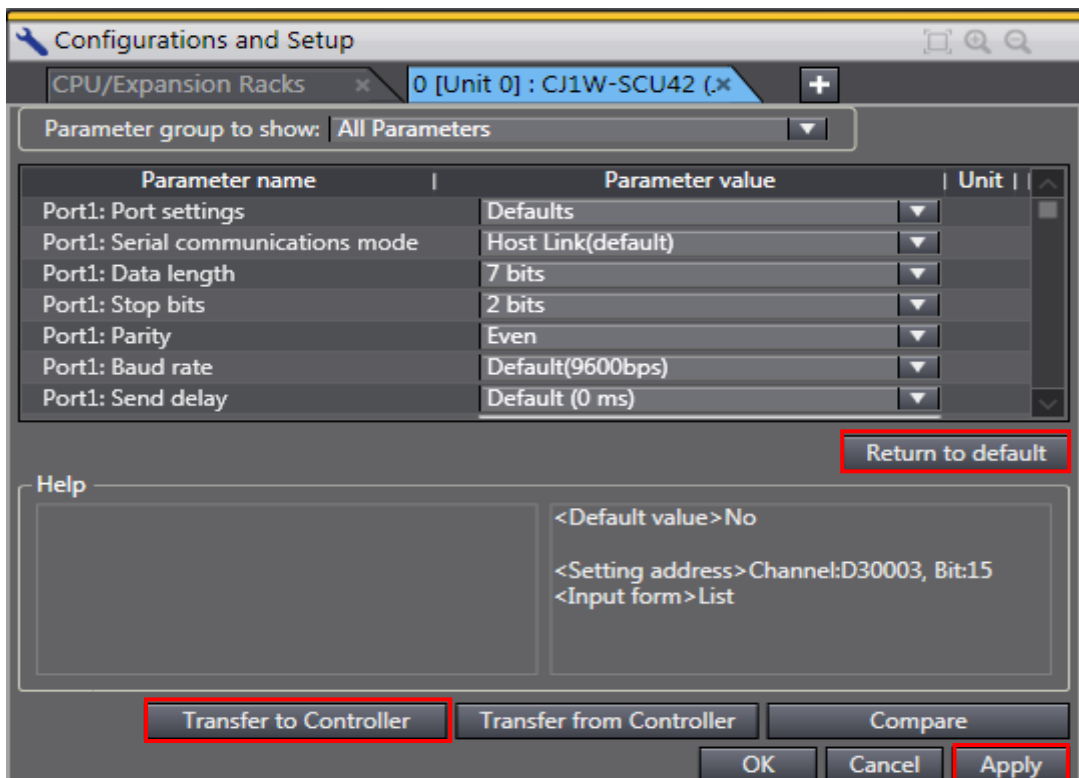
To initialize the settings of the Controller, it is necessary to initialize the Serial Communications Unit and the CPU Unit. Place the operating mode to PROGRAM mode before initialization.

8.1.1. Serial Communications Unit

To initialize the settings of the Serial Communications Unit, select **Edit Special Unit Settings** of CJ1W-SCU42 in CPU/Expansion Racks from the Sysmac Studio.

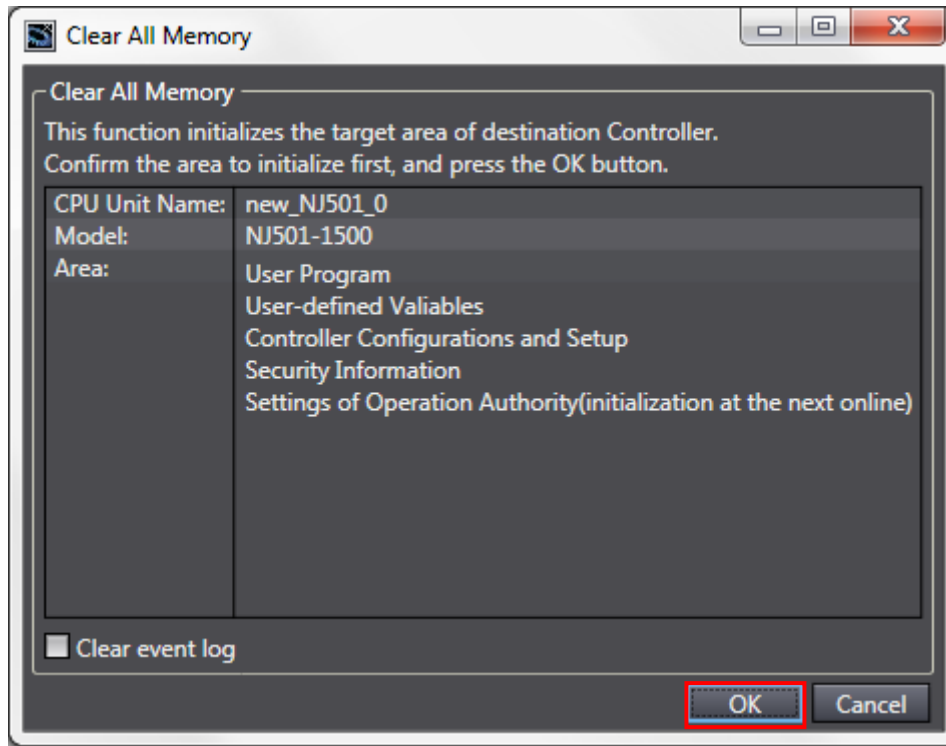


Click the **Return to default** Button and click the **Apply** Button. Then, click the **Transfer to Controller** Button.



8.1.2. CPU Unit

To initialize the settings of the Controller, select **Clear All Memory** from the Controller Menu of the Sysmac Studio. The Clear All Memory Dialog Box is displayed. Click the **OK** Button.



8.2. Initializing the Displacement Sensor

For the initialization of the Displacement Sensor, refer to *Initializing Settings* in *Setting the System* in *Chapter 3 SETTINGS FOR FUNCTIONS* of the *Confocal Fiber Type Displacement Sensor User's Manual* (Cat. No. Z322).

9. Program

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

9.1. Overview

This section explains the specifications and functions of the program used to check the connection between the Displacement Sensor (ZW series) (hereinafter referred to as the destination device) to the Controller (Serial Communications Unit) (hereinafter referred to as an SCU Unit).

This program uses the serial communications of the SCU Unit to send/receive "VR (version information acquisition command)" to/from the destination device and to detect a normal end or an error end.

A normal end of this program means a normal end of the serial communications.

An error end means an error end of the serial communications and an error end of the destination device (detected with the response data from the destination device)

In this section, the prefix "10#" (possible to omit) is added to decimal data and the prefix "16#" to hexadecimal data when it is necessary to distinguish between decimal and hexadecimal data. (e.g., "1000" or "10#1000" for decimal data and "16#03E8" for hexadecimal data, etc.) Also, to specify a specific data type, the prefix "<data type>#" is added. (e.g., "WORD#16#03E8")



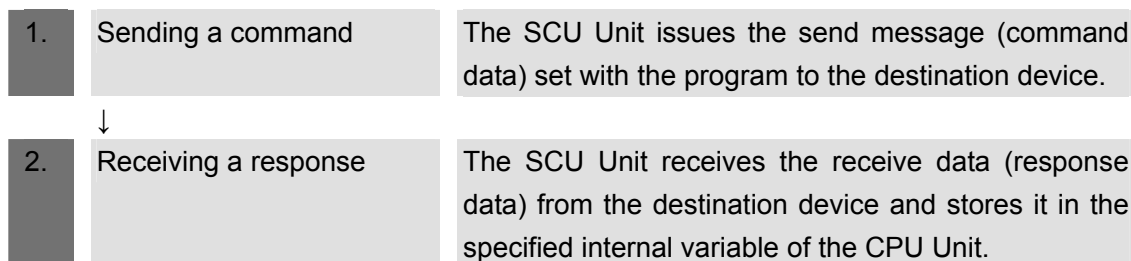
Additional Information

OMRON has confirmed that normal communications can be performed using this program under the OMRON evaluation conditions including the test system configuration, version of each product, and product Lot, No. of each device which was used for evaluation.

OMRON does not guarantee the normal operation under the disturbance such as electrical noise and the performance variation of the device.

9.1.1. Communications Data Flow

The following figure shows the data flow from when the Controller (SCU Unit) issues the serial communications command to the destination device until when the Controller receives the response data from the destination device.



*The response data is not sent after receiving a command or the response data is sent without the need for a command depending on the destination device and command. With this program, the Send/Receive processing required/not required setting can be set for the General-purpose serial no-protocol communications sequence setting function block.

If Send only is set, the response data receive processing is not performed. If Receive only is set, the command data send processing is not performed.

9.1.2. Serial Communications Instructions and Send/Receive Messages

This section outlines the function blocks for Serial Communications Unit (hereinafter referred to as serial communications instructions) and the general operation of the send/receive messages.



Additional Information

For details, refer to *Communications Instructions in 2 Instruction Descriptions* of the *NJ-series Instructions Reference Manual* (Cat. No. W502).

