R-IN, RZ/T1, EC-1, TPS-1 Groups

Software PLC Guide: Configuring Projects and Creating User Interfaces

Outline

This application note explains the procedure for running evaluation boards with on-chip microcontrollers of the R-IN, RZ/T1, EC-1, and TPS-1 Groups in connection with the CODESYS software programmable logic controller (PLC).

By connecting a software PLC with an evaluation board, users can read commands transferred from the controller and responses from the evaluation board.

Target Devices

R-IN32M3-EC

R-IN32M3-CL

RZ/T1

EC-1

TPS-1

Contents

1. Creating a Project and Ensuring Connection with Devices

This section describes the following procedures.

- Creating a project
- Adding a device
- Running a project
- Ensuring connection of the device

This section covers how to build new projects and how to add new devices and make connection with them. Refer to the startup manual (CODESYS_StartupGuide_rev*.*.pdf) regarding the procedure for programming.

Please obtain from Links company site. http://linx.jp/download/codesysv3

This application note describes how to add a new device to the CODESYS program, with a PROFINET I/O stack, taken as an example. See section 1.3, Connecting to the Software PLC, for executing an existing project.

1.1 Starting the CODESYS and Creating a New Project

(1) **Starting the CODESYS**

Select "All Programs" > 3S CODESYS > CODESYS > CODESYS Vx.x (x.x represents the version number) from the Windows start menu.

You can also startup the program by double-clicking on the "CODESYS" icon, which will be created on the desktop after the installation of the program.
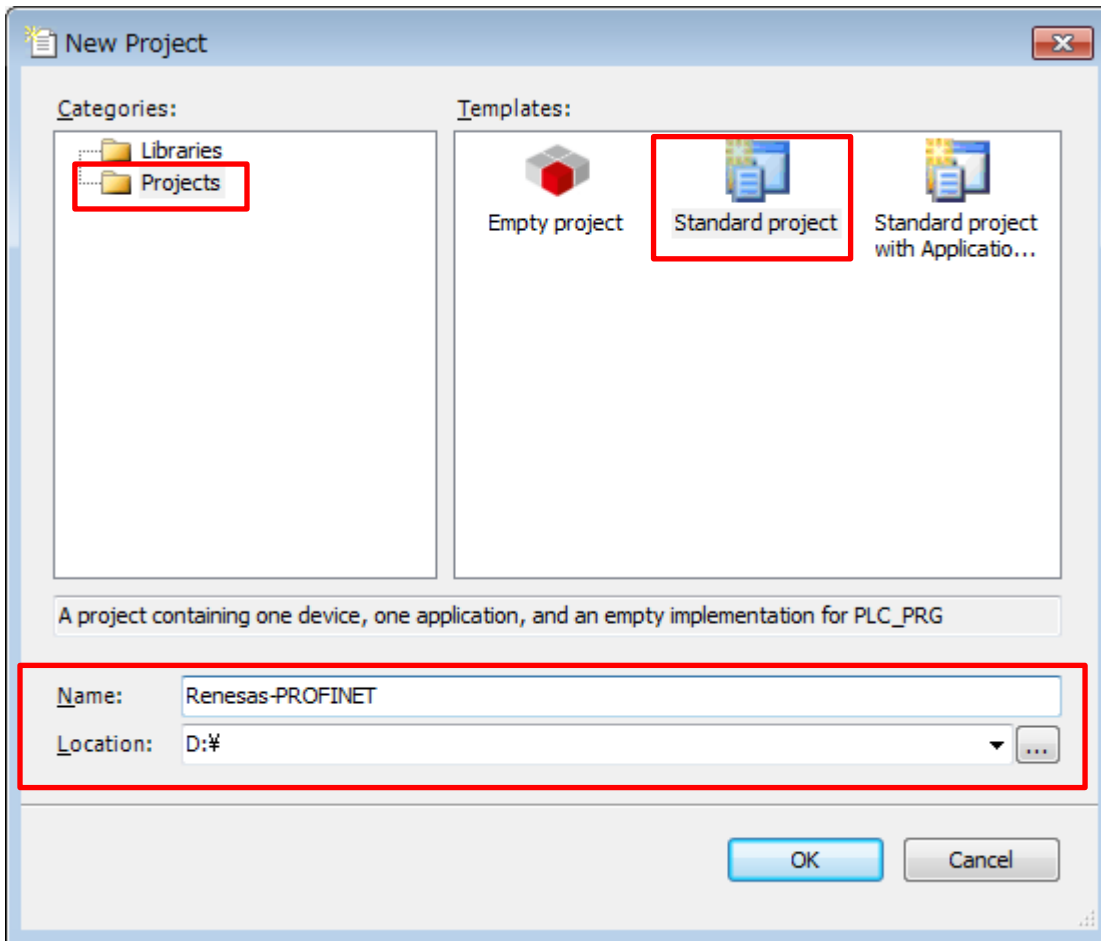
(2) **Creating a New Project**

Select "New Project" from the "File" menu to create a new project.
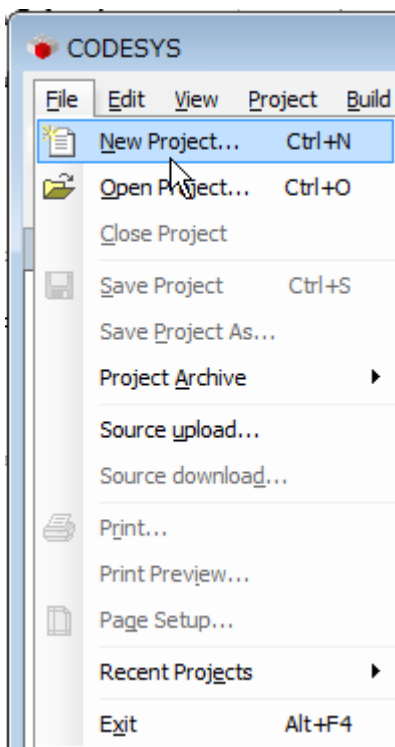
In the "New Project" window, select "Projects" from the "Categories" section and "Standard project" from the "Templates" section.
Then, specify the name of the project and its location and click on "OK".

