

Microcontroller

Nu-EX User Manual

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www.nuvoton.co.jp

About This Manual

This manual is intended for engineers who will be setting up software and hardware for the Nu-EX series with 101C / 101E / 101L / 103L / 103S / 103H series, and describes the installation method.

n Organization

This manual mainly consists of two chapters of software and hardware.

The software section explains how to install Integrated Development Environment (DebugFactory Builder), Flash memory programmer (EX Commander), the compiler and the real-time OS.

After DebugFactory Builder files have been installed on a hard disk, certain settings need to be made in accordance with the system configuration and the model. For details on the settings and verifying, refer to the hardware section.

The hardware section covers the following topics:

- Checking package contents
- Connection methods
- Setup procedure and operation check procedure of DebugFactory Builder
- Connection between the target board and the Nu-EX series.

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Chapter 1 Software

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1.1 Installation

1.1.1 Checking Operating Environment

n Host Computer Specifications

Table 1.1 Host Computer Specifications

OS (Except virtual environment)	Windows 8.1 (32bit / 64bit OS) Windows 10 (32bit / 64bit OS)
CPU	Intel Pentium III 1GHz or higher *including compatible CPU
Memory	1GB or more
Available hard disk space	400 MB minimum (1 GB or more recommended)
Others	with USB1.1/2.0 interface

Note :The memory required depends on the size of the program to create.

1.1.2 Installation

This section describes how to install Integrated Development Environment (DebugFactory Builder), Flash memory programmer (EX Commander), the compiler and the Real-time OS.

Visit Nuvoton Semiconductor Support System (<https://nuvoton.co.jp/semi-spt/general/>) for the latest version of the software, and use the latest DebugFactory Builder, EX Commander, the compiler and the Real-time OS.

Note : DebugFactory Builder incorporates the product version compiler, assembler and linker. It is not necessary to install the stand-alone compiler separately if you don't use it.

1.1.2.1 Setting up Integrated Development Environment (DebugFactory Builder 5)

This section describes an explanation about installing DebugFactory Builder 5.

Note : - The installation must be done by an account with administrator privileges. After installation, an account with standard privileges can use it.
- Do not connect Nu-EX series to the host computer when installing DebugFactory Builder.

1. When double-click the downloaded installer, a dialog of Figure 1.1.1 appears. Select the language that you use the DebugFactory Builder 5.

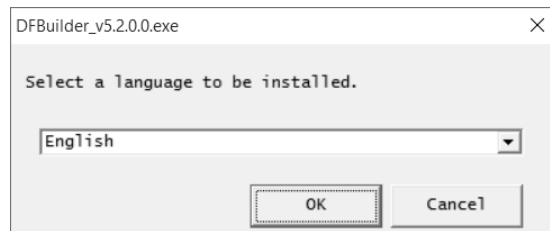


Figure 1.1.1 Selecting the language

2. After Setup program is started, the dialog shown in Figure 1.1.2 appears. Click <Next>.

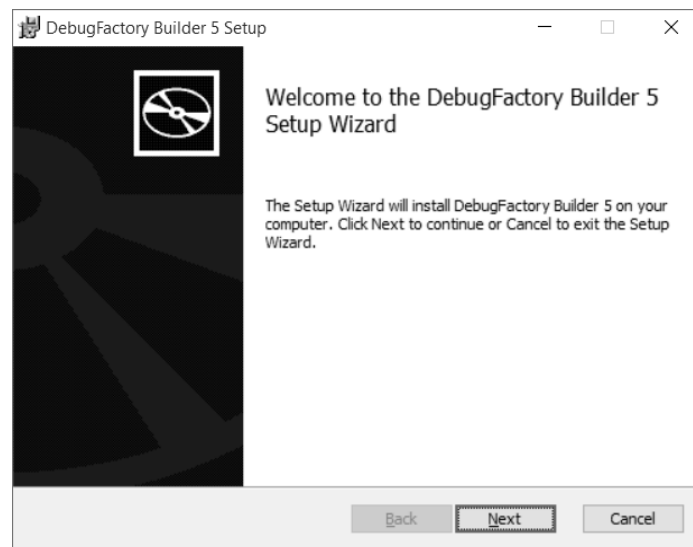


Figure 1.1.2 Starting of setting up DebugFactory Builder 5

3. The dialog shown in Figure 1.1.3 appears. Confirm the software license agreement, and click <Next>.

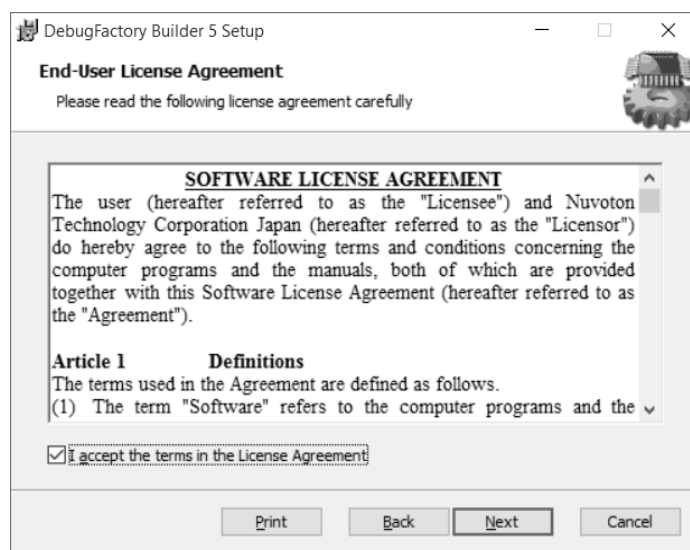


Figure 1.1.3 Licence agreement of DebugFactory Builder 5

4. The dialog shown in Figure 1.1.4 appears. Confirm the destination folder where the software tools will be installed, then click <Next>. If you want to install in a different folder, click <Change...> to specify the folder.