•Serial communications instructions

This program uses the following 2 types of standard instructions to perform serial communications.

| Name | Function block | Description |
|--------------------|----------------|--|
| SCU Send Serial | SerialSend | Sends data in No-protocol Mode from the serial port. (Send instruction) |
| SCU Receive Serial | SerialRcv | Reads the receive data from the serial port in No-protocol Mode. (Receive instruction) |

•Serial communications instructions argument data

•SCU Send Serial

| Instruction | Name | FB/ FUN | Graphic expression | ST expression |
|-------------|-----------------|------------|--------------------|--|
| SerialSend | SCU Send Serial | FB | | SerialSend_instance(Execute, Port, SrcDat, SendSize, Done, Busy, Error, ErrorID, ErrorIDEx); |

Variables

| Name | Meaning | I/O | Description | Valid range | Unit | Default |
|---------------------|------------------|-------|---|-----------------------|------|---------|
| Port | Destination port | Input | Destination port | --- | --- | --- |
| SrcDat[] (array) | Send data array | | Send data array | Depends on data type. | | * |
| SendSize | Send data size | | Data size to send from <i>Src-Dat[]</i> | 0 to 256 | | 1 |

* If you omit an input parameter, the default value is not applied. A building error will occur.

•SCU Receive Serial

| Instruction | Name | FB/ FUN | Graphic expression | ST expression |
|-------------|--------------------|------------|--------------------|--|
| SerialRcv | SCU Receive Serial | FB | | SerialRcv_instance(Execute, Port, Size, DstDat, Done, Busy, Error, ErrorID, ErrorIDEx, RcvSize); |

Variables

| Name | Meaning | I/O | Description | Valid range | Unit | Default |
|------------------|---------------------------|--------|--|-----------------------|-------|---------|
| Port | Destination port | Input | Destination port | --- | --- | --- |
| Size | Receive data size | | Size of receive data stored in <i>DstDat[]</i> | 0 to 256 | Bytes | 1 |
| DstDat[] (array) | Receive data array | In-out | Receive data array | Depends on data type. | --- | --- |
| RcvSize | Receive data storage size | Output | Size of receive data that was actually stored in <i>DstDat[]</i> | 0 to 256 | Bytes | --- |

•The data type (_sPORT) of destination port Port

| Name | Meaning | Description | Data type | Valid range | Unit | Default |
|--------------|--------------------|--|-----------|------------------------|------|-----------|
| Port | Destination port | Destination port | _sPORT | --- | --- | --- |
| UnitNo | Unit number | Unit number of Serial Communications Unit | _eUnitNo | _CBU_No00 to _CBU_No15 | --- | _CBU_No00 |
| PhysicPortNo | Serial port number | Serial port number on Serial Communications Unit | USINT | 1 or 2 | --- | 1 |

•Send/Receive messages

[Overview of send/receive messages]



9.2. Destination Device Command

This section explains the destination device command executed in this program.

9.2.1. Overview of the Command

This program uses the VR (version information acquisition) command to read information from the destination device.

| Command | Description |
|---------|------------------------------|
| VR | Acquire version information. |



Additional Information

For details on the destination device command and message format, refer to *Command format* in *Chapter 5 Ethernet/RS-232C COMMUNICATION* of the *Confocal Fiber Type Displacement Sensor User's Manual* (Cat. No. Z322).

9.2.2. Detailed Description of the Command

This section explains the “VR (Version information acquisition)” command.

- Command format of the send message

This is the command format of the message that is sent by the Controller to the destination device according to the setting of the “VR (Version information acquisition)” command.

- ASCII codes are sent except for the terminator.

| Data name | Number of bytes | Remarks |
|------------|-----------------|------------------------------|
| Header | - | None |
| Command | 2 | Fixed: "VR" |
| Terminator | 1 | Fixed: [CR](16#0D) (Default) |

- Command format of the receive message (normal)

This is the response format of the normal message received by the Controller from the destination device according to the setting of the “VR (Version information acquisition)” command.

- ASCII codes are received except for the terminator.

- The version information differs depending on the Displacement Sensor used.

| Command | Number of bytes | Remarks |
|---------------------|-----------------|------------------------------|
| Header | - | None |
| Version information | - | - |
| Product type | 6 | "ZW-C15" |
| Blank | 2 | Fixed: " " |
| Version | 8 | "Ver1.000" |
| Blank | 1 | Fixed: " " |
| Release data | 10 | "2012/02/09" |
| Terminator | 1 | Fixed: [CR](16#0D) (Default) |

- Command format of the receive message (error)

This is the response format of the error message received by the Controller from the destination device according to the setting of the "VR (Version information acquisition)" command.

- ASCII codes are received except for the terminator.

| Command | Number of bytes | Remarks |
|------------|-----------------|------------------------------|
| Error code | 2 | Fixed: "ER"(16#4552) |
| Terminator | 1 | Fixed: [CR](16#0D) (Default) |

9.2.3. Command Settings

This section explains the details on the "VR (Version information acquisition)" command settings.

- Send data (command) settings

The send data is set in the SendMessageSet function block.

| Variable | Contents (Data type) | Set value |
|----------------|------------------------------------|-------------------------|
| Send_Header | Send header (STRING[5]) | ''(Setting unnecessary) |
| Send_Addr | Send address (STRING[5]) | ''(Setting unnecessary) |
| Send_Command | Send data (STRING[256]) | 'VR' |
| Send_Check | Addition of send check (STRING[5]) | ''(Setting unnecessary) |
| Send_Terminate | Send terminator (STRING[5]) | ''(Setting unnecessary) |

*The SCU Unit adds the terminator (CR) to the send message. Therefore, do not set the terminator.

| Variable | Contents (Data type) | Data | Description |
|-----------|----------------------------|--|--|
| Send_Data | Send message (STRING[256]) | CONCAT(Send_Header, Send_Command, Send_Addr, Send_Check, Send_Terminate) | Used as send data of SerialSend instruction (SerialSend_instance). |

- Receive data (response) that is stored

The receive data is stored and then checked in the Serial_ReceiveCheck function block.

| Variable | Description (data type) | Storage area |
|-----------|----------------------------|--|
| Recv_Data | Receive data (STRING[256]) | Receive data storage area (stores the receive buffer data) |
| Recv_Buff | Receive data (STRING[256]) | Receive buffer |

●Send/Receive messages

*Send message

| | | |
|---------|------------|------|
| 56 | 52 | 0D |
| V | R | [CR] |
| Command | Terminator | |

*Receive message (at normal process)

| | | | | | | | |
|--------------|----|----|----|----|----|-------|-------|
| 5A | 57 | 2D | 43 | 31 | 35 | 20 | 20 |
| Z | W | - | C | 1 | 5 | [SP] | [SP] |
| Product type | | | | | | Blank | Blank |

| | | | | | | | | |
|---------|----|----|----|----|----|----|----|-------|
| 56 | 65 | 72 | 31 | 2E | 30 | 30 | 30 | 20 |
| V | e | r | 1 | . | 0 | 0 | 0 | [SP] |
| Version | | | | | | | | Blank |

| | | | | | | | | | | |
|--------------|----|----|----|----|----|----|----|----|----|------------|
| 32 | 30 | 31 | 32 | 2F | 30 | 32 | 2F | 30 | 39 | 0D |
| 2 | 0 | 1 | 2 | / | 0 | 2 | / | 0 | 9 | [CR] |
| Release data | | | | | | | | | | Terminator |

*Receive message (at error process)

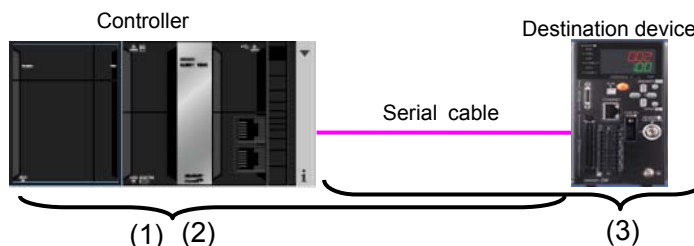
| | | |
|------------|------------|------|
| 45 | 52 | 0D |
| E | R | [CR] |
| Error code | Terminator | |

9.3. Error Detection Processing

This section explains the error detection processing of this program.

9.3.1. Error Detection in the Program

This program detects and handles the following errors (1) to (3). For information on the error codes, refer to 9.7. *Error Process*.



- (1)Errors at execution of the serial communications instructions (serial communications instruction errors)

Errors in the Unit, the command format, or the parameters at the execution of the SerialSend or SendCmd instruction are detected as "serial communications instruction errors". An error is detected with the error code (*ErrorID*) and the expansion error code(*ErrorIDEx*) of the serial communications instructions. If the "Serial communications instruction error" is caused by a transmission error due to, for example, a character corruption or an unmatched baud rate setting, the transmission error status (*J01_P2_TransErrSta*) device variable of the SCU Unit is stored in the output variable.

- (2)Timeout errors at execution of the program (Timeout errors)

When the send processing or receive processing are not normally performed and cannot be completed within the monitoring time, it is detected as a "timeout error". An error is detected with the timer monitoring function in the program. For information on the time monitoring function of the timer in the program, refer to 9.3.2. *Time Monitoring Function*.

- (3)Errors in the destination device (Destination device errors)

The destination device errors include a command error, a parameter error, and an execution failure in the destination device. An error is detected with the response data which is returned from the destination device. For information on the send/receive messages, refer to 9.2. *Destination Device Command*.

9.3.2. Time Monitoring Function

This section explains the time monitoring function of this program.