In the "Standard Project" window, select the controller and programming language you wish to use from the drop-down lists for "Device" and "PLC_PRG in". For this example, select "CODESYS Control Win V3" and "Structured Text (ST)", respectively. After that, click on "OK" to open the new project.
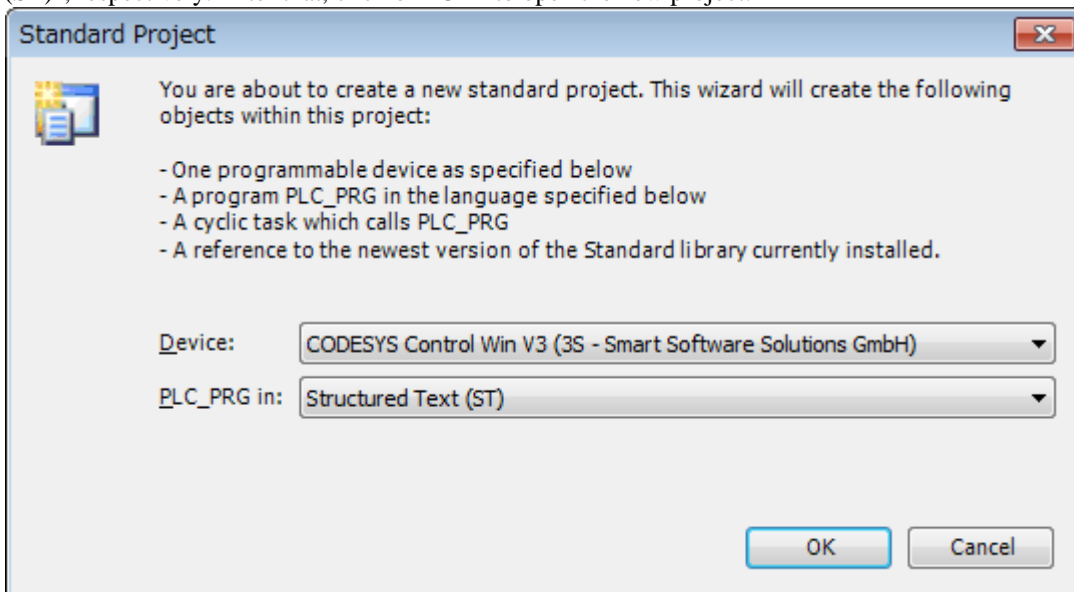
The "Device" tree for the newly created project will be displayed as shown below.

The components that belong to "Device (CODESYS Control Win V3)" are managed in a tree structure.
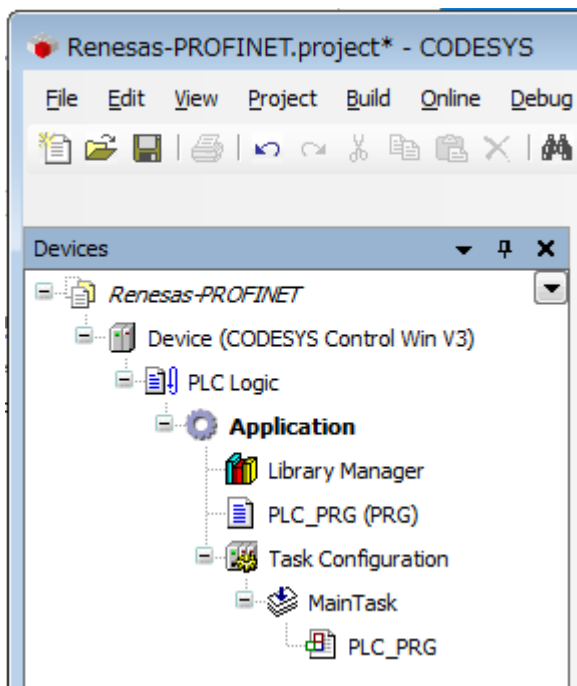
1.2   Adding a Salve Device

To add a device, you need to install an applicable device information file.

ESI, EDS, and Generalized Station Description Markup Language (GSDML) files are provided with the release package of the protocol stack.

Install the appropriate file for the device you want to add with reference to the application note for the given protocol;

For PROFINET: R01AN3545EJ0100

For EtherNetIP: R01AN3546EJ0100

For EtherCAT: R01AN3547EJ0100

Complete addition of the target device by following the procedure given in the corresponding application note. The added device will be indicated as shown within the red rectangle in the figure below.
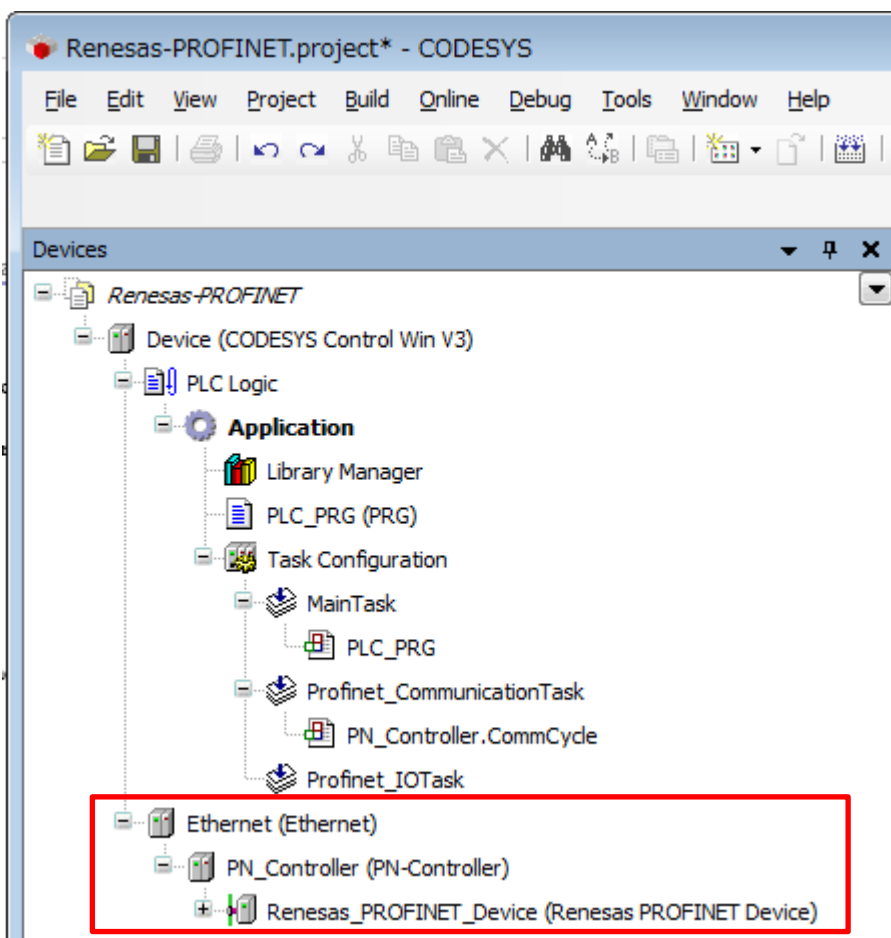
1.3   Connecting to the Software PLC

This section gives the procedure for connection to the target software PLC from the CODESYS development environment via a gateway.

(1)   **Starting the Gateway Server**

Check the state of the gateway server on the system tray. If the server is down, click on the " 🔴 " icon and select "Start Gateway" to start the server up. Usually, the server will automatically be started as a standard service on booting of Windows and its status is indicated in the system tray[Note] in the lower-right corner of the desktop.
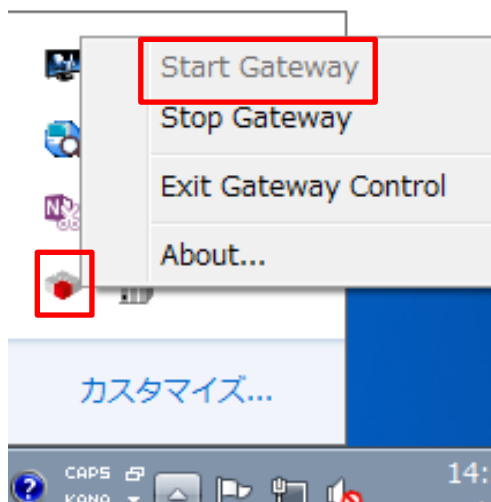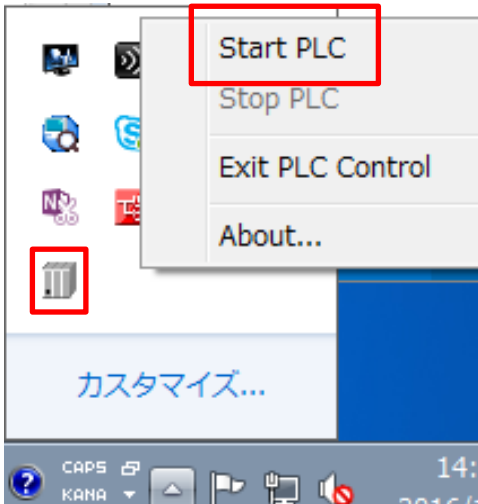