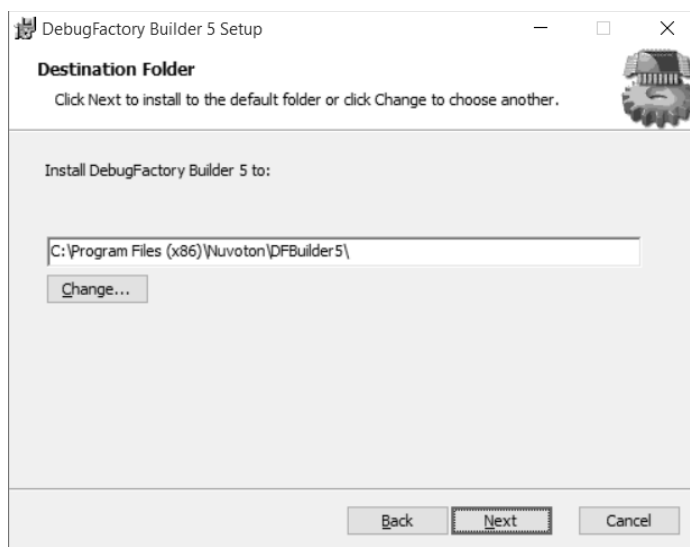


Figure 1.1.4 Choose Destination Folder

5. The dialog shown in Figure 1.1.5 appears. Click <Install>.

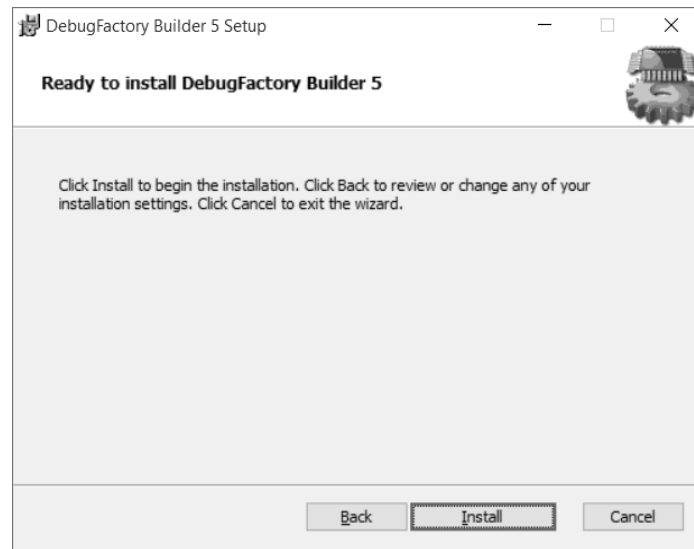


Figure 1.1.5 Start Installation

6. The dialog shown in Figure 1.1.6 appears. Wait while DebugFactory Builder 5 installs.

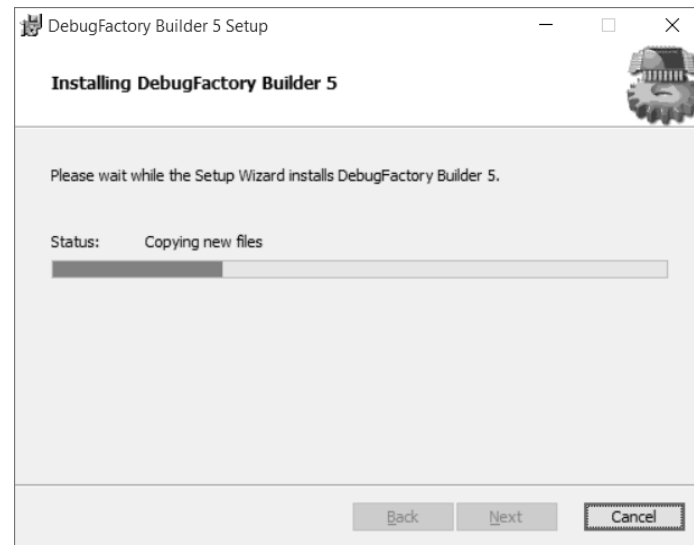


Figure 1.1.6 During installing of DebugFactory Builder 5

7. The dialog shown in Figure 1.1.7 appears. Click <Finish>.

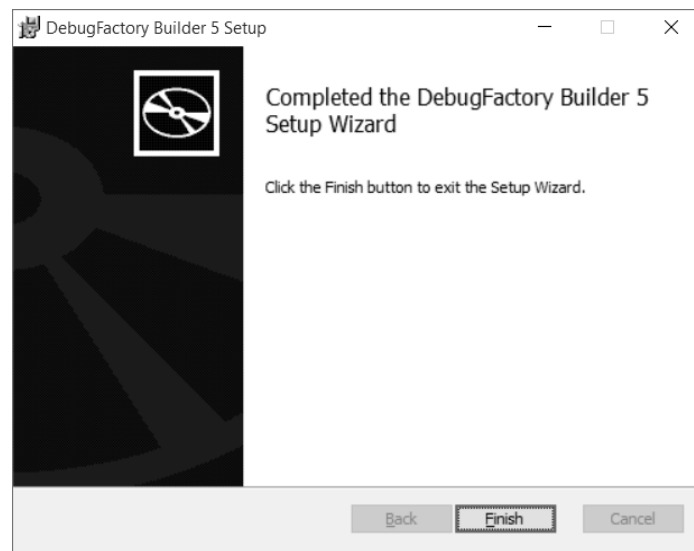


Figure 1.1.7 Setup Completed

1.1.2.2 Setting up Flash memory programmer (EX Commander)

This section describes an explanation about installing EX Commander.

Note : - The installation must be done by an account with administrator privileges. After installation, an account with standard privileges can use it.
- Do not connect Nu-EX series to the host computer when installing DebugFactory Builder.

1. When double-click the downloaded installer, a dialog of Figure 1.1.8 appears. Select the language you use.

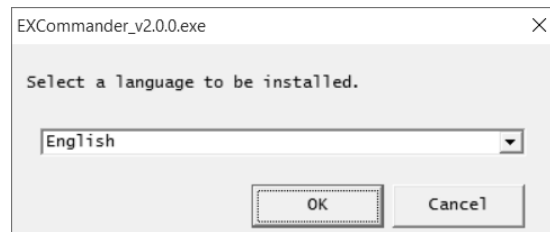


Figure 1.1.8 Selecting the language

2. The dialog shown in Figure 1.1.9 appears. Click <Next>.



Figure 1.1.9 Starting EX Commander Setup

3. The dialog shown in Figure 1.1.10 appears. Please read the following license agreement. When you accept to all articles of the licensing agreement, you add a check to [I accept all the terms in the License Agreement], and click <Next>.

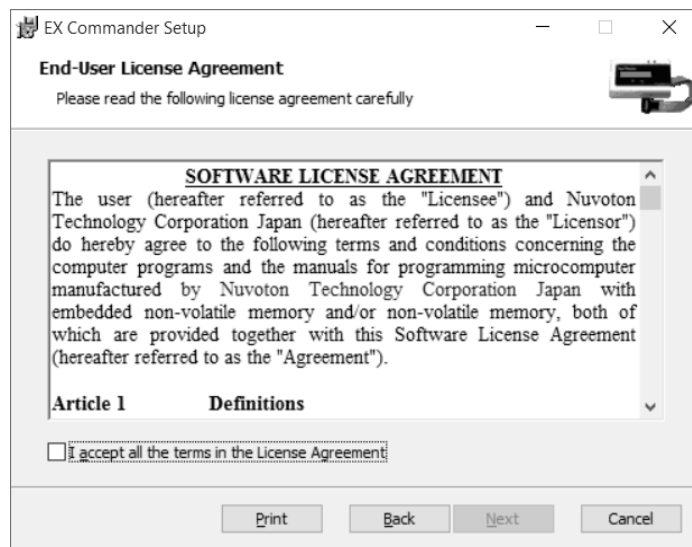


Figure 1.1.10 Software license agreement

4. The dialog shown in Figure 1.1.11 appears. Confirm the destination folder where EX Commander will be installed, then click <Next>. If you want to install in a different folder, click <Change...> to specify the folder.