- Time monitoring function using the timer in the program

To avoid the status that keeps a communications process executing without stop due to abnormality, the timer is used in this program to abort the processing (timeout). The timeout value for each processing from the send processing to the receive processing is 5 seconds (default).

[Time monitoring function of the timer in the program]

| Processing | Monitoring | Timeout value |
|--------------------|---|-------------------------|
| Send processing | Send processing monitoring time: Time from when the program waits for the send processing to be allowed until when the send processing ends. *An operation end of the SerialSend instruction means the end of the processing. | 5 seconds (Default) |
| Receive processing | Receive processing start time: Time from the start to the end of the receive processing. *When the receive processing is repeated, the program monitors each receive processing separately. | 5 seconds (Default) |
| Receive wait | Receive wait monitoring time: Receive waiting time between responses *The receive waiting time for the next response after the receive processing ends once is also set in the <i>TrTime</i> variable as the receive waiting time monitoring timer. If the next response does not arrive from the destination device within this time, it is detected that the receive processing ended. | 0.3 second (Default) |

9.4. Variables

The variables used in this program are listed below.

9.4.1. List of Variables

The following tables list the data types, external variables (user-defined global variables/device variable for CJ-series Unit/system-defined variable) and internal variables that are used in this program.

•Data type (Structure)

[Communications processing status flags]

| Name | Data type | Description |
|---------|-----------|---|
| sStatus | STRUCT | Structure of communications processing status flags |
| Busy | BOOL | Communications processing in progress flag TRUE: Processing is in progress. FALSE: Processing is not in progress. |
| Done | BOOL | Communications processing normal end flag TRUE: Normal end / FALSE: Other than normal end |
| Error | BOOL | Communications processing error end flag TRUE: Error end / FALSE: Other than error end |

[Communications instruction execution flags]

| Name | Data type | Description |
|----------|-----------|--|
| sControl | STRUCT | Serial communications instruction execution flags |
| Send | BOOL | Send processing instruction TRUE: Executed / FALSE: Not executed |
| Recv | BOOL | Receive processing instruction TRUE: Executed / FALSE: Not executed |

[Timer enable flags]

| Name | Data type | Description |
|---------------|-----------|--|
| sTimerControl | STRUCT | Time monitoring timer enable flags |
| Tfs | BOOL | Send processing time monitoring timer instruction TRUE: Enabled / FALSE: Not enabled |
| Tfr | BOOL | Receive processing time monitoring timer instruction TRUE: Enabled / FALSE: Not enabled |
| Tr | BOOL | Receive waiting time monitoring timer instruction TRUE: Enabled / FALSE: Not enabled |

[Send/Receive processing required/not required setting flags]

| Name | Data type | Description |
|----------|-----------|---|
| sComType | STRUCT | Send/Receive processing required/not required setting flags |
| Send | BOOL | Send processing TRUE: Required / FALSE: Not required *Specify this when sending a command. |
| Recv | BOOL | Receive processing TRUE: Required / FALSE: Not required *Specify this when receiving a response. |
| Error | BOOL | Send/Receive processing required/not required setting error flag (This flag changes to ON when a setting error occurs.) |

●Data type (Union)

[Error code processing]

| Name | Data type | Description |
|-------------|-------------------------|---|
| uErrorFlags | UNION | Error code processing union |
| BoolData | ARRAY[0..15] OF BOOL | 2-byte error code is processed in units of 1 bit as 16-bit string. : TRUE (Error) / FALSE (Normal) •Communications error BoolData[0]: Send processing BoolData[1]: Receive processing •Timeout error BoolData[8]: Send processing BoolData[9]: Receive processing BoolData[14]: Receive wait •Others BoolData[2..3,6..7,10..11,13]: Reserved BoolData[4]: Processing number error BoolData[5]: Send/Receive required/not required detection error BoolData[12]: Destination device error BoolData[15]: Transmission error |
| WordData | WORD | 2-byte error code is processed as WORD at once. |

●External variables

[User-defined global variables]

| Variable name | Data type | Description |
|----------------------|-------------|--|
| Input_Start | BOOL | Communication start switch The program starts when this flag changes from FALSE to TRUE. |
| Output_RecvMess | STRING[256] | An area that stores the receive data (response) (256 bytes) |
| Output_ErrCode | WORD | An area that stores the error flag for a communications error or a timeout error that is detected at the send processing or receive processing. Normal end: 16#0000 |
| Output_CmdsErrorID | WORD | An area that stores the error code for an error that is detected at the send processing or receive processing. Normal end: 16#0000 |
| Output_CmdsErrorIDEx | DWORD | An area that stores the extension error code for an error that is detected at the send processing or receive processing. Normal end: 16#00000000 |
| Output_TransErrCode | WORD | An area that stores the transmission error status (J01_P2_TransErrSta) at a communications error. Normal end: 16#0000 |
| Output_MErrCode | DWORD | An area that stores the destination device error code for a destination device error. Normal end: 16#00000000 |
| Output_ReceiveLength | INT | An area that stores the receive data size |

[Device variables for CJ-series Unit] (Serial Communications Unit)

| Variable name | Data type | Description |
|-----------------------------|-----------|--------------------------------|
| J01_P2_NopSerialSendExecSta | BOOL | Send processing executing flag |
| J01_P2_TransErr | BOOL | Transmission error |
| J01_P2_TransErrSta | BOOL | Transmission error status |
| J01_P2_NopRcvCompleteSta | BOOL | Receive completion |



Additional Information

For details on the variables of the Serial Communications Unit, refer to *2-3 Device Variable for CJ-series Unit* in the *CJ-series Serial Communications Units Operation Manual for NJ-series CPU Unit* (Cat.No. W494).

[System-defined variable]

| Variable name | Data type | Description |
|-------------------|-----------|---|
| _Port_isAvailable | BOOL | Communications Port Enabled Flag TRUE: Enabled, FALSE: Not enabled |



Additional Information

For information on the system-defined variables, refer to *Communications Instructions in Section 2 Instruction Descriptions* of the *NJ-series Instructions Reference Manual* (Cat. No. W502).

•Internal variables (Instance variables)

The following tables list the internal variables used to execute the function blocks in the program. An internal variable is called an “instance”. The name of the function block to use is specified as the data type of the variable.

[Instances of user-defined function blocks]

| Variable name | Data type | Description |
|--------------------------------|----------------|---|
| Serial_ParameterSet_instance | ParameterSet | No-protocol serial communications parameter setting function block This variable sets the monitoring time of each processing from the send processing to receive processing. |
| Serial_SendMessageSet_instance | SendMessageSet | No-protocol serial communications send data setting function block This variable sets the send/receive processing required/not required setting and sets the send message. |
| Serial_ReceiveCheck_instance | ReceiveCheck | No-protocol serial communications receive processing function block This variable stores the receive data and detects a normal end or an error end. |

*For information on the user-defined function blocks, refer to *9.5.3 Detailed Description of Function Blocks*.

[Instances of timers]

| Variable name | Data type | Description |
|------------------|-----------|--|
| Tfs_TON_instance | TON | Send processing monitoring timer This variable counts the time taken to perform the send processing. |
| Tfr_TON_instance | TON | Receive processing monitoring timer This variable counts the time taken to perform the receive processing. |
| Tr_TON_instance | TON | Receive wait monitoring timer This variable counts the time taken to wait for the receive data from the destination device. |

[Instances of communications instructions]

| Variable name | Data type | Description |
|---------------------|------------|--|
| SerialSend_instance | SerialSend | SCU send serial (no-protocol send processing) function block |
| SerialRcv_instance | SerialRcv | SCU receive serial (no-protocol receive processing) function block |



Additional Information

For information on the communications instructions, refer to *Communications Instructions* in *Section 2 Instruction Descriptions* of the *NJ-series Instructions Reference Manual* (Cat. No. W502)

•Internal variables

| Variable name | Data type | Description |
|------------------------|---------------------------|--|
| Local_Status | sStatus | Communications processing status flags This variable is defined as sStatus structure. |
| Local_State | DINT | Processing number |
| Local_ErrCode | uErrorFlgs | An area in which an error code is edited. This variable is defined as uErrorFlgs union. |
| Local_ExecFlgs | sControl | Communications instruction execution flags This variable is defined as sControl structure. |
| Local_SrcDataByte | UINT | Number of bytes to send |
| Local_SrcData | ARRAY[0..255] OF BYTE | An area that stores the send data of the SerialSend instruction (256 bytes) |
| Local_RecvData | ARRAY[0..2000] OF BYTE | An area that stores the receive data of the SerialRcv instruction (2001 bytes) |
| Local_ReceiveMessage | STRING[256] | An area that stores the receive data after converted into a string. (256 characters) |
| Local_ReceiveSize | UINT | Size of receive data of SerialRcv instruction |
| Local_RecvDataLength | UINT | Total byte length of receive data |
| Local_RecvCHNo | UINT | The element number in Local_RecvData that stores the receive data |
| Local_RecvCheckFlg | BOOL | Destination device error detection instruction execution flag TRUE: Executed / FALSE: Not executed |
| Local_InitialSettingOK | BOOL | Initialization processing normal setting flag |
| Local_TONFlgs | sTimerControl | Timer enable flags This variable is defined as sTimerControl structure. |
| Local_ComType | sComType | Send/Receive processing required/not required setting flags This variable is defined as sComType structure. |
| Local_Port | _sPORT | Used port |