Note: If you cannot find the icon in the system tray, start the server up by the following procedure:
         Click on "All Programs" > 3S CODESYS > CODESYS Gateway V3 > CODESYS Gateway V3.
         If the icon still does not show up, reboot the PC you are using.
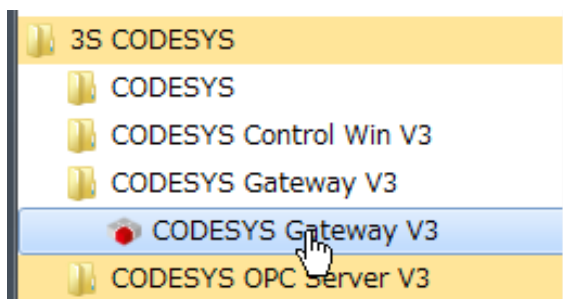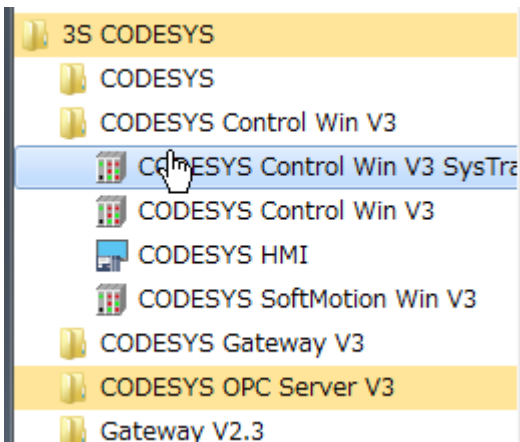
(2)   **Starting the Software PLC**

Check the state of the software PLC on the system tray. If the program is stopped, click on the " " icon and select
"Start PLC" to start the program up. Usually, the program will automatically be started as a standard service on booting
of Windows and its status is indicated in the system tray[Note] in the lower-right corner of the desktop.

Note: If you cannot find the icon in the system tray, start the server up by the following procedure:
Click on "All Programs" > 3S CODESYS > CODESYS Control Win V3 > CODESYS Control Win V3
SysTray.
If the icon still does not show up, reboot the PC you are using.

(3)   **Configuring Connection with the Software PLC**

Make connection settings for connecting the software PLC service from your development environment. Double-click on the "Device (CODESYS Control Win V3) in the "Device" tree. On the "Device" tabbed page, select "Connection settings" and click on the "Scan network…" button.
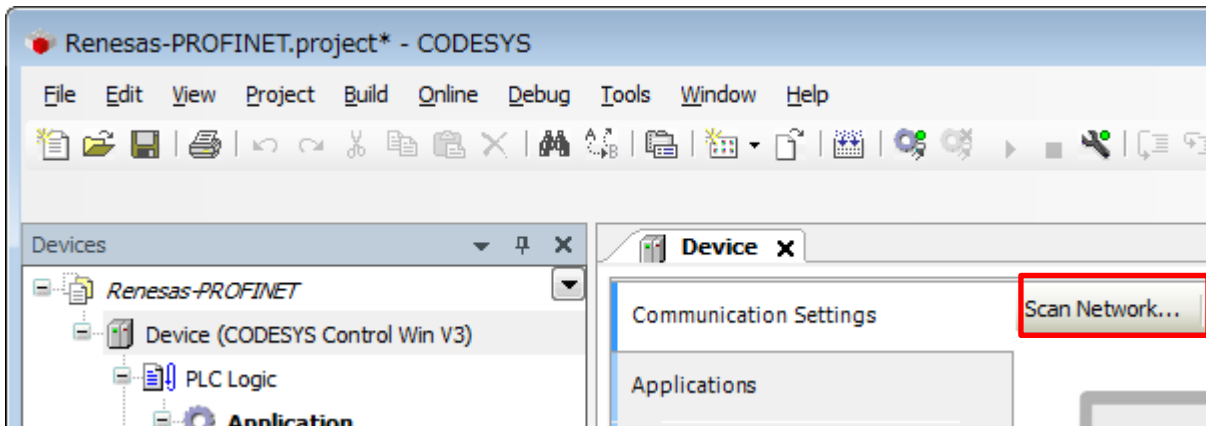
The "Select Device" window opens and a search for available devices that can use the local network automatically starts. Finding a software PLC service constitutes success and the name of the corresponding PC will be indicated. Double-click on the PC name to make a connection.

If the service will not be found, check the settings described in previous sections, (1)Starting the Gateway Server and (2)Starting the Software PLC.
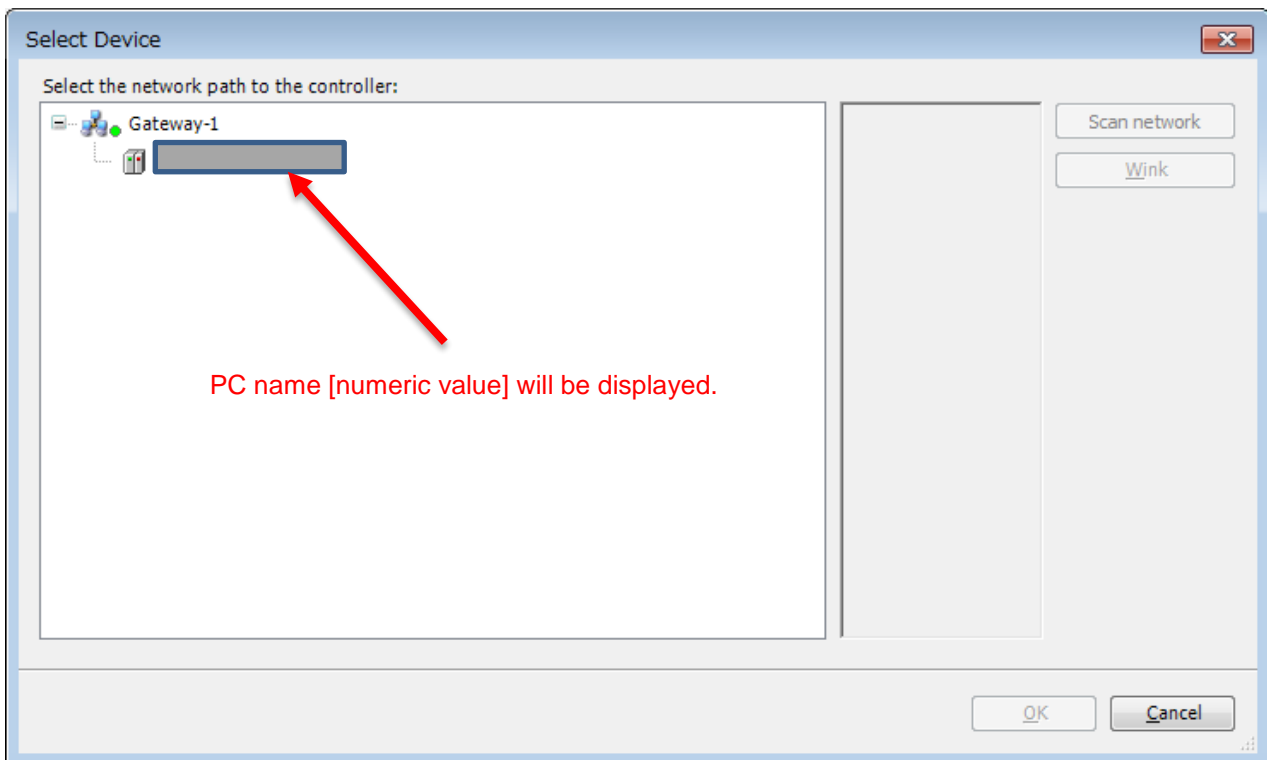
1.4   Setting the Device Network