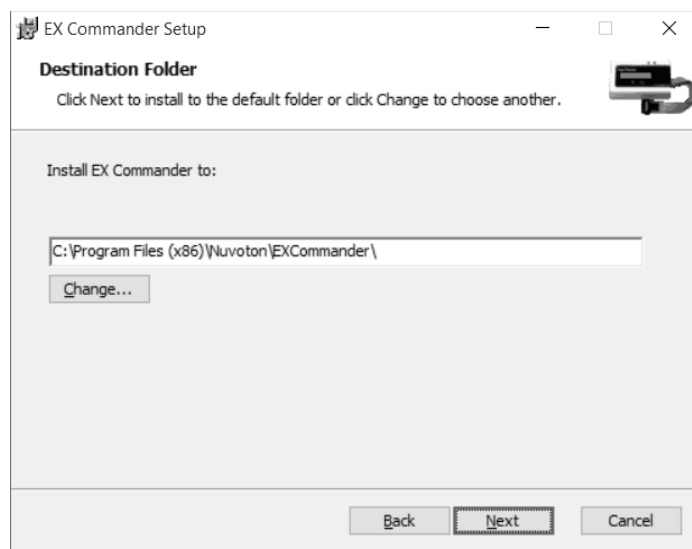


Figure 1.1.11 Choose Destination Folder

5. The dialog shown in Figure 1.1.12 appears. Click <Install>.

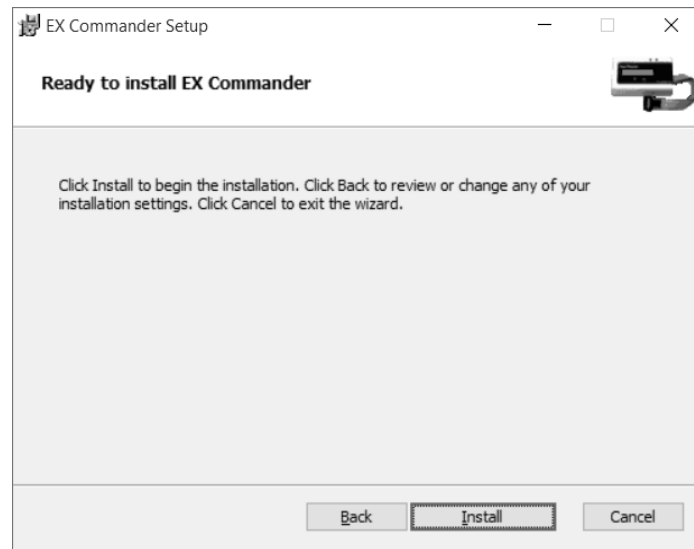


Figure 1.1.12 Start Installation

6. The dialog shown in Figure 1.1.13 appears. Wait while EX Commander installs.

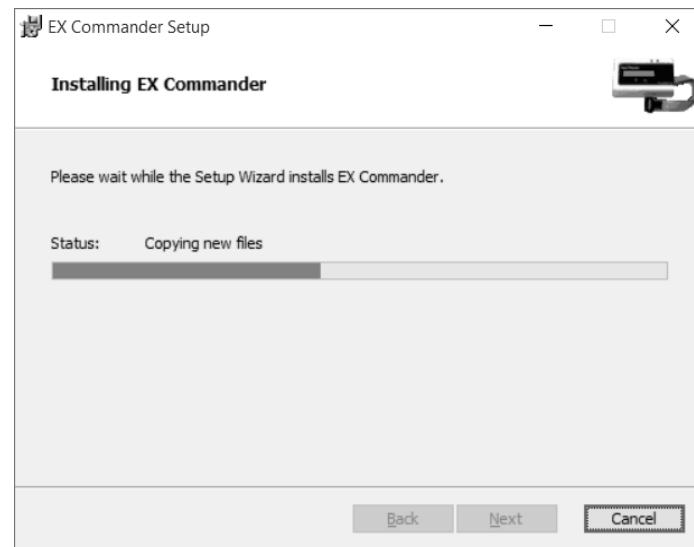


Figure 1.1.13 During installing of EX Commander

7. The dialog shown in Figure 1.1.14 appears. Click <Finish>.

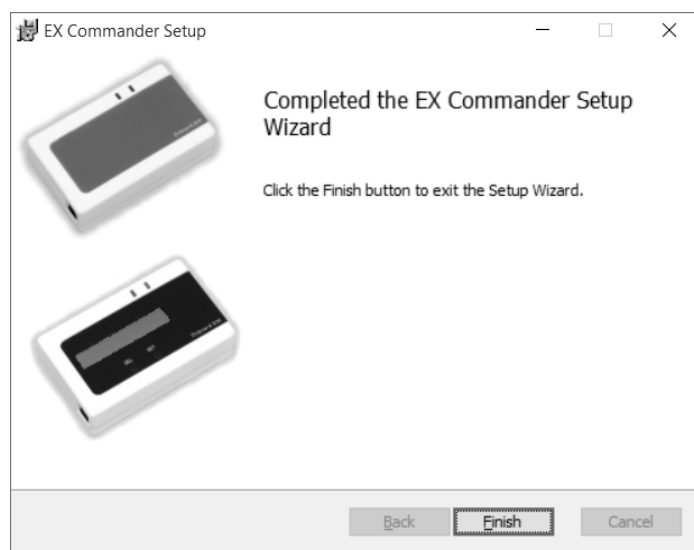


Figure 1.1.14 Setup Completed

1.1.2.3 Setting up Compiler

This section describes an explanation about installing the compiler. As an example, here describe the case to install the compiler for 101E / 101L series. The procedures can be applied for other series as well.

1. When double-click the downloaded installer, folder "cc101" is generated.
2. Move folder "cc101" to the installation folder.

1.1.2.4 Setting up Real-time OS

The Real-time OS for 103S series (mITRON V4 Standard) is taken as an example in the procedures. The procedures can be applied for other series as well.

Note : The real-time OS can only be downloaded and set up by the person who purchased it.

1. When double-click the downloaded installer, folder "pr103s4" is generated.
2. Move folder "pr103s4" to the installation folder.

1.1.3 Update to product Information

When using DebugFactory Builder or EX Commander, if your target device (microcontroller or system LSI) is not exist in the product type list, you can add the target device by updating the Firmware and Product Definition file. The firmware and product definition files can be downloaded from the Nuvoton Semiconductor Support System (<https://nuvoton.co.jp/semi-spt/general/>).

Note : Update the software (DebugFactory Builder, EX Commander) to the latest version before updating the product definition file.

1.2 Checking Operations of DebugFactory Builder 5

This section describes procedures for environment setting and checking operations of DebugFactory Builder 5.

n Startup

From the menu [Start], select [All Program]-[Nuvoton DebugFactory Builder 5] then click [Builder] to start up the DebugFactory Builder. If the software tools have been successfully installed, the startup window in Figure 1.2.1 appears.