9.5. ST Program

9.5.1. Functional Components of Program

This program is written in the ST language. The functional components are as follows:

| Major classification | Minor classification | Description |
|------------------------------------|---|---|
| 1. Communications processing | 1.1. Starting the communications processing 1.2. Clearing the communications processing status flags 1.3. Communications processing in progress status | The communications processing starts. |
| 2. Initialization processing | 2.1. Initializing the timers 2.2. Initializing the instructions 2.3. Initializing the instruction execution flags 2.4. Initializing the timer enable flags 2.5. Initializing the error code storage areas 2.6. Setting each processing monitoring time and setting the communications parameters 2.7. Setting the send/receive processing required/not required setting and send data 2.8. Converting send data from a string to a BYTE array 2.9. Initializing the receive data storage areas 2.10. Initialization setting end processing | The parameters for serial communications are set and the error code storage areas are initialized. The send/receive required/not required setting is set, and the send data and receive data are set. |
| 3. Send processing | 3.1. Determining the send processing status and setting the execution flag 3.2. Enabling the send processing time monitoring timer 3.3. Executing the send instruction | The processing starts when the send processing required/not required setting is set to Required and the initialization processing ends normally. |
| 4. Receive processing | 4.1. Determining the receive processing status and setting the execution flag 4.2. Enabling the receive waiting time monitoring timer 4.3. Enabling the receive processing time monitoring timer 4.4. Executing the receive instruction 4.5. Executing the destination device error detection instruction | The processing starts when the receive processing required/not required setting is set to Required and the send processing ends normally. The receive processing is repeated when multiple receive data arrive. The receive data is stored and checked. |
| 5. Processing number error process | 5. Processing number error process | The error processing is executed when a non-existent status processing number is detected. |

9.5.2. Program List

The program is shown below.

The communications setting and send data (command data) setting, which need to be changed depending on the destination device, are set in the function blocks (ParameterSet, SendMessageSet, and ReceiveCheck). For information on how to change these values, refer to 9.5.3 Detailed Description of the Function Blocks.

- Program: Program0 (General-purpose serial communications connection check program)

1. Communications processing

```
(*=====
Name: NJ-series general-purpose serial no-protocol (RS-232C) communications
connection check program
Serial Communications Unit: CJ1W-SCU42 (No-protocol, Unit number: 0, Serial port number :2)
Version: V1.00 New release 7 December 2012
      V1.01 Update 25 February 2013
(C)Copyright OMRON Corporation 2012 All Rights Reserved.
===== *)
```

(* 1. Communications processing

```
Communications start switch: Input_Start
Communications processing status flags: Local_Status<STRUCT>
  .Busy: Communications in progress
  .Done: Communications normal end
  .Error: Communications error end
Processing number: Local_State
10:Initialization processing
11:Send processing
12:Receive processing *)
```

(* 1.1. Starting the communications processing

Start communications processing when the communications start switch changes to ON when communications processing status flags have been cleared. *)

```
IF Input_Start AND
  NOT (Local_Status.Busy OR Local_Status.Done OR Local_Status.Error) THEN
  Local_Status.Busy:=TRUE;
  Local_State:=10; //10: Initialization processing
END_IF;
```

(* 1.2. Clearing the communications processing status flags

Clear the communications processing status flags when the communications start switch changes to OFF while communications processing is not in progress. *)

```
IF NOT Input_Start AND NOT Local_Status.Busy THEN
  Local_Status.Done:=FALSE;
  Local_Status.Error:=FALSE;
END_IF;
```

(* 1.3. Communications processing in progress status

Perform the processing corresponding to the processing number (Local_State) *)

```
IF Local_Status.Busy THEN
  CASE Local_State OF
```

2. Initialization processing

(* 2. Initialization processing

-Perform initialization for the whole communications and set the parameters.

-Set the send data and initialize the receive data storage areas. *)

10:

(* 2.1. Initializing the processing time monitoring timers *)

Tfs_TON_instance(In:=FALSE);

Tfr_TON_instance(In:=FALSE);

Tr_TON_instance(In:=FALSE);

(* 2.2. Initializing the communications instructions *)

SerialSend_instance(Execute:=FALSE,SrcDat:=Local_SrcData[0]);

SerialRcv_instance(Execute:=FALSE,DstDat:=Local_RecvData[0]);

(* 2.3. Initializing the communications instruction execution flags *)

Local_ExecFlgs.Send:=FALSE;

Local_ExecFlgs.Recv:=FALSE;

(* 2.4. Initializing the processing time monitoring timer enable flags *)

Local_TONflgs.Tfs:=FALSE;

Local_TONflgs.Tfr:=FALSE;

Local_TONflgs.Tr:=FALSE;

(* 2.5. Initializing the error code storage areas *)

Local_ErrCode.WordData:=WORD#16#0000;

Output_ErrCode:=WORD#16#0000;

Output_TransErrCode:=WORD#16#0000;

Output_MErrCode:=DWORD#16#FFFFFFFF;

Output_CmdsErrorID:=WORD#16#FFFF;

Output_CmdsErrorIDEx:=DWORD#16#FFFFFFFF;

(* 2.6. Setting each processing monitoring time and

setting the general-purpose serial no-protocol-related parameters *)

(* Set each processing monitoring time *)

Serial_ParameterSet_instance(Execute:=TRUE);

(* Set the port for communications instructions *)

Local_Port.UnitNo:=_CBU_No00;

Local_Port.PhysicPortNo:=USINT#2;

(* 2.7. Setting the send/receive processing required/not required setting
and setting the send data *)

Serial_SendMessageSet_instance(Execute:=TRUE);

(* Detect a setting error in the send/receive processing required/not required setting. *)

Local_ComType.Send:=TestABit(Serial_SendMessageSet_instance.ComType,0);

Local_ComType.Recv:=TestABit(Serial_SendMessageSet_instance.ComType,1);

Local_ComType.Error:=NOT(Local_ComType.Send OR Local_ComType.Recv);

IF Local_ComType.Error THEN

Output_ErrCode:=WORD#16#0020;

Local_InitialSettingOK:=FALSE;

ELSE

Local_InitialSettingOK:=TRUE;

END_IF;

```

(*2.8. Converting the send data from string to BYTE array *)
Local_SrcDataByte:=
    StringToAry(Serial_SendMessageSet_instance.Send_Data,Local_SrcData[0]);

(* 2.9. Initializing the receive data storage areas *)
ClearString(Local_ReceiveMessage);
ClearString(Output_RecvMess);
Local_RecvCHNo:=0;
Local_RecvDataLength:=0;
Local_ReceiveSize:=UINT#256;

(* 2.10. Initialization setting end processing
    Determine the next transition state
    based on the send/receive processing required/not required flag *)
IF NOT Local_InitialSettingOK THEN
    Local_Status.Busy:=FALSE;
    Local_Status.Error:=TRUE;
    Local_State:=0; //0: Communications not in progress status
ELSIF Local_ComType.Send THEN
    Local_State:=11; //11: Send processing
ELSIF Local_ComType.Recv THEN
    Local_State:=12; //12: Receive processing
END_IF;

```

```

3. Send processing
(* 3. Send processing
-Send data from the specified serial port *)
11:
(* 3.1. Determining the send processing status and setting the execution flag *)
(* 3.1.1. Timeout processing *)
IF Tfs_TON_instance.Q THEN
    Local_ErrCode.BoolData[8]:=TRUE;
    Output_CmdsErrorID:=WORD#16#FFFF;
    Output_CmdsErrorIDEx:=DWORD#16#FFFFFFFF;
    Local_ExecFlgs.Send:=FALSE;
    Local_TONflgs.Tfs:=FALSE;
    Output_TransErrCode:=
        SEL(J01_P2_TransErr,WORD#16#0000,J01_P2_TransErrSta);

    (* Error end processing *)
    Local_ErrCode.BoolData[15]:=TRUE;
    Output_ErrCode:=Local_ErrCode.WordData;
    Local_Status.Busy:=FALSE;
    Local_Status.Error:=TRUE;
    Local_State:=0; //0: Communications not in progress status

(* 3.1.2. Normal end processing *)
ELSIF SerialSend_instance.Done AND NOT (J01_P2_NopSerialSendExecSta) THEN
    Local_ErrCode.BoolData[0]:=FALSE;
    Output_CmdsErrorID:=WORD#16#0000;
    Output_CmdsErrorIDEx:=WORD#16#00000000;
    Local_ExecFlgs.Send:=FALSE;
    Local_TONflgs.Tfs:=FALSE;
    Output_TransErrCode:=WORD#16#0000;
    Output_ErrCode:=Local_ErrCode.WordData;

    (* Determine the next transition state
    based on the send/receive processing required/not required flag *)
    IF Local_ComType.Recv THEN
        Local_State:=12; //12: Receive processing
    ELSE
        Local_Status.Busy:=FALSE;
        Local_Status.Done:=TRUE;
        Local_State:=0; //0: Communications not in progress status
    END_IF;