Network settings for the device you have added to the system in section 1.2 Adding a Salve Device are required. For details, refer to the application note for the given protocol;
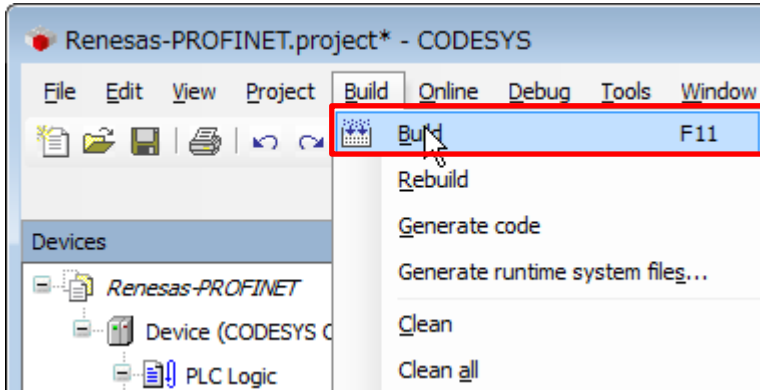
For PROFINET: R01AN3545EJ0100

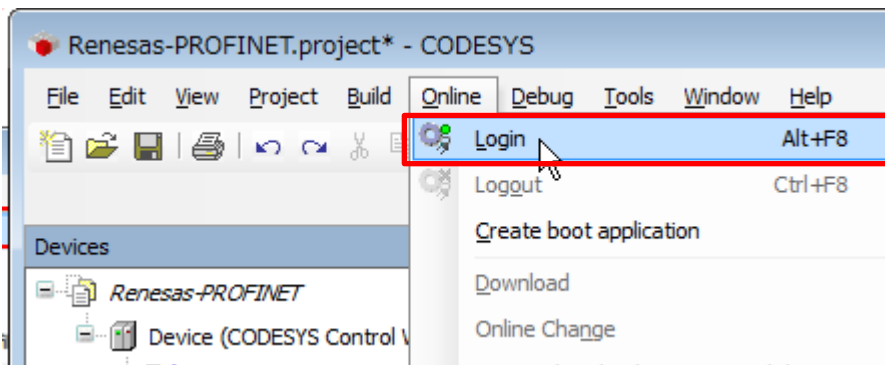For EtherNetIP: R01AN3546EJ0100

For EtherCAT: R01AN3547EJ0100

1.5   Ensuring Connection of the Device

This section describes how to run a program on the CODESYS development environment and how to ensure connection of the device.
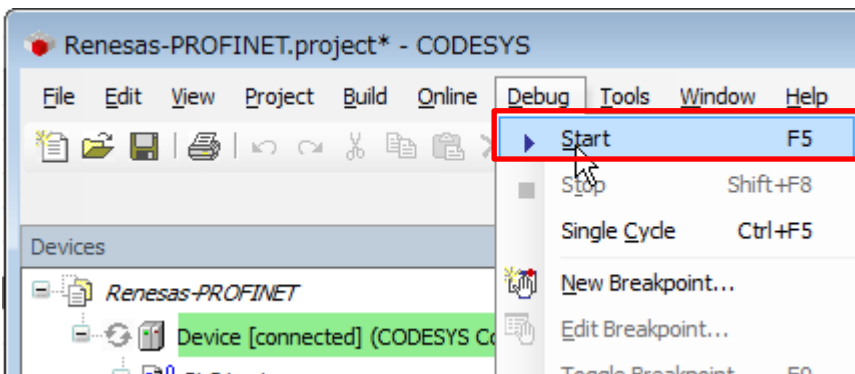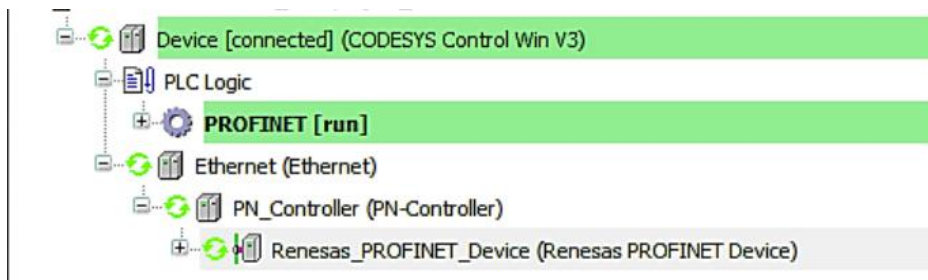
Select "Build" from the "Build" menu.

Select "Login" from the "Online" menu.

Select "Start" from the "Debug" menu. The project will automatically start on Windows.

The states of connection will be indicated next to each device name. Successful connection is indicated by the " " icon as shown in the tree view below.

The icons indicating status of each device is listed below.

　　:　　The application is connected to the PLC and is running.

　　:　　The application is connected to the PLC but is not running.

　　:　　Error. Check the error contents and the settings of the device.

　　:　　There is no device information in the device repository. Review the device information file and re-install it.

2. Creating and Simulating a User Interface

This section includes the following procedures:

- Displaying the development environment screen
- Implementation example
- Relating variables to components and to the I/O ports of devices


The CODESYS development environment allows the creation of user interfaces. You can access all internal variables used in the PLC program on the screen as well as monitoring and changing the parameters. Here, as an example, placement of components in the display for the development environment and the association of variables with those components and to preset I/O ports so that they can be handled from the master display are explained.