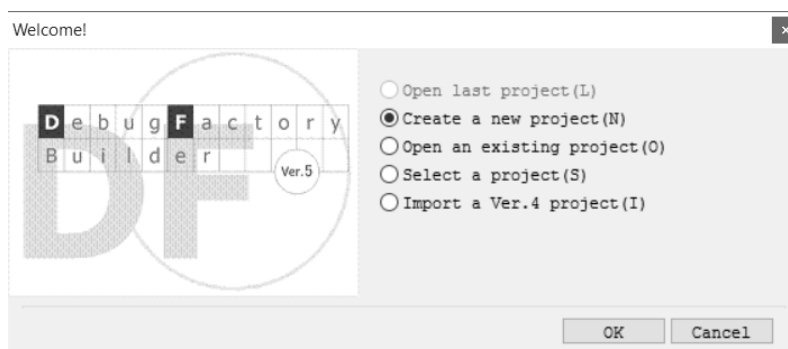


Figure 1.2.1 Startup Window

Create the project and configure the settings to start DebugFactory Builder 5. Those can be easily performed through the [Project creation wizard] dialog.

Select [New project creation] and click <OK> in [Startup window] shown in Figure 1.2.1, and the dialog shown in Figure 1.2.2 appears. Select [Standard], and click <Next>.

Select "101C/101E/101L Series" at "Microcomputer series" and click <Next> button.

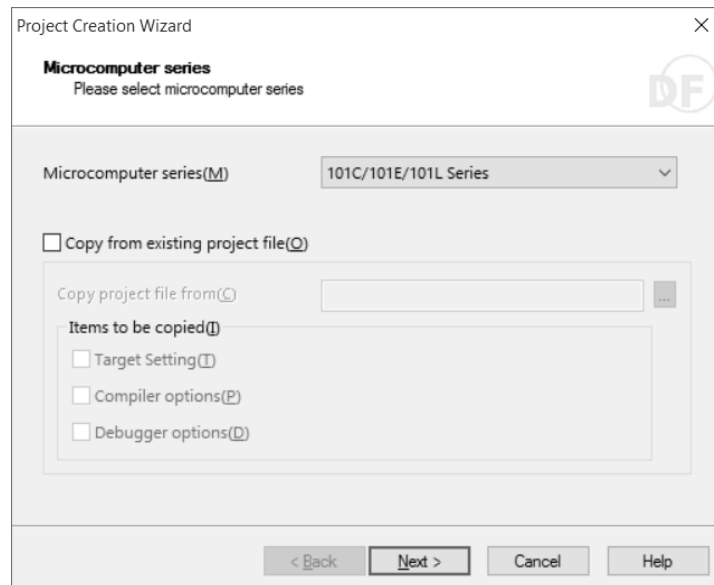


Figure 1.2.2 Project creation wizard

In this wizard, configure the settings for a project to be newly created. Here, configure only project settings to check operations, and use default settings for other items.

- | | |
|---------------------|---------------------------------------|
| Project name: | Specify the project file name. |
| Folder to save: | Specify the destination folder. |
| Project group name: | Specify "<Create new project group>". |

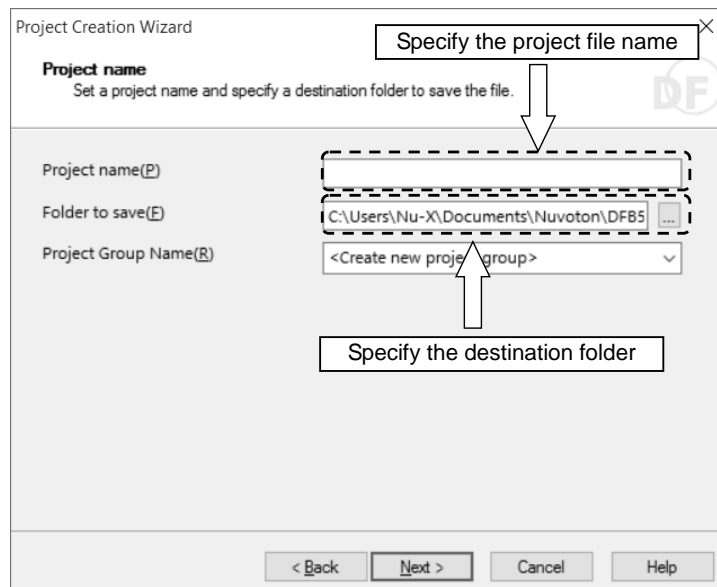


Figure 1.2.3 Project setting

When dialog box of Figure 1.2.4, click the button on the "Next" without check "Use starter kit".



Figure 1.2.4 Starter kit setting

Figure 1.2.5 appears in the <Details> button click. Choose the product type to use and select "Onboard" as debug target type.

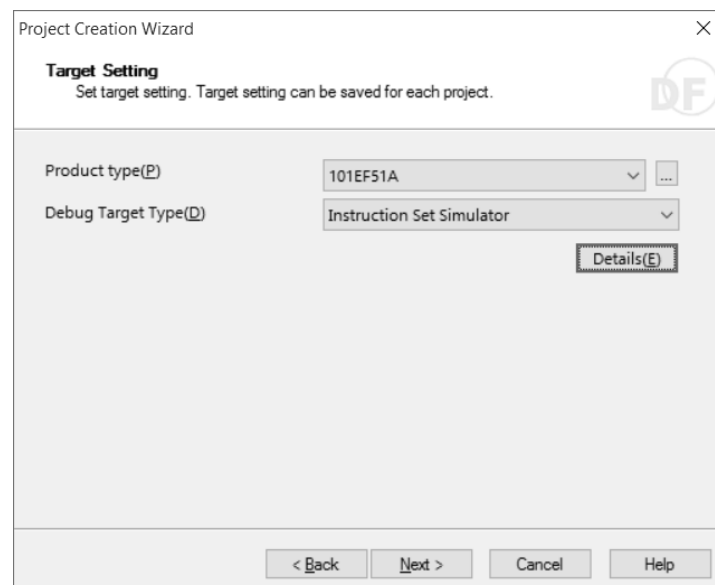


Figure 1.2.5 Target setting

Figure 1.2.6 appears in the < Details> button click.

- Target setting dialog box (General)

Select a product type to use. Select "Onboard" as debug target type.

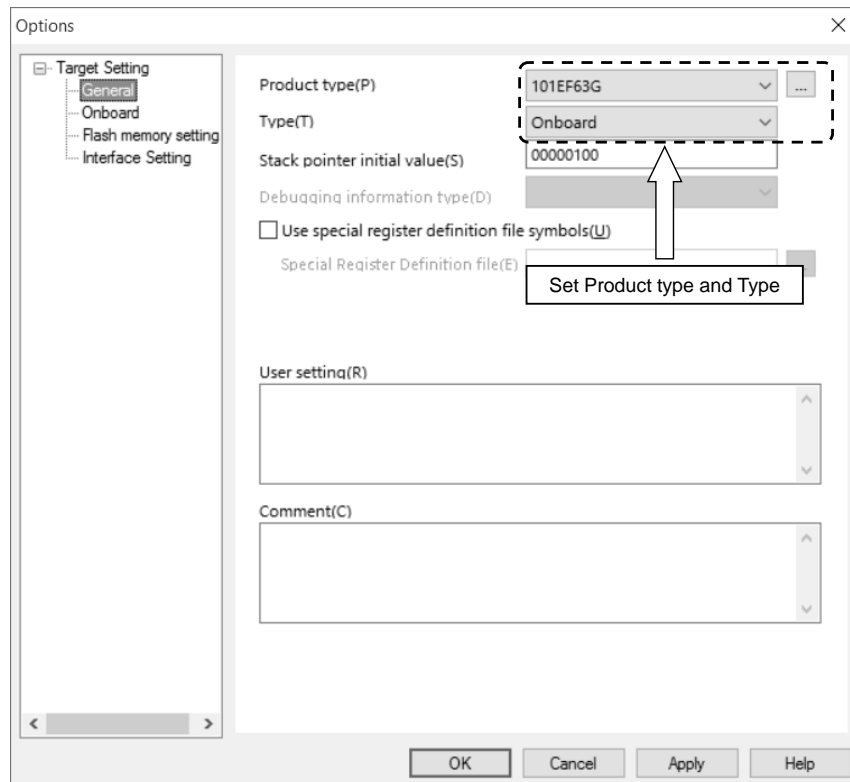


Figure 1.2.6 Target setting dialog box (General)

- Target setting dialog box (Onboard)
Select [Onboard] page. The dialog box changes as shown in Figure 1.2.7.
If there is no special reason, don't change the setting.