```

```

(* 3.1.3. Send error end processing *)
ELSIF SerialSend_instance.Error THEN
    Local_ErrCode.BoolData[0]:=TRUE;
    Output_CmdsErrorID:=SerialSend_instance.ErrorID;
    Output_CmdsErrorIDEx:=SerialSend_instance.ErrorIDEx;
    Local_ExecFlgs.Send:=FALSE;
    Local_TONflgs.Tfs:=FALSE;
    Output_TransErrCode:=
        SEL(J01_P2_TransErr,WORD#16#0000,J01_P2_TransErrSta);

    (* Error end processing *)
    Local_ErrCode.BoolData[15]:=TRUE;
    Output_ErrCode:=Local_ErrCode.WordData;
    Local_Status.Busy:=FALSE;
    Local_Status.Error:=TRUE;
    Local_State:=0; //0: Communications not in progress status

(* 3.1.4. Setting the send instruction execution flag *)
ELSIF _Port_isAvailable AND NOT (SerialSend_instance.Busy)
    AND NOT(J01_P2_NopSerialSendExecSta) THEN
    Local_ExecFlgs.Send:=TRUE;

(* 3.1.5. Setting the send processing timer enable flag *)
ELSE
    Local_TONFlgs.Tfs:=TRUE;
END_IF;

(* 3.2. Enabling the send processing time monitoring timer *)
Tfs_TON_instance(
    In:= Local_TONFlgs.Tfs,
    PT:=MULTIME(T#10ms,Serial_ParameterSet_instance.TfsTime));

(* 3.3. Executing the send instruction *)
SerialSend_instance(
    Execute:=Local_ExecFlgs.Send,
    Port:=Local_Port ,
    SrcDat:=Local_SrcData[0] ,
    SendSize:=Local_SrcDataByte);

```



```

4. Receive processing
(* 4. Receive processing
-Read the data from the receive buffer of the specified serial port *)
12:
(* 4.1. Determining the receive processing status and setting the execution flag *)
(* 4.1.1. Receive end processing *)
IF Tr_TON_instance.Q THEN
    Local_TONFlgs.Tfr:=FALSE;
    Local_TONFlgs.Tr:=FALSE;
    Local_ErrCode.BoolData[1]:= FALSE;
    Output_CmdsErrorID:=WORD#16#0000;
    Output_CmdsErrorIDEx:=DWORD#16#00000000;

    (* Convert the receive data from BYTE array to STRING. *)
    Local_ReceiveMessage:=
        AryToString(Local_RecvData[0],Local_RecvDataLength);

    (* Reset the communications processing in progress flag *)
    Local_Status.Busy:=FALSE;

    (* Communications processing normal end *)
    IF (Local_ErrCode.WordData = WORD#16#0000)
        AND NOT(J01_P2_TransErr) THEN
        Output_TransErrCode:=WORD#16#0000;
        Local_RecvCheckFlg:=TRUE;

    (* Communications processing error end *)
    ELSE
        Local_Status.Error:=TRUE;
        Output_TransErrCode:=J01_P2_TransErrSta;
        Local_ErrCode.BoolData[15]:=TRUE;
        Output_ErrCode:=Local_ErrCode.WordData;
    END_IF;
    Local_State:=0; //0: Communications not in progress status

(* 4.1.2. Timeout processing *)
ELSIF Tfr_TON_instance.Q THEN
    Local_ErrCode.BoolData[9]:=TRUE;
    Output_CmdsErrorID:=WORD#16#FFFF;
    Output_CmdsErrorIDEx:=DWORD#16#FFFFFFFF;
    Local_ExecFlgs.Recv:=FALSE;
    Local_TONFlgs.Tfr:=FALSE;
    Local_TONFlgs.Tr:=FALSE;
    Output_TransErrCode:=
        SEL(J01_P2_TransErr,WORD#16#0000,J01_P2_TransErrSta);

    (* Error end processing *)
    Local_ErrCode.BoolData[15]:=TRUE;
    Output_ErrCode:=Local_ErrCode.WordData;
    Local_Status.Busy:=FALSE;
    Local_Status.Error:=TRUE;
    Local_State:=0; //0: Communications not in progress status

```

```

(* 4.1.3. Normal end processing *)
ELSIF SerialRcv_instance.Done THEN
    Local_RecvDataLength:=
        Local_RecvDataLength+SerialRcv_instance.RcvSize;
    Local_RecvCHNo:=Local_RecvDataLength;
    Local_TONFlgs.Tfr:=FALSE;
    Local_ExecFlgs.Recv:=FALSE;
    Local_TONFlgs.Tr:=TRUE; // 4.1.5. Reading the receive data

(* 4.1.4. Error end processing *)
ELSIF SerialRcv_instance.Error THEN
    Local_ErrCode.BoolData[1]:=TRUE;
    Output_CmdsErrorID:=SerialRcv_instance.ErrorID;
    Output_CmdsErrorIDEx:=SerialRcv_instance.ErrorIDEx;
    Local_ExecFlgs.Recv:=FALSE;
    Local_TONFlgs.Tfr:=FALSE;
    Local_TONFlgs.Tr:=FALSE;
    Output_TransErrCode:=
        SEL(J01_P2_TransErr,WORD#16#0000,J01_P2_TransErrSta);

(* Error end processing *)
Local_ErrCode.BoolData[15]:=TRUE;
Output_ErrCode:=Local_ErrCode.WordData;
Local_Status.Busy:=FALSE;
Local_Status.Error:=TRUE;
Local_State:=0; //0: Communications not in progress status

(* 4.1.5. Reading the receive data
    When there is data to read: Receive processing continues. *)
ELSIF J01_P2_NopRcvCompleteSta THEN
    IF _Port_isAvailable AND NOT SerialRcv_instance.Busy THEN
        Local_ExecFlgs.Recv:=TRUE;
        Local_TONFlgs.Tfr:=TRUE;
        Local_TONFlgs.Tr:=FALSE;
    END_IF;
    (* When there is no data to read:
        -When no data is received, no processing is performed.
        -When data is already received, the waiting time to receive the response is monitored,
        and if there is no more response, the receive processing ends
        after reading the data that was already received. *)
(* 4.1.6. Setting the timer enable flag *)
ELSE
    Local_TONFlgs.Tfr:=TRUE;
    (* Initialize the destination device error detection instruction execution flag *)
    Local_RecvCheckFlg:=FALSE;
END_IF;

```

```

(* 4.2. Enabling the receive waiting time monitoring timer *)
Tr_TON_instance(
  In:= Local_TONFlgs.Tr,
  PT:=MULTIME(T#100ms,Serial_ParameterSet_instance.TrTime));

(* 4.3. Enabling the receive processing time monitoring timer *)
Tfr_TON_instance(
  In:= Local_TONFlgs.Tfr,
  PT:=MULTIME(T#10ms,Serial_ParameterSet_instance.TfrTime));

(* 4.4. Executing the receive instruction *)
SerialRcv_instance(
  Execute:=Local_ExecFlgs.Rcv ,
  Port:=Local_Port ,
  Size:=Local_ReceiveSize,
  DstDat:=Local_RecvData[Local_RecvCHNo]);

(* 4.5. Executing the destination device error detection instruction *)
Serial_ReceiveCheck_instance(
  Execute:=Local_RecvCheckFlg,
  Recv_Buff:=Local_ReceiveMessage,
  Recv_Data:=Output_RecvMess,
  tLength:= Local_RecvDataLength,
  Done:=Local_Status.Done,
  Error:=Local_Status.Error,
  ErrorID:=Output_ErrCode,
  ErrorIDEx:=Output_MErrCode);

5. Processing number error process
(* 5. Processing number error process
  -Error process for nonexistent processing number *)
99:
  Output_ErrCode:=WORD#16#0010;
  Local_Status.Busy:=FALSE;
  Local_Status.Error:=TRUE;
  Local_State:=0; //0: Communications not in progress status

ELSE
  Local_State:=99; //99: Processing number error process

END_CASE;

END_IF;

```

9.5.3. Detailed Description of the Function Blocks

The user-defined function blocks are shown below.

The code which you need to edit according to the destination device is indicated by the red frames on the function blocks below.