(1) **Adding Components**

Components to be placed on a user-interface display need to be added to the "Device" tree before creating one. Right-click on "Application" in the tree and select "Add Object", then "Visualization…".
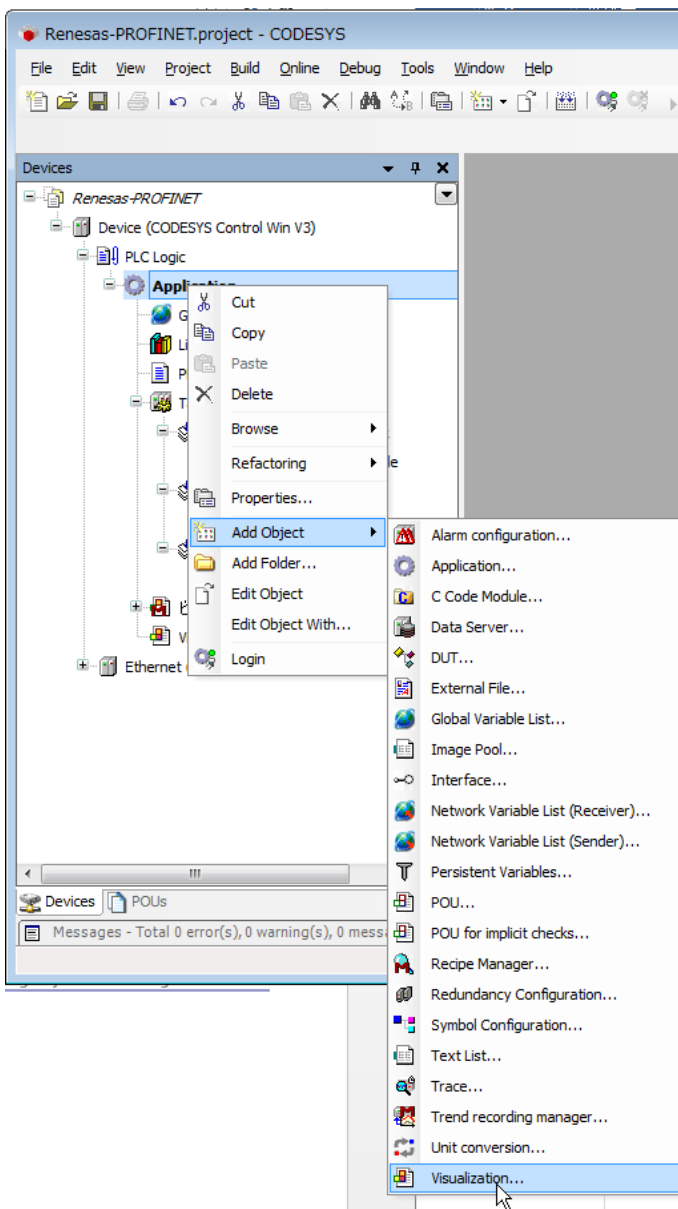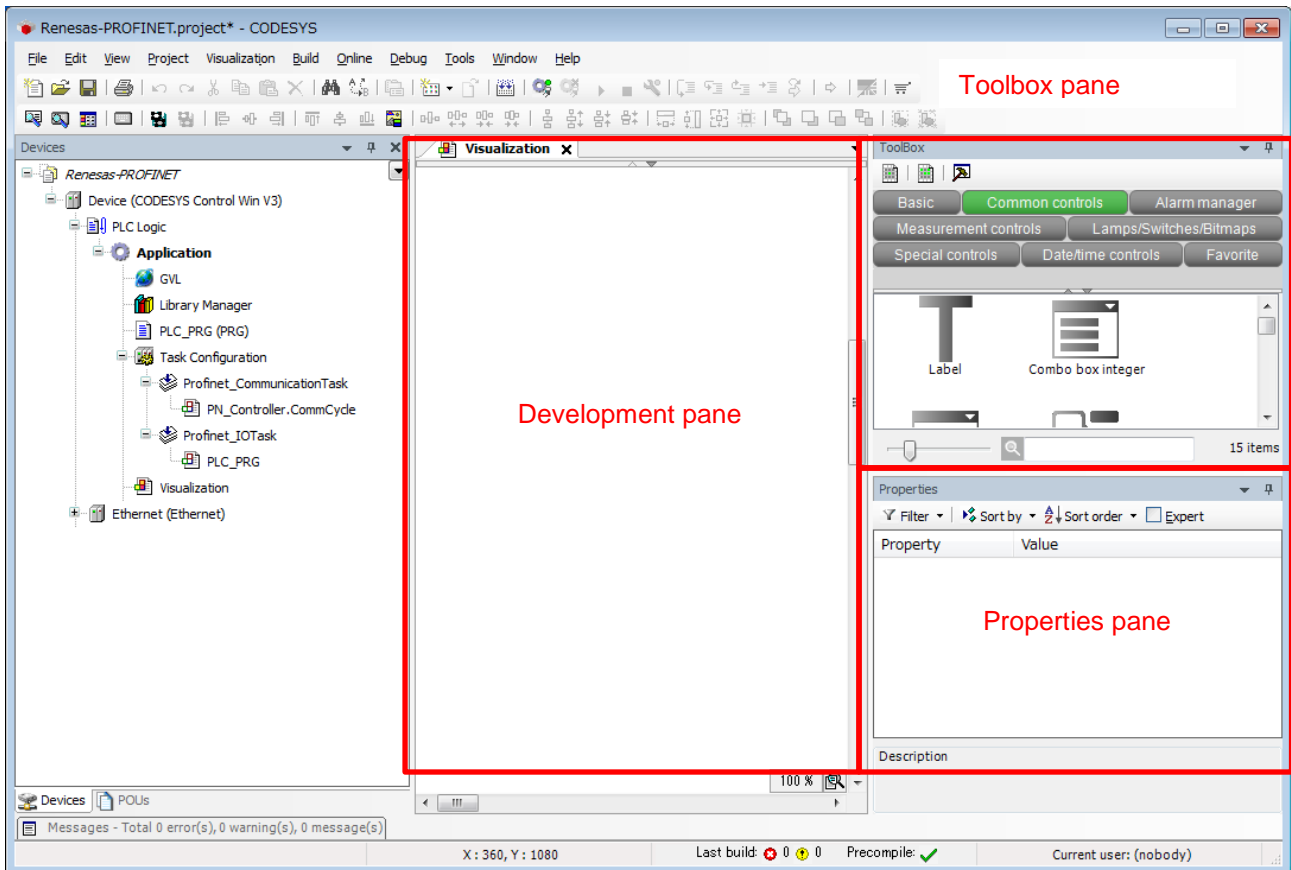
Selected component is added in the "Device" tree.
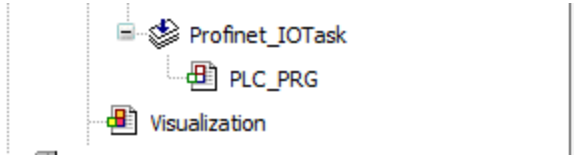
(2)   **Development Pane**

Double-clicking on "Visualization" in the tree displays the development pane.

Development pane
The main pane for structuring user-interface displays.
Place the components you will be using here.

Toolbox
The toolbox provides basic components for placements in the development pane. As well as such as graphs, tables, and labels, meters, switches, progress bars, and other items are available.
Users can select the desired components from this box and place them in the development pane.

Properties
Parameters for the components placed on the development pane are monitored and changed from here. The internal variables of the PLC program are also handled within this pane.

(3)   **Placing Components**

Configuring a user interface for use in data transfer with a given device is explained, taking PROFINET I/O as an example. Here, the descriptions are on the assumption that the devices have 8-bit I/O ports.

Creating a sample display and setting variables:

1.   Groups of LEDs and switches in the development pane, each consisting of eight members so as to match the width of the I/O ports of the given device, are to form the interface.