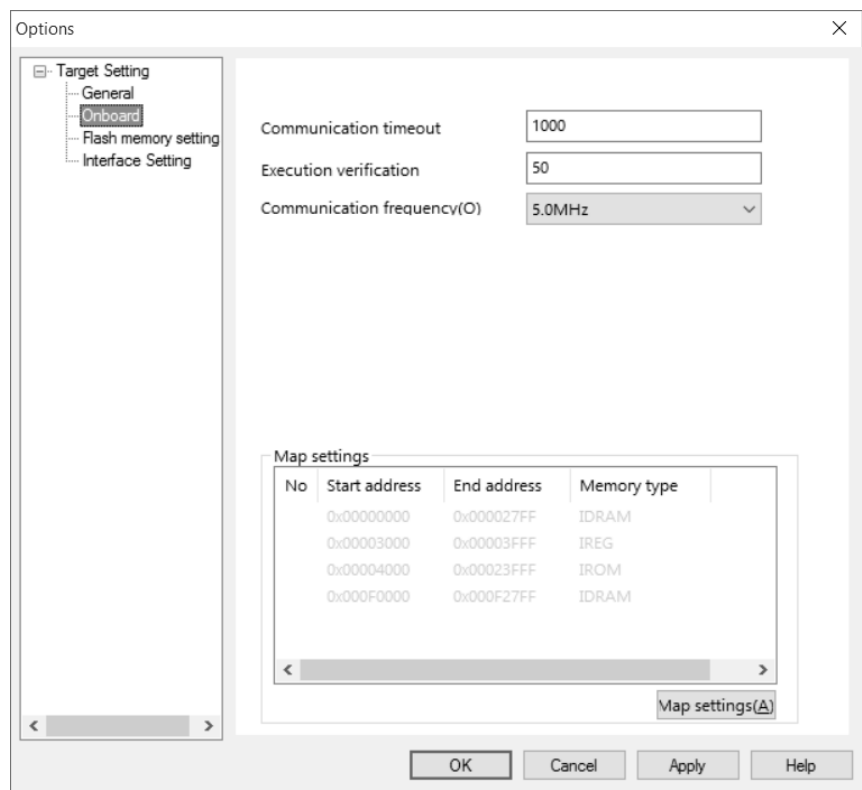


Figure 1.2.7 Onboard setting

Click <OK> after setting.

Sample source file page provides options to add sample files to the project. Check both "Sample startup assembler" and "Sample main C source".

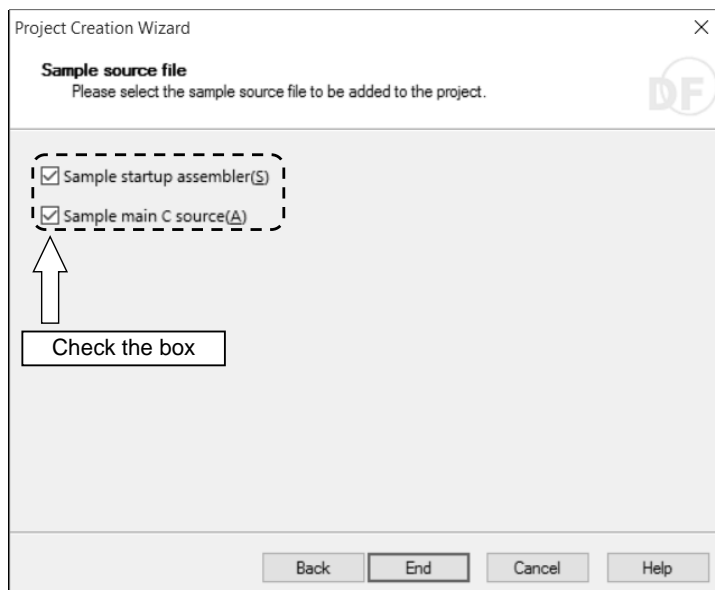


Figure 1.2.8 Sample source file setting

After completing project settings and clicking <End>, the window shown in Figure 1.2.9 appears.

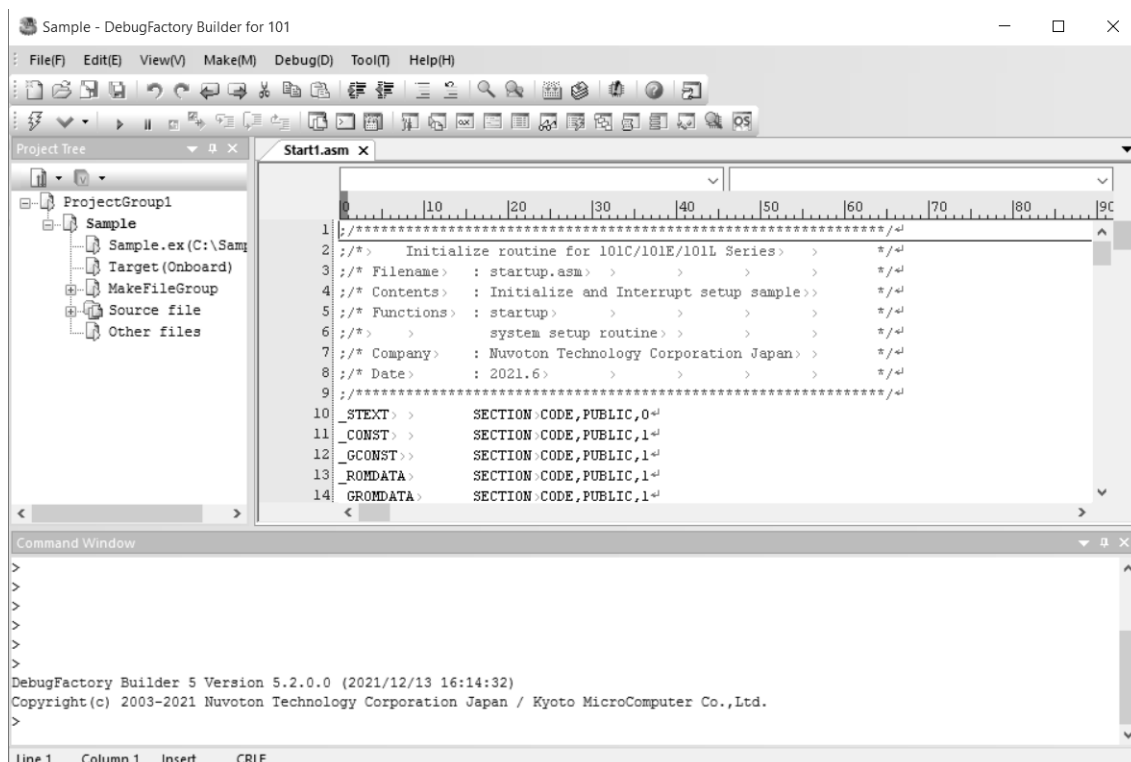


Figure 1.2.9 Startup Window of DebugFactory Builder 5

The startup assembler and the sample source file set in the project creation wizard are added in the project, and the startup assembler is displayed in the [Code] window.