●ParameterSet function block

(General-purpose serial no-protocol communications parameter setting)

| Instruction | Name | ST expression |
|--------------|---|---|
| ParameterSet | General-purpose serial no-protocol communications parameter setting | Serial_ParameterSet_instance (Execute, TfsTime, TrTime, TfrTime); |

[Internal variables]

None

[Input/output]

| Variable name | I/O | Data type | Description | |
|---------------|--------|-----------|---|---|
| Execute | Input | BOOL | Execution flag: The function block is executed when this flag changes to TRUE and it is stopped when this flag changes to FALSE. | |
| TfsTime | Output | UINT | Send processing monitoring time: This variable sets the monitoring time of the send processing in increments of 10 ms. | |
| TrTime | Output | UINT | Receive wait monitoring time: This variable sets the waiting time for the receive data in increments of 100 ms. | |
| TfrTime | Output | UINT | Receive processing monitoring time: This variable sets the monitoring time of the receive processing in increments of 10 ms. | |
| Busy | Output | BOOL | Busy | Not used (Not used in this program.) |
| Done | Output | BOOL | Normal end | |
| Error | Output | BOOL | Error end | |
| ErrorID | Output | WORD | Error information | |
| ErrorIDEx | Output | DWORD | Error information | |

[External variables]

None

[Program]

```
(* =====
Name: NJ-series general-purpose serial no-protocol communications
parameter setting function block
Applicable device: OMRON Corporation ZW-series Displacement Sensor
Version: V1.00 New release 7 December 2012
V1.01 Update 25 February 2013
(C)Copyright OMRON Corporation 2012 All Rights Reserved.
===== *)
```

IF Execute THEN

(* Set the processing monitoring time:

Maximum time from the start to the end of the processing *)

TfsTime:= UINT#500;

// Send processing monitoring time setting: Setting unit 10ms<500->5s>

TfrTime:= UINT#500;

// Receive processing monitoring time setting: Setting unit 10ms<500->5s>

(* Maximum waiting time of the interval at which multiple messages are received. *)

TrTime:= UINT#3;

// Receive wait monitoring time: Setting unit 100ms<3->300ms>

END_IF;

RETURN;

●SendMessageSet function block

(General-purpose serial no-protocol communications send data setting)

| Instruction | Meaning | ST expression |
|----------------|---|--|
| SendMessageSet | General-purpose serial no-protocol communications send data setting | Serial_ParameterSet_instance(Execute, Send_Data, ComType); |

[Internal variables]

| Name | Data type | Description |
|----------------|-------------|--|
| Send_Header | STRING[5] | Send header: Header of send message |
| Send_Addr | STRING[5] | Destination device address: Address of destination device |
| Send_Command | STRING[256] | Destination device command: Command sent to destination device |
| Send_Check | STRING[5] | Send check code: Check code of send message |
| Send_Terminate | STRING[5] | Send terminator: Terminator of send message |

[Input/Output]

| Name | I/O | Data type | Description |
|-----------|--------|-------------|---|
| Execute | Input | BOOL | Execute: The function block is executed when this flag changes to TRUE and it is stopped when this flag changes to FALSE. |
| Send_Data | Output | STRING[256] | Send data: This variable sets a command that is sent to the destination device. |
| ComType | Output | BYTE | Send/receive type: This variable sets whether send/receive processing are required. 1: Send only, 2: Receive only, 3: Send and Receive |
| Busy | Output | BOOL | Busy |
| Done | Output | BOOL | Normal end |
| Error | Output | BOOL | Error end |
| ErrorID | Output | WORD | Error code |
| ErrorIDEx | Output | DWORD | Expansion error code |

Not used
(Not used in this project.)

[External variable]

None

[Program]

```
(* =====
Name: NJ-series general-purpose serial no-protocol communications
send data setting function block
Applicable device: OMRON Corporation ZW-series Displacement Sensor
Version: V1.00 New release 7 December 2012
      V1.01 Update 25 February 2013
(C)Copyright OMRON Corporation 2012 All Rights Reserved.
===== *)
```

IF Execute THEN

(* Set the send/receive processing required/not required setting *)

ComType:= BYTE#16#03; // 1: Send only, 2: Receive only, 3: Send/Receive

(* Set the send data *)

| | |
|----------------------|---|
| Send_Header:= ""; | // Header |
| Send_Addr:= ""; | // Address (Station No.) |
| Send_Command:= 'VR'; | // Destination device command: VR |
| Send_Check:= ""; | // FCS calculation: None |
| Send_Terminate:= ""; | // Terminator: 'None' |
| | // Presence or absence of SCU Unit end code |
| | // Set CR(0x0D). |

(* Concatenate the send data *)

Send_Data:=
CONCAT(Send_Header,Send_Addr,Send_Command,Send_Check,Send_Terminate);

END_IF;

RETURN;

●ReceiveCheck function block

(General-purpose serial no-protocol communications receive processing)

| Instruction | Meaning | ST expression |
|--------------|--|---|
| ReceiveCheck | General-purpose serial no-protocol communications receive processing | Serial_ReceiveCheck_instance(Execute, Recv_Data, Recv_Buff, Done, Error, ErrorID, ErrorIDEx); |

[Internal variables]

| Name | Data type | Description |
|---------------|-----------|--|
| Receive_Check | STRING[5] | FCS receive value: FCS receive result of receive data |
| Calc_Check | STRING[5] | FCS calculation value: FCS calculation result of receive data |

[Input/Output]

| Variable name | I/O | Data type | Description |
|---------------|--------|-------------|--|
| Execute | Input | BOOL | Execution flag: The function block is executed when this flag changes to TRUE and it is stopped when this flag changes to FALSE. |
| tLength | Input | UINT | Receive data length: Byte length of receive data |
| Recv_Data | In-out | STRING[256] | Receive data storage area: An area that stores the receive data after detection |
| Recv_Buff | In-out | STRING[256] | Receive buffer: An area that temporarily stores the receive data that is used for detection. |
| Done | In-out | BOOL | Normal end: TRUE for a normal end |
| Error | In-out | BOOL | Error end: TRUE for an error end |
| ErrorID | In-out | WORD | Error code: This variable stores 16#1000 for a destination device error and 16#2000 for an FCS error. |
| ErrorIDEx | In-out | DWORD | Expansion error code: This variable stores the FCS determination result or the destination device error code. |
| Busy | Output | BOOL | Busy |
| Rcv_Size | Output | INT | Storage receive data length: Data length of receive data |

[External variable]

None

[Program]

```
(* =====
Name: NJ-series general-purpose serial no-protocol communications
    receive processing function block
Applicable device: OMRON Corporation ZW-series Displacement Sensor
Version: V1.00 New release 7 December 2012
        V1.01 Update 25 February 2013
(C)Copyright OMRON Corporation 2012 All Rights Reserved.
===== *)
```

IF Execute THEN

(* Store the receive buffer data in the receive data storage area *)

Recv_Data:= Recv_Buff;

(* Detect the destination device error *)

(* Error: The code starts with 'ER' *)

IF FIND(LEFT(Recv_Buff,2),'ER') = UINT#1 THEN

Done:= FALSE; // Reset normal end flag.

Error:= TRUE; // Set error flag.

ErrorID:= WORD#16#1000; // Set error code.

ErrorIDEx:= DWORD#16#45520000; // Store destination device error code (ER).

(* Normal: The code does not start with 'ER'. *)

ELSE

Done:= TRUE; // Set normal end flag.

Error:= FALSE; // Reset error flag.

ErrorID:= WORD#16#0000; // Clear error code.

ErrorIDEx:= DWORD#16#00000000; // Clear destination device error code.

END_IF;

END_IF;

RETURN;

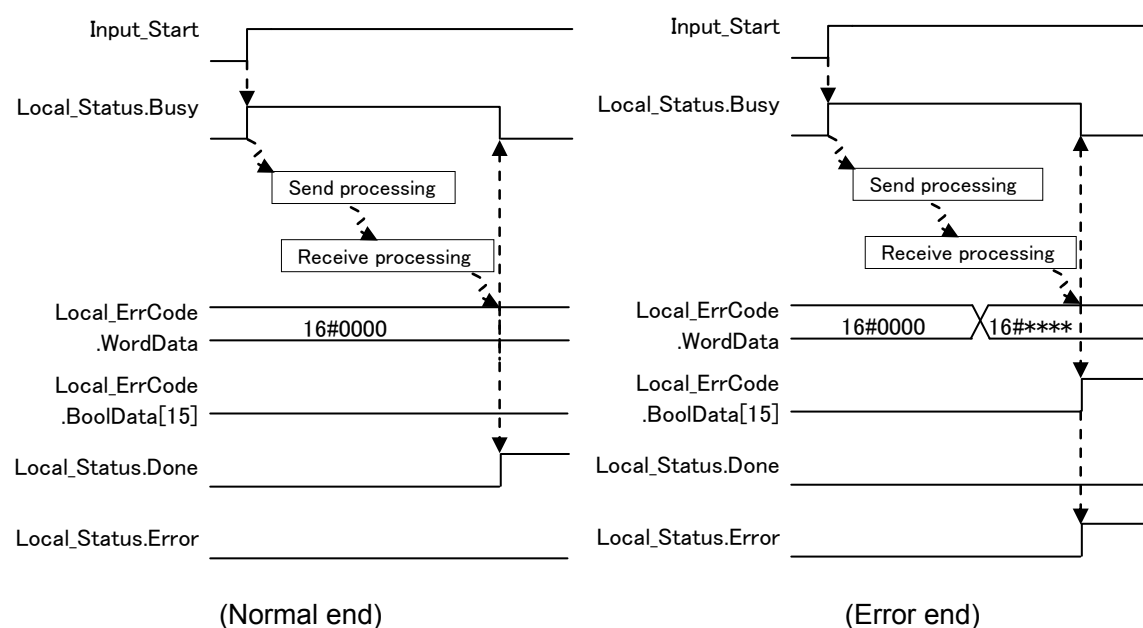
9.6. Timing Charts

This section explains the timing charts of the program.