2.   Switch the display in the Toolbox to "Common controls" and select "GroupBox", then place two boxes on the development pane by dragging and dropping. The names of the group boxes can be edited in the "Text" menu in the "Properties" pane.

3.   Place components in each group as follows;

      i.   LED group: Select "Rectangle" from the "Basic" group and place eight rectangles in the box for LEDs.

      ii.   Switch group: Select "Lamps/Switches/Bitmaps" then "DipSwitch". Place eight of them in the box for switches.

      iii.   Give labels to each element such as "LE**" and "SW**" by dragging and dropping from "Label".

After the above actions, the display will be configured as shown below.
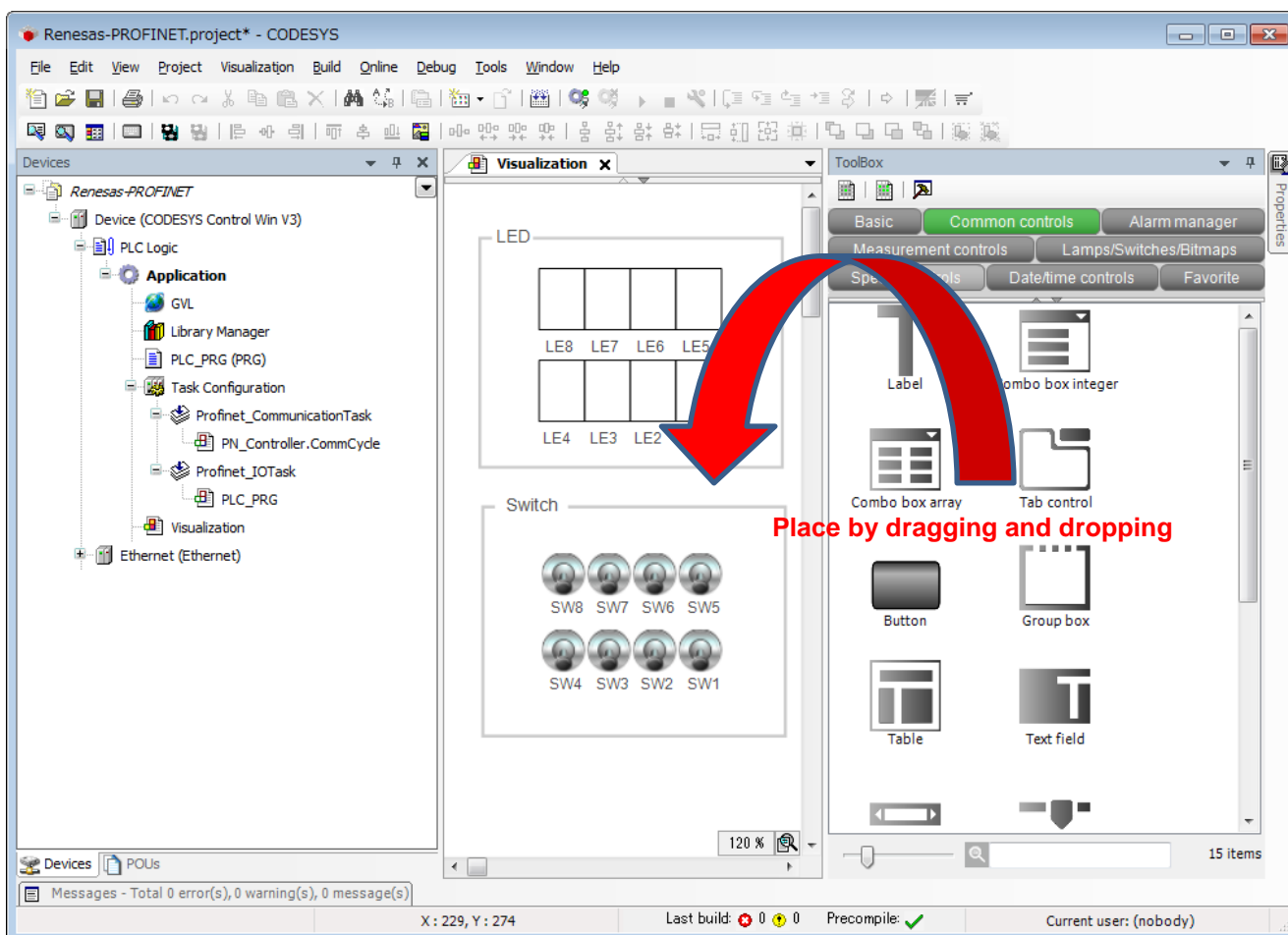
The tools added in the previous steps need to be related to internal variables in order to use them in a program.