The start-up assembler contains processing indispensable to describe a sample program by the C language.

n Make execution

Select [Make]-[Make <makefile name>] in the main menu, then compiling and linking are performed. The message "Execution file has been created" is displayed in the [Make output] window shown in Figure 1.2.10, when the make is completed.

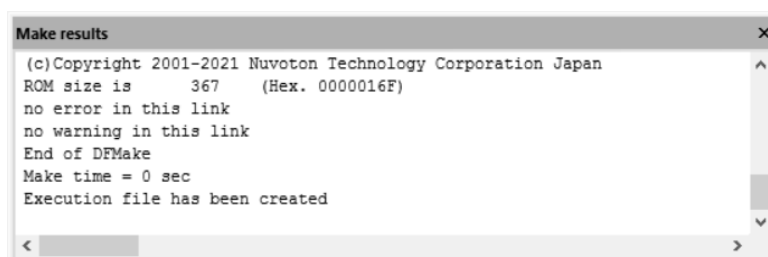


Figure 1.2.10 Make output

n Verification

Please check the connection of the debug unit and target board before verifying. For details, refer to "2.5 Connecting to Target Board (p.43)" and "2.6 Connection Method (p.45)".

Select [Debug]-[Start debugging] in the main menu as shown in Figure 1.2.11. When various settings are performed correctly, the message of "Start of the debug mode" is displayed in the command window as shown in

Figure 1.2.12. Then debugging operation such as memory change and execution of the program on the device to be debugged becomes possible. If the command window is not displayed, select [Show]-[Window]-[Command] in the main menu.

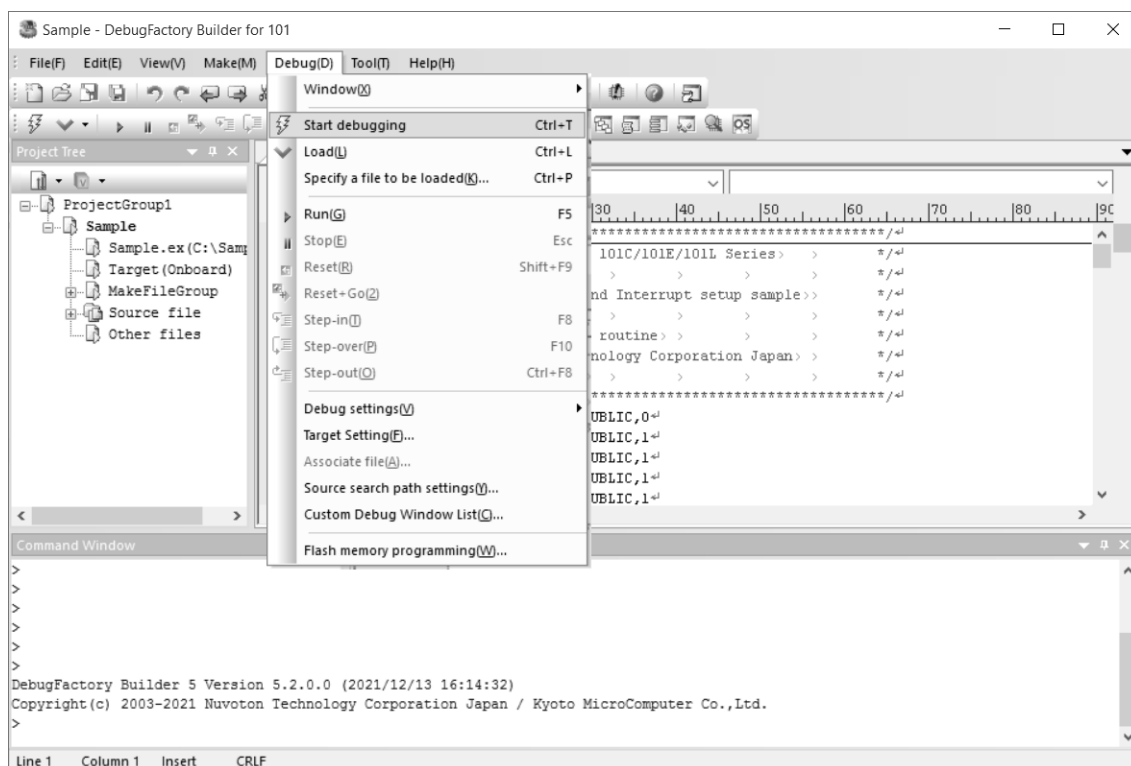
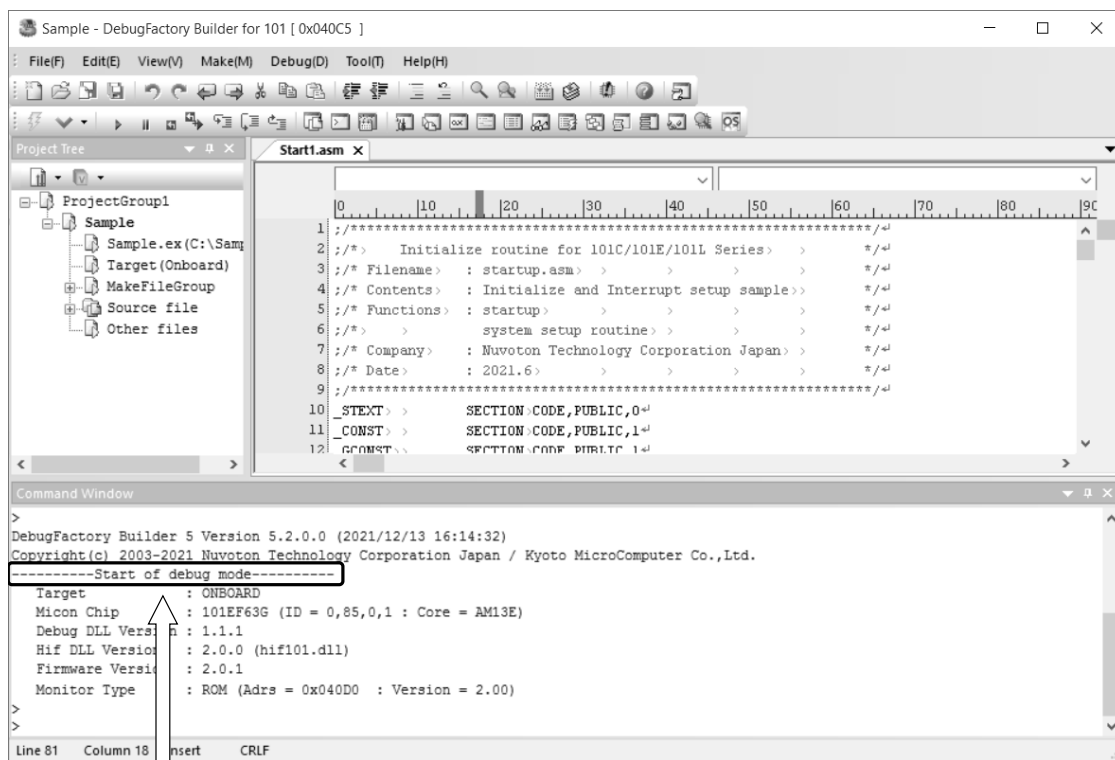


Figure 1.2.11 Selection of [Start debugging]



"Start of debug mode" is displayed.