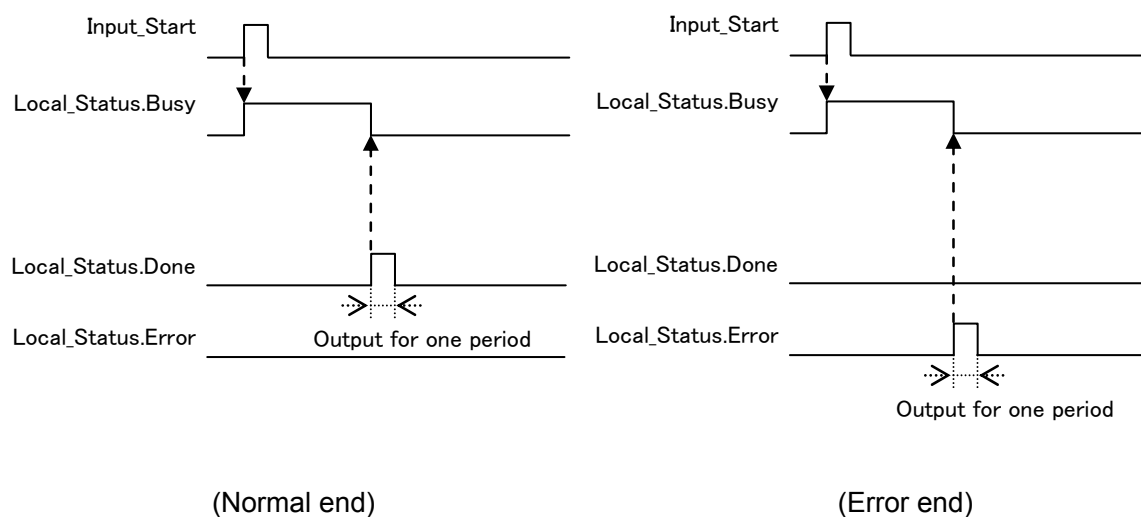
The definitions of the timing chart patterns are as follows:

| Pattern | Normal end | Error end (1) Serial communications instruction error | Error end (2) Timeout error | Error end (3) Destination device error |
|-----------------------|------------|---|--------------------------------|--|
| Command | Normal | Error | Normal | Normal |
| Destination device | Normal | Normal or error | Normal or error | Error |
| Response | Yes | None | None | Yes |

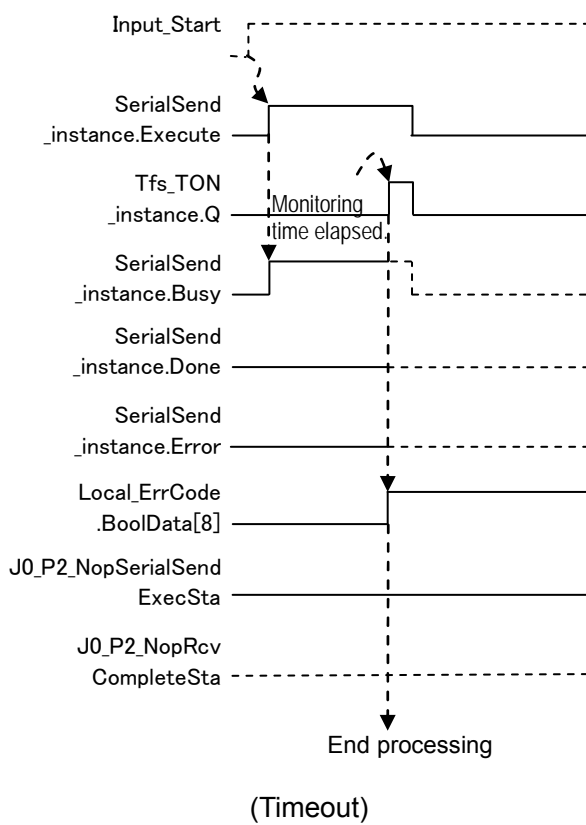
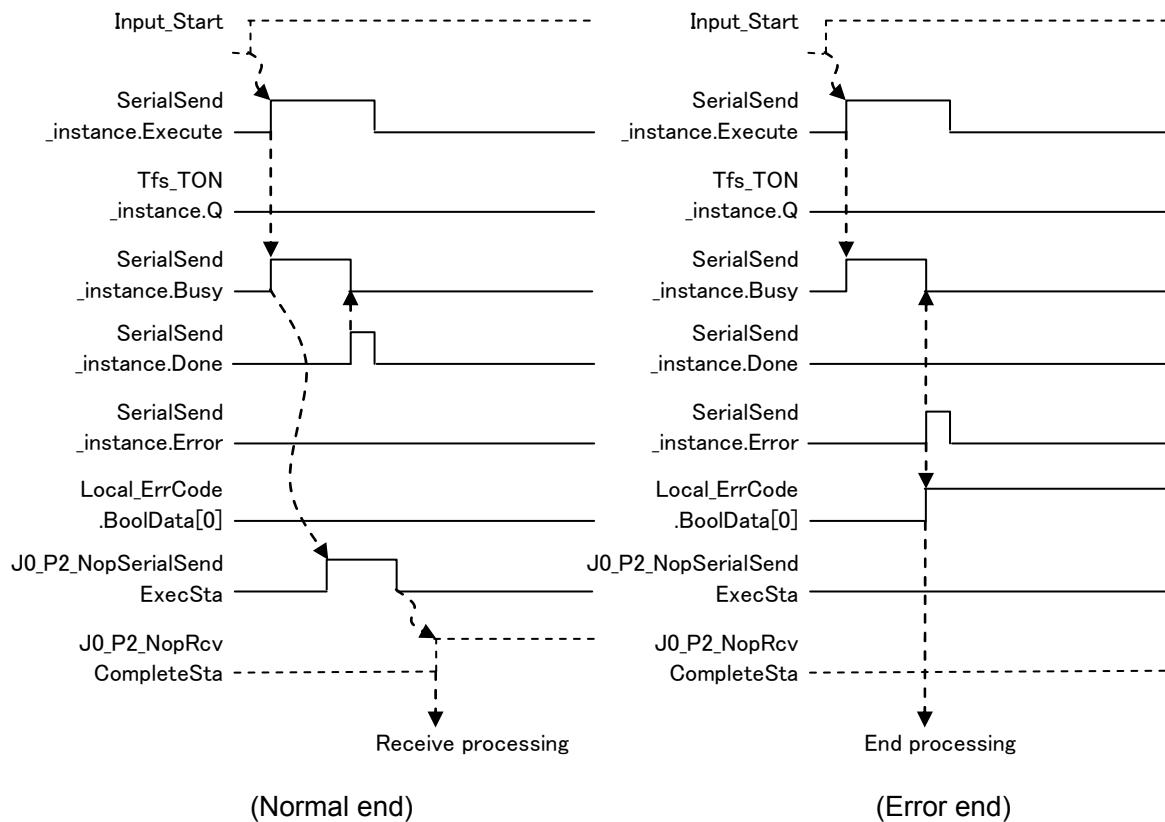
●Start&End processing



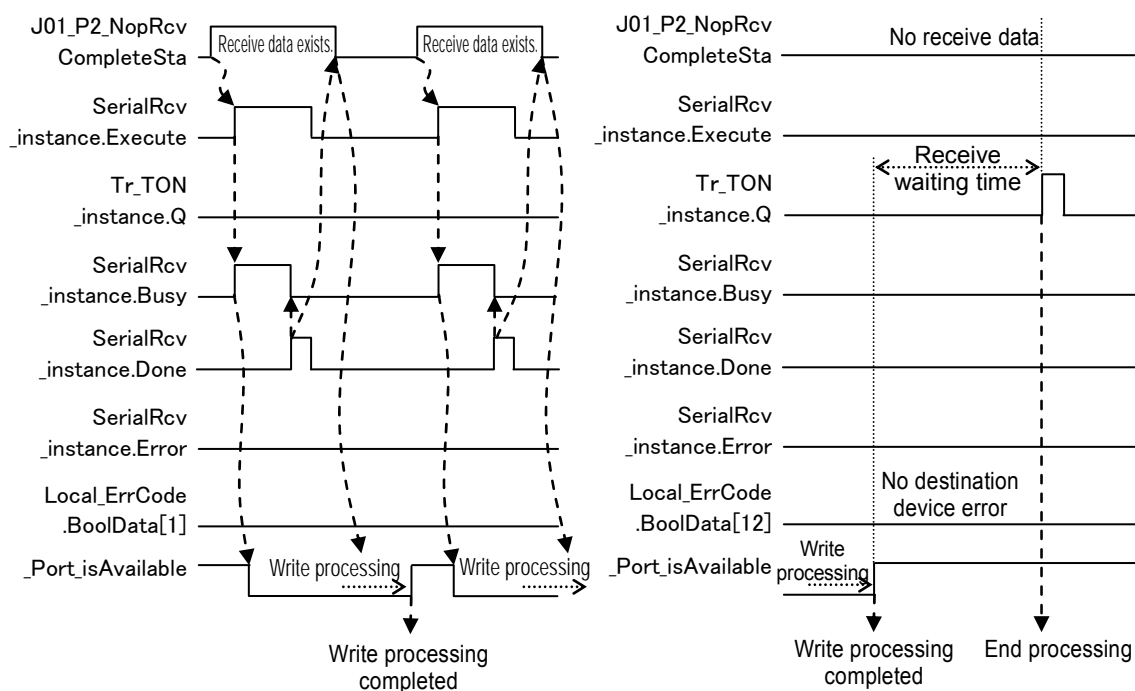
If *Input_Start* changes from TRUE to FALSE during execution, a normal end or an error end is output for one period after the processing is completed as described below.