Open the "PLC_PRG" tabbed page by double-clicking on its name in the "Device" tree. Define BYTE variables in the lines where variables are to be declared.
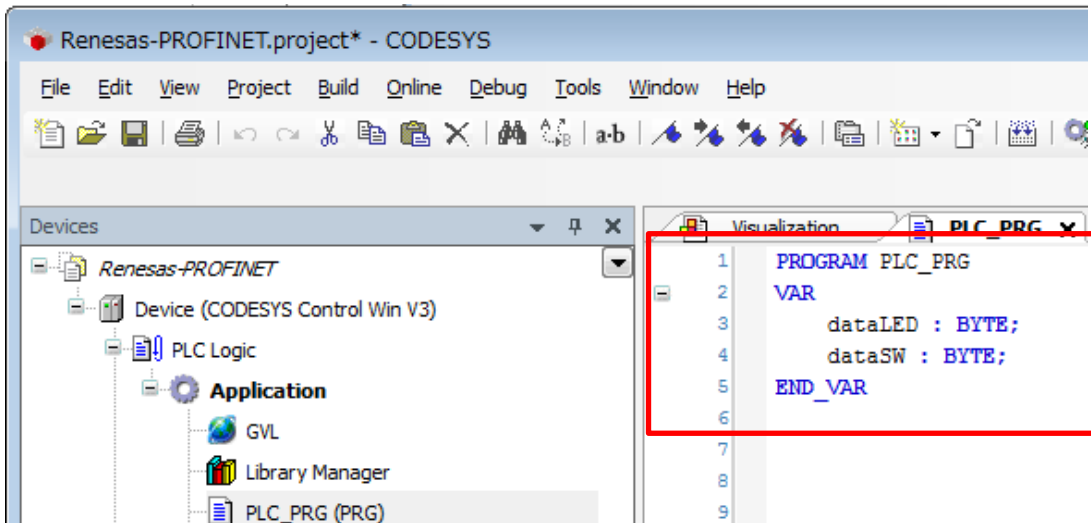
Variables corresponding to the tools selected in the development pane are designated in the "Properties" pane.
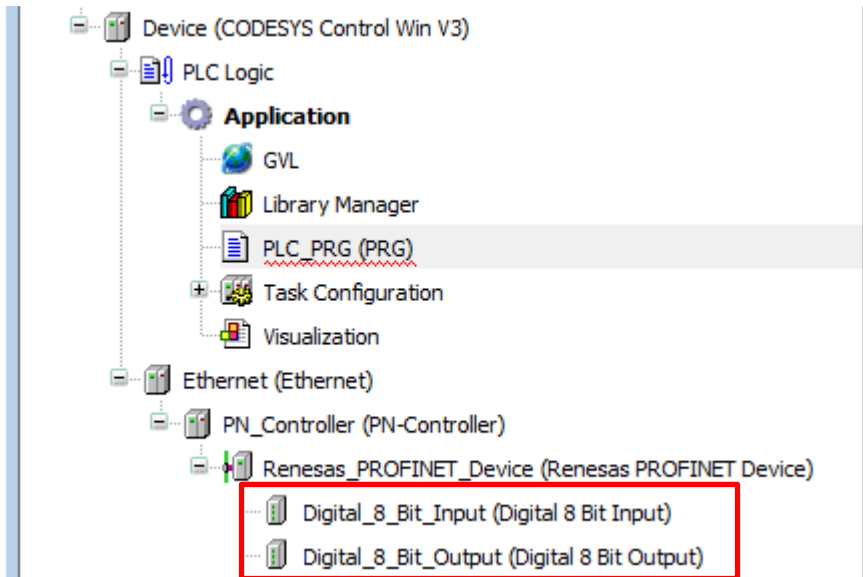
Relate variables to the elements of the interface bit-by-bit.
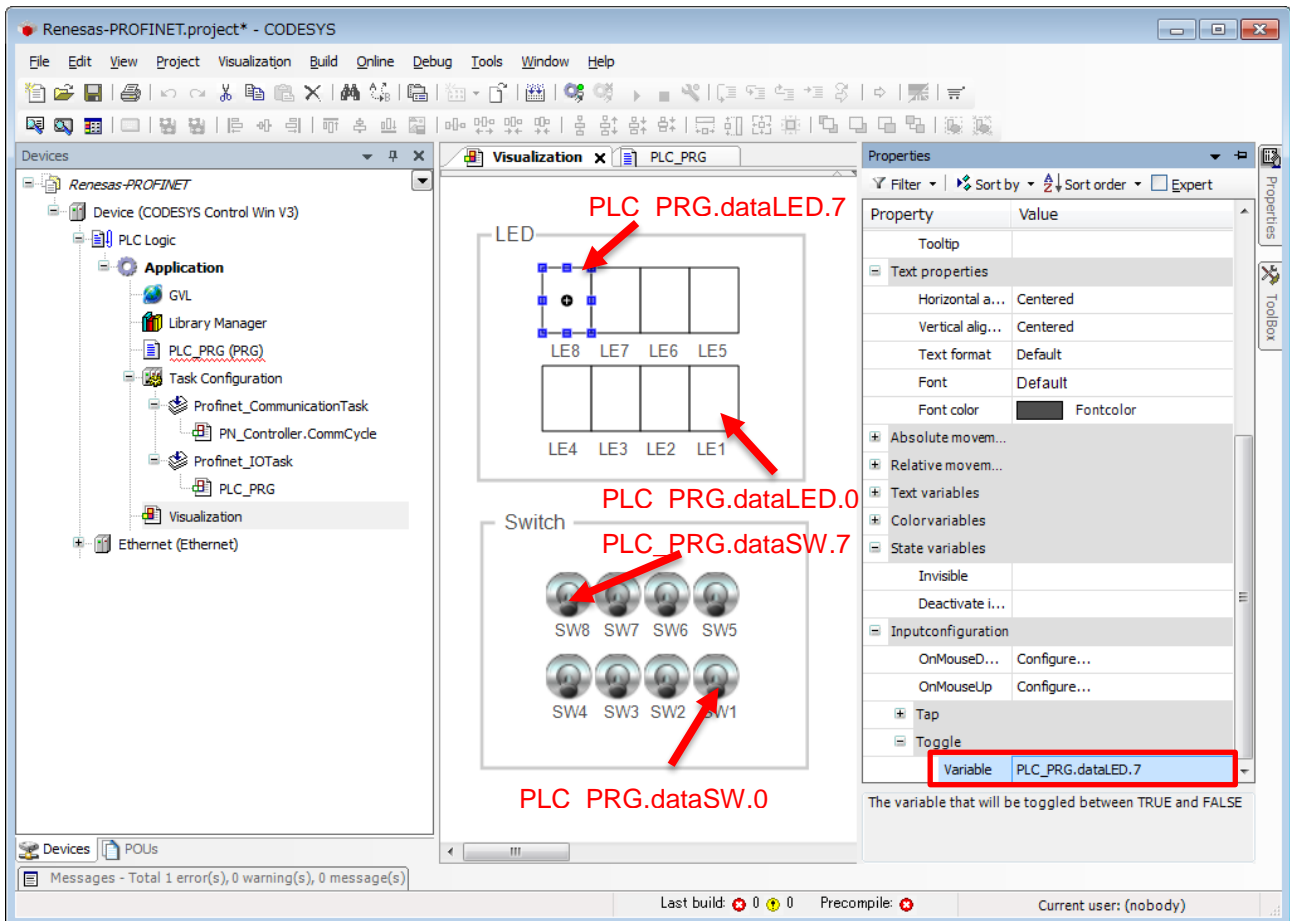
Configuring the I/O ports of the given device:

If the device information file for the device you have added in section1.2, Adding a Salve Device, includes the I/O settings, the information will be reflected in the "Device" tree. Below is an example of 8-bit input and output ports added to the tree.

Note that these I/O ports are still not available in the CODESYS environment because they have not been related to appropriate variables.

Here, we define global variables for them since we want to use them in a general way.

Variables are defined in the Global Variable List (GVL). Right-click on the "Application" in the "Device" tree and select "Add Object", then "Global variable list…" to open the GVL window. Click on "Add" to add a list in the tree.
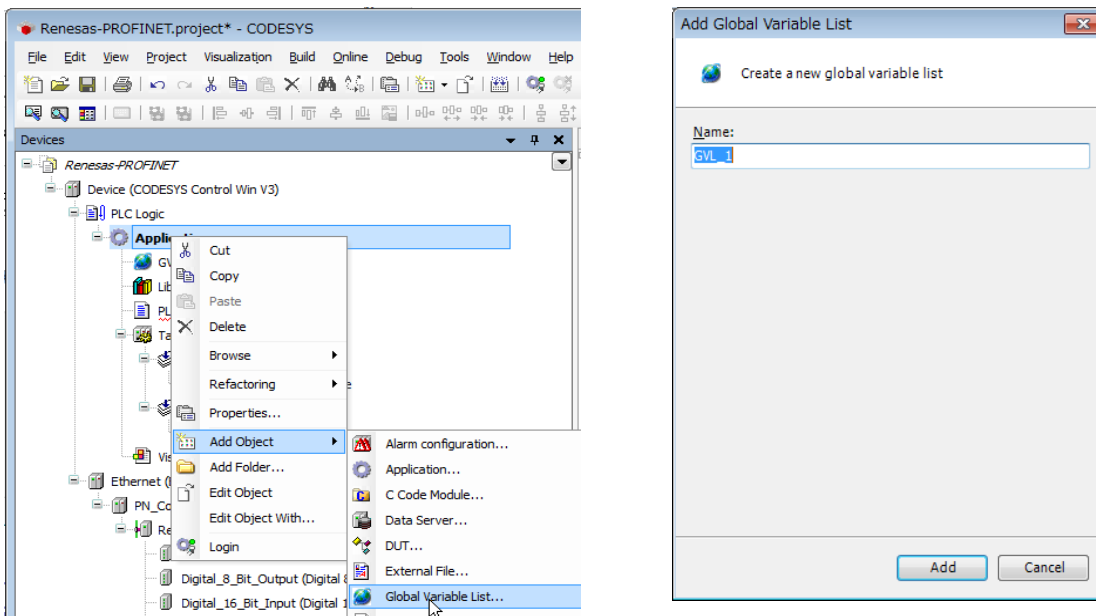
Open the GVL tabbed page by double-clicking the name newly added in the "Device" tree. Define global variables as in the screenshot below.