Figure 1.2.12 Debug Mode Start

Note : When an error message is displayed and a debug mode does not start successfully, select again [Debug]-[Start debugging] in the main menu after verifying relevant settings and the connection between the host computer and Nu-EX.

If [Debug]-[Quit debugging] in the main menu is selected as shown in Figure 1.2.13, the confirmation dialog of the debug mode exit (Figure 1.2.14) is displayed.

When <OK> is clicked, the debug mode is exited. (Figure 1.2.15)

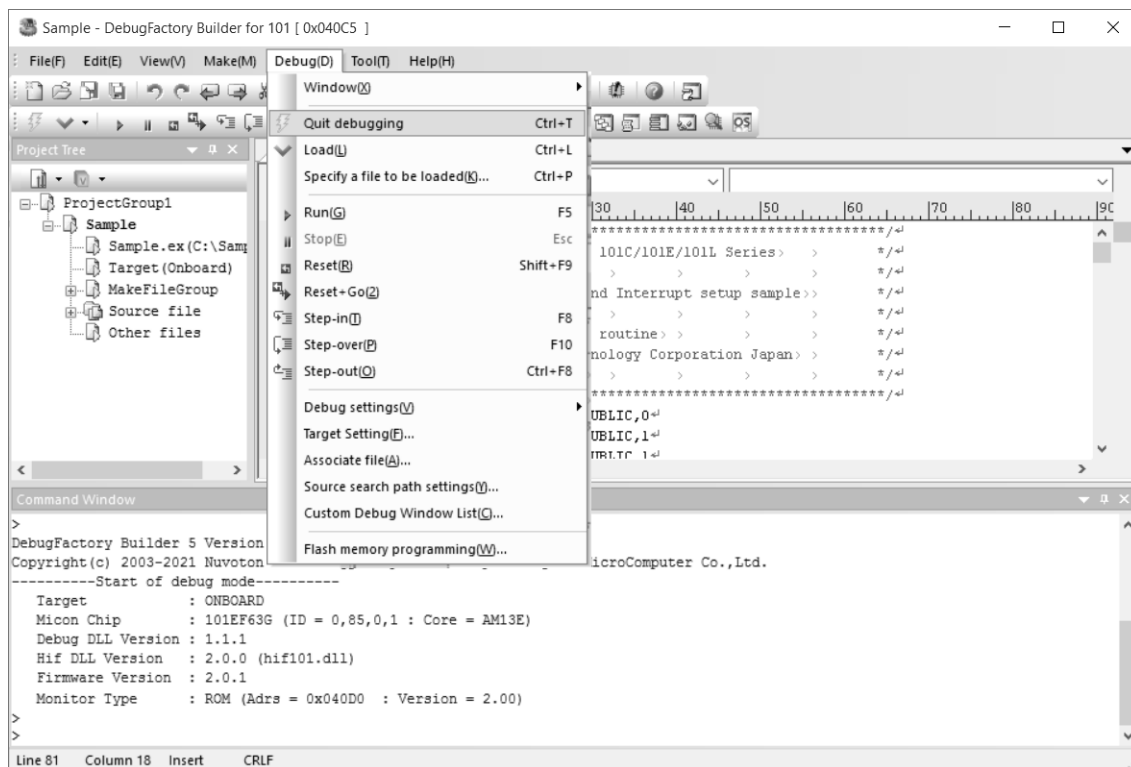


Figure 1.2.13 Selection of [Quit debugging]

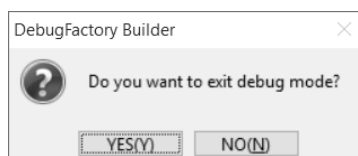
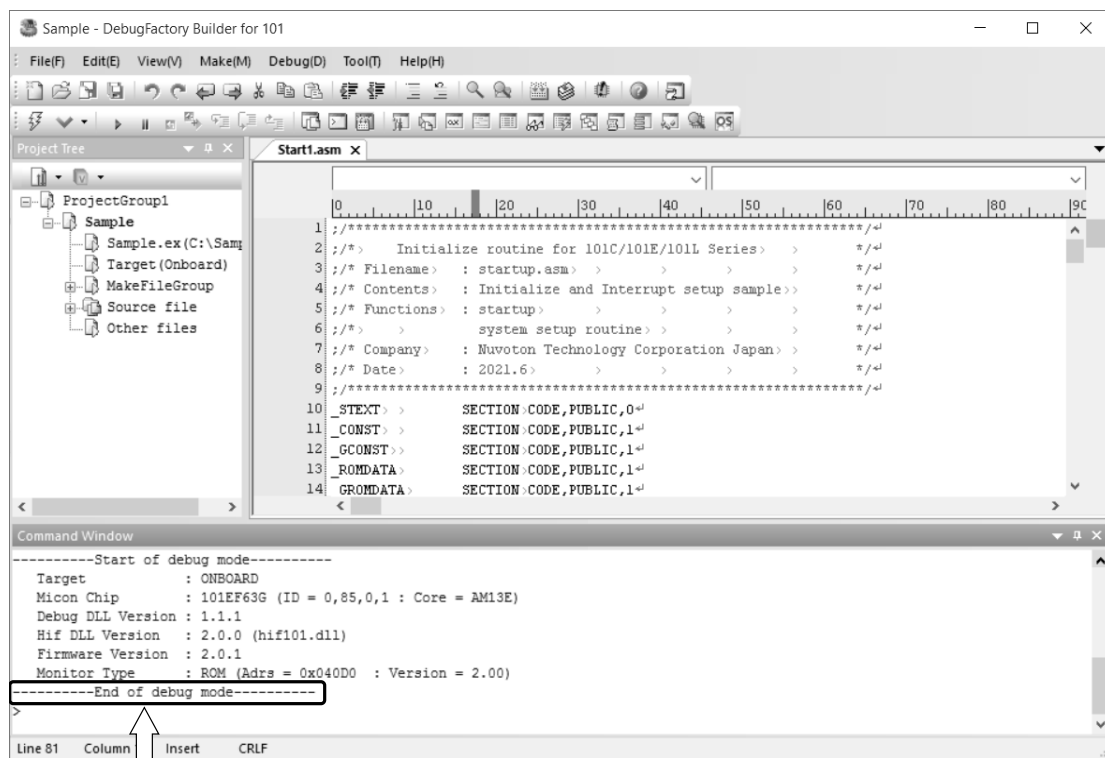


Figure 1.2.14 Confirmation of the Debug Mode Exit



"End of debug mode" is displayed.