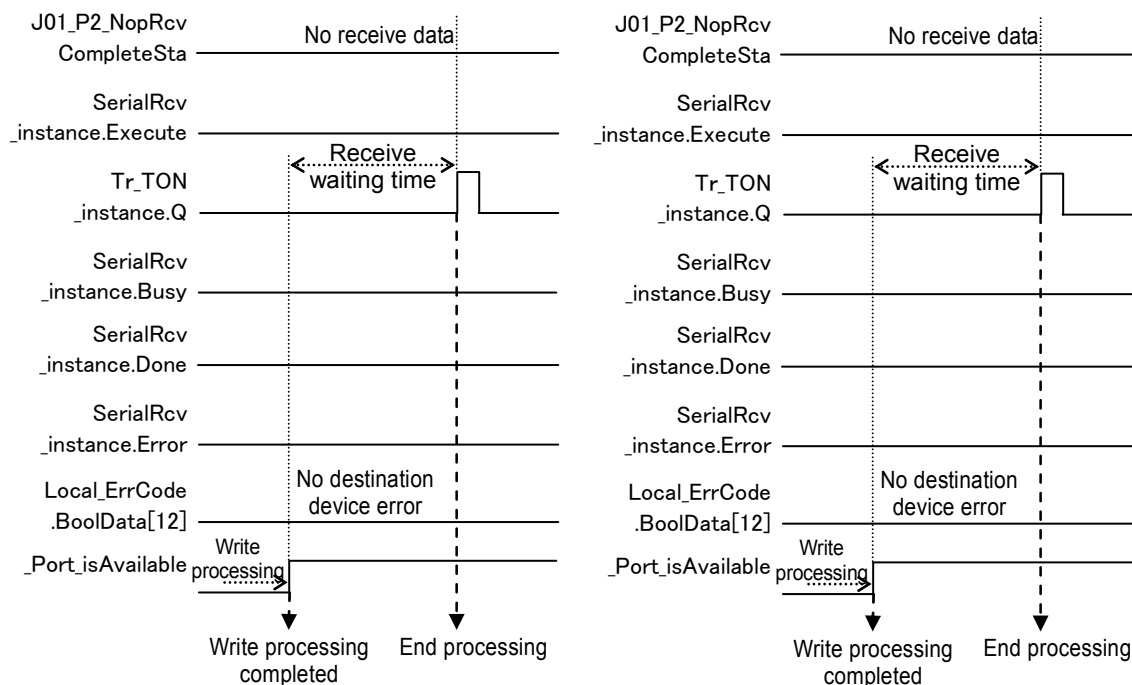
•Send processing



•Send processing

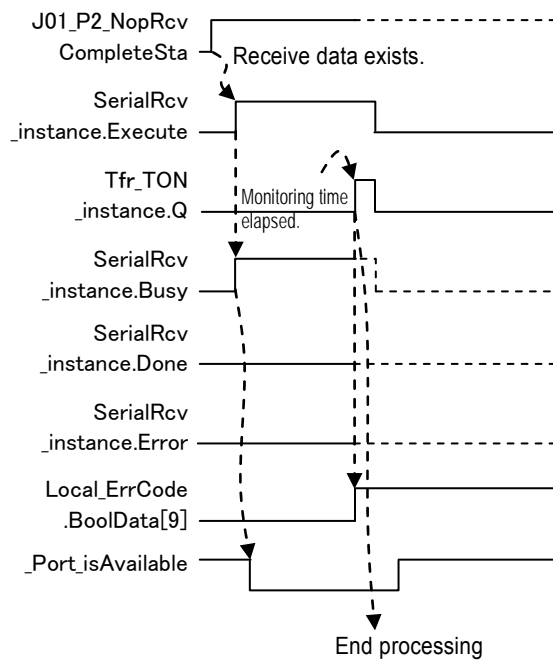


(Repetition) (Normal end)



(Destination device error)

(Error end)



(Timeout)

9.7. Error Process

The error codes for this program are shown below.

Refer to the descriptions on the error codes (*Output_ErrCode*) listed in 9.7.1 Common Errors and check the detailed codes listed in 9.7.2 Transmission Errors to 9.7.4. Destination Device Errors.

9.7.1. Common Errors

The error codes commonly used for errors are shown below.

- Error code [*Output_ErrCode*]

The error information is stored in *Output_ErrCode*.

| Error code | Description |
|------------|---|
| 16#0000 | Normal end |
| 16#0001 | The send processing ended in error. (Serial communications instruction error) |
| 16#0002 | The receive processing ended in error. (Serial communications instruction error) |
| 16#0100 | The send processing did not end in time. (Timeout error) |
| 16#0200 | The receive processing did not end in time. (Timeout error) (Including when an arrival of the response cannot be checked.) |
| 16#0010 | Processing number error |
| 16#0020 | Send/Receive required/not required detection error |
| 16#1000 | The response from the destination device is illegal. (Destination device error) |
| 16#8000 | Transmission error (Transmission error occurred.) |

*The error codes detected for each processing are added and the addition result is stored in the error code.

(Example) Transmission error + Send processing error

WORD#16#8000 (Transmission error)
+WORD#16#0001 (Send processing error)

↓

Output_ErrorID: WORD#16#8001

9.7.2. Transmission Errors

The error codes commonly used for transmission errors are shown below.

- Transmission error status [Output_TransErrCode]

When a transmission error occurs, *Output_TransErrCode* stores the sum of the transmission error status data and the destination device error.

| Bit | Description |
|---------|--|
| 15 | 1:Transmission error 0:Normal |
| 14 | (Not used) |
| 13 | 1:Destination device checksum error 0:Normal |
| 12 | 1:Destination device error 0:Normal |
| 5 to 11 | (Not used) |
| 4 | 1:Overflow error 0:Normal |
| 3 | 1:Framing error 0:Normal |
| 2 | 1:Parity error 0:Normal |
| 0 and 1 | (Not used) |

9.7.3. Serial Communications Instruction Errors

The error codes used when the serial communications instructions (SerialSend instruction and SerialRcv instruction) end in error are shown below.

- Serial communications instruction error codes [Output_CmdsErrorID and Output_CmdsErrorIDEx]

An error code of *ErrorID* is stored in *Output_CmdsErrorID* and an error code of *ErrorIDEx* is stored in *Output_CmdsErrorIDEx*.

[Output_CmdsErrorID]

| Code | Description |
|---------|---|
| 16#0000 | Normal end |
| 16#0400 | An input parameter for an instruction exceeded the valid range for an input variable. |
| 16#0406 | The data position specified for an instruction exceeded the data area range. |
| 16#0407 | The results of instruction processing exceeded the data area range of the output parameter. |
| 16#040D | The Unit specified for an instruction does not exist. |
| 16#0C00 | The Serial Communications Unit is not in the serial communications mode required to execute an instruction. |
| 16#0800 | An error occurred when a command was sent or received. |
| 16#0801 | The port is being used. |
| 16#FFFF | The instruction is not completed. |



Additional Information

For details on *ErrorID*, refer to *A-1 Error Codes Related to Instructions*, *A-2 Error Code Descriptions* and *A-3 Error Code Details* in *Appendices* of the *NJ-series Instructions Reference Manual* (Cat. No. W502).

[Output_CmdsErrorIDEx]

| Code | Description |
|-------------|--|
| 16#00000000 | Normal end |
| 16#00000205 | The serial communications mode is set to Host Link Mode. |
| 16#00000401 | The serial communications mode is set to Protocol Macro, NT Link, Echoback Test, or Serial Gateway Mode. |
| 16#00001001 | The command is too long. |
| 16#00001002 | The command is too short. |
| 16#00001003 | The value of SendSize does not match the number of send bytes. |
| 16#00001004 | The command format is incorrect. |
| 16#0000110C | Other parameter error |
| 16#00002201 | The SerialSend or SerialRcv instruction is already in execution. |
| 16#00002202 | The protocol is being switched, so execution is not possible. |
| 16#FFFFFFFF | The instruction is not completed. |



Additional Information

For details on *ErrorIDEx*, refer to *Communications instructions* in *Section 2 Instruction Descriptions* of the *NJ-series Instructions Reference Manual* (Cat. No. W502).



Additional Information

For details and troubleshooting the SerialSend and SerialRcv instruction errors, refer to *9-3 Troubleshooting* of *Section 9 Troubleshooting and Maintenance* in the *CJ-series Serial Communications Units Operation Manual for NJ-series CPU Unit* (Cat. No. W494).

9.7.4. Destination Device Error

The error codes for destination device errors are shown below.

- Destination device error code [Output_MErrCode]

A destination device error code is stored in *Output_MErrCode*.

If a destination device error occurs, the response data will be "ER".

| Code | Description |
|--------------|--|
| #16#00000000 | Normal end |
| #16#45520000 | The error response from the destination device ("ER" is received.) |



Additional Information

For details and troubleshooting the destination device errors, refer to *Troubleshooting* in *Chapter 7 APPENDIX* of the *Confocal Fiber Type Displacement Sensor User's Manual* (Cat. No. Z322).

10. Revision History

| Revision code | Date of revision | Revision reason and revision page |
|---------------|------------------|-----------------------------------|
| 01 | Jul. 31, 2013 | First edition |

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