Open the tabbed page for the target I/O port by double-clicking on the name in the "Device" tree. In the "PNIO Module I/O Mapping" sub-tabbed page, configure variables under the "Variable" menu.
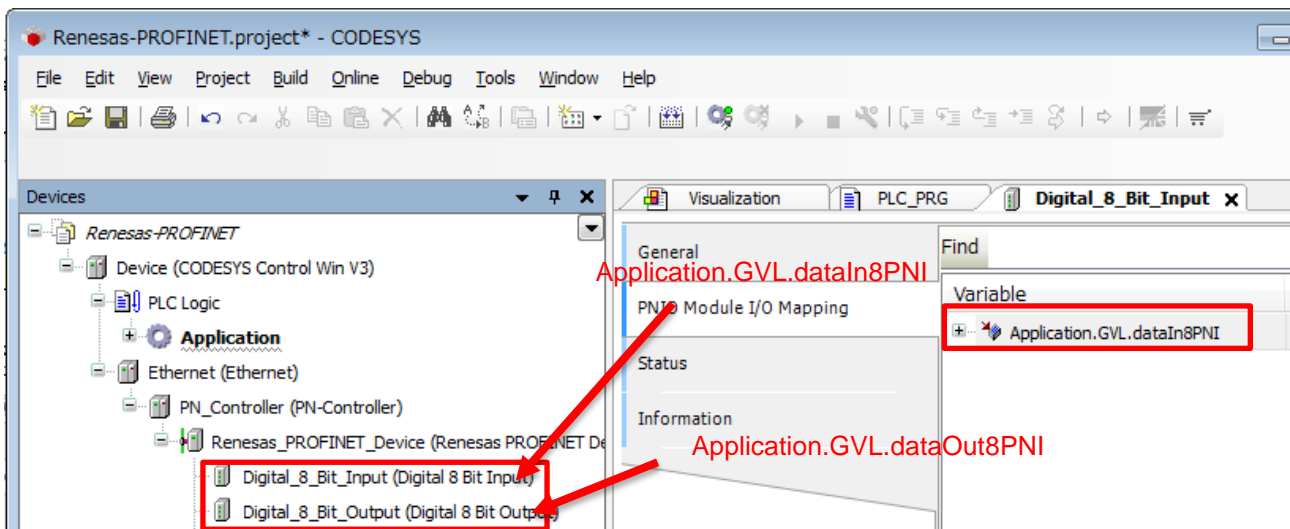
(4)   **Result of Running the Program**

On the "PLC_PRG" tabbed page, write the source code in the code-writing section with defined variables as in the example below.
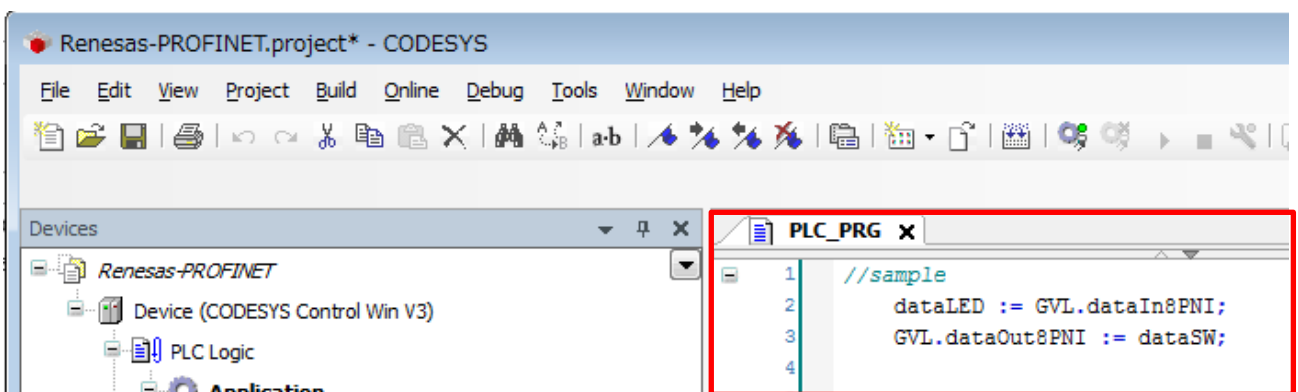
Running the above program produces the following operations:

- The system receives data from the connected device and switches the LEDs on or off in response.
- The system sends the state of the switches to the connected device and obtains the desired operation from the application on the device.

An image of the operations is given below.
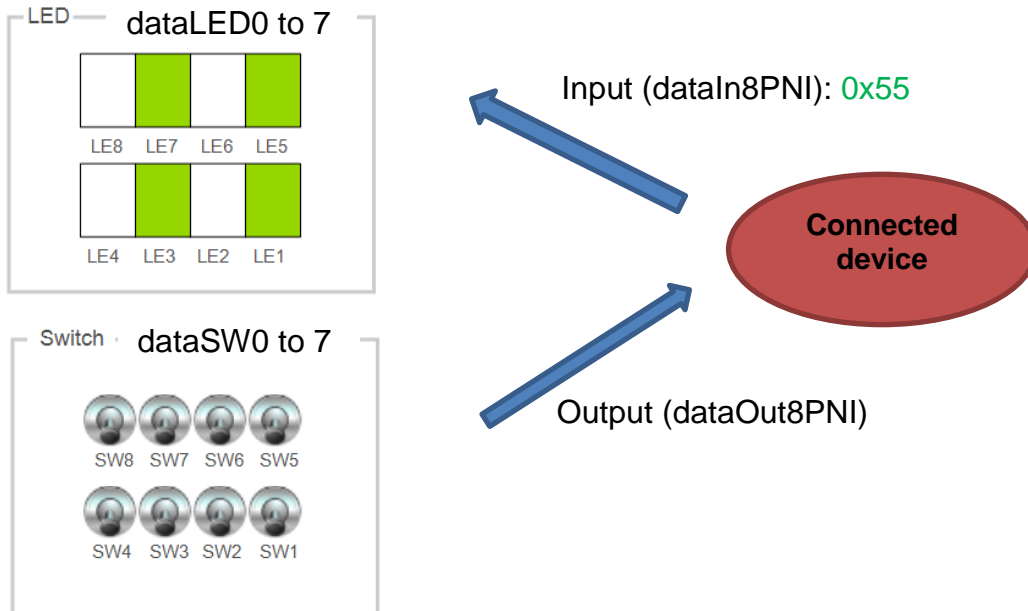
3.   Website and Support

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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	May. 17, 2017	—	First edition issued

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

<div style="border:1px solid black; padding:10px;">

1. Handling of Unused Pins

   Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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