Figure 1.2.15 Debug Mode Exit

n Exit

Select [File]-[Exit] in the main menu to exit the DebugFactory Builder 5.

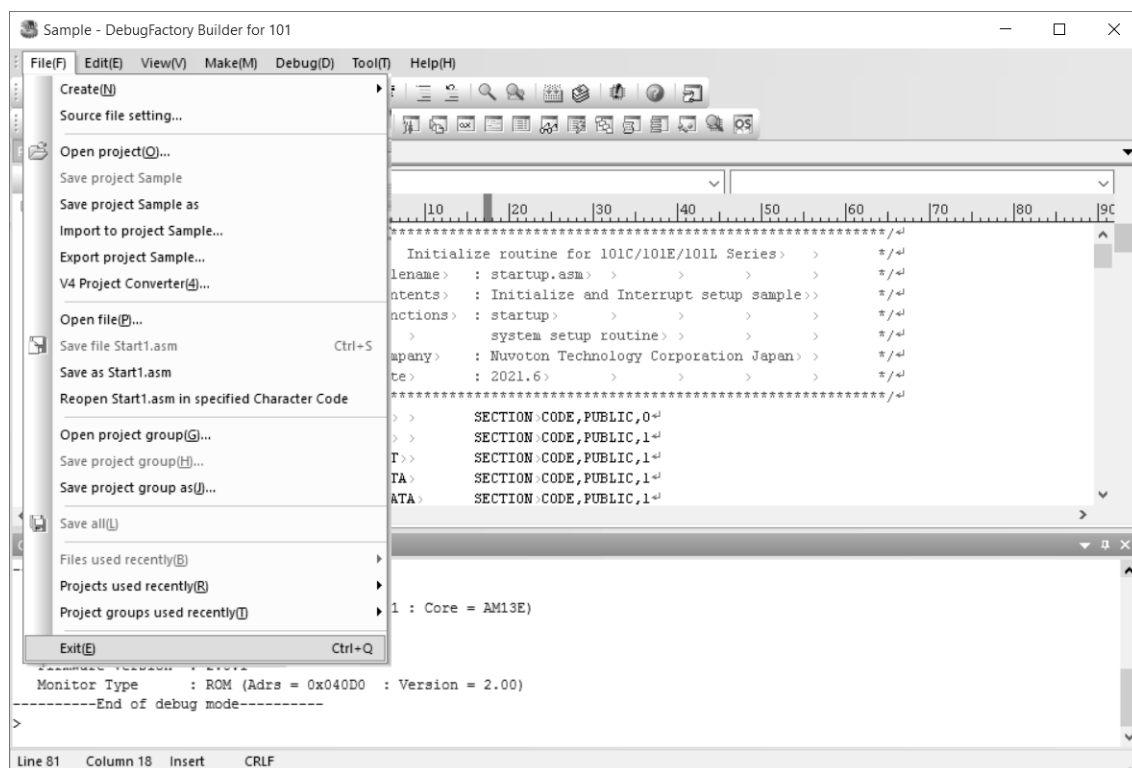


Figure 1.2.16 Exit of DebugFactory Builder 5

1.3 Checking Operations of EX Commander

n Startup

From the menu [Start], select [All Program]-[Nuvoton EX Commander], then click [EX Commander] to start up the EX Commander. If the software tools have been successfully installed, the startup window in Figure 1.3.1 appears.



Figure 1.3.1 EX Commander main screen

Select [Setting] tab, and set items as follows.

- Microcomputer product type
Select the microcontroller product type from the list.
- Programming tool
Select "Nu-EX".
- Main program file / Boot program file
Select the file to write to the flash memory.
- Keycode file
Select the key code file when set security to the flash memory or write to the flash memory that has already set security.

Set items above, Click <Execute>, then EX Commander starts writing to the flash memory.

n Exit

Select [File]-[Exit] in the main menu or click the <X> button to exit the EX Commander.

1.4 USB Driver

The Nu-EX series uses WinUSB, which is a standard Windows driver. If the USB driver is not installed, the installation will start when the USB cable is connected.

Check the installation status of the USB driver on Device Manager.

Select [Device Manager] From the [Start] menu to display the Device Manager window shown in Figure 1.4.5.

If "Nu-EX Series (PX-ODBX**)" is not displayed in the "Universal Serial Bus Device" group, the USB driver may not be installed properly.

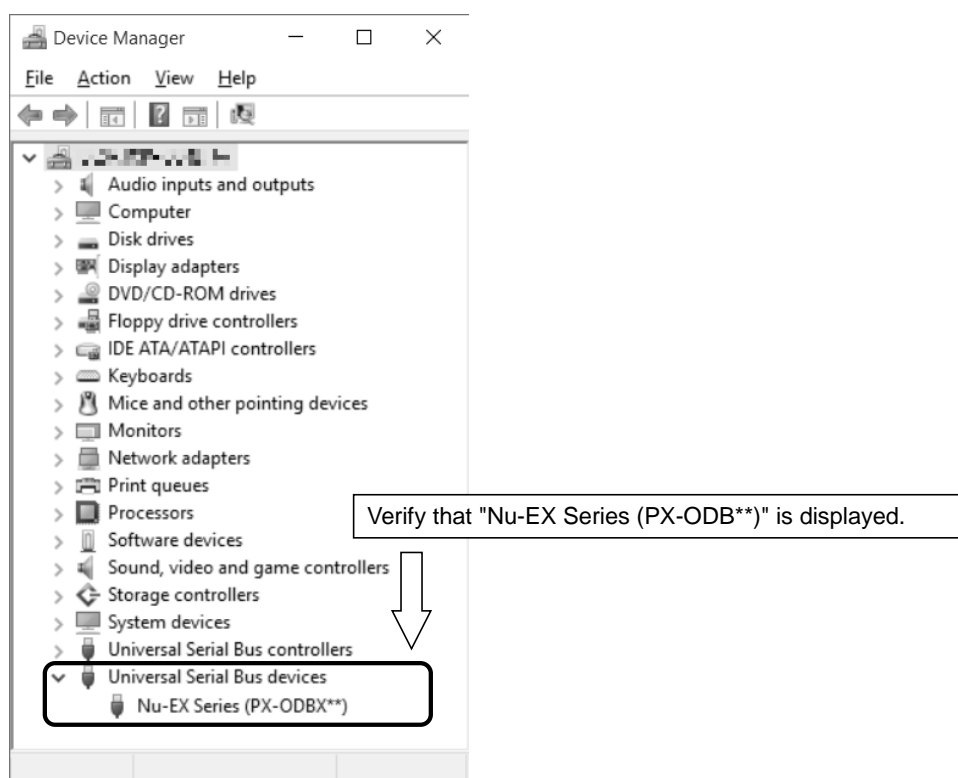


Figure 1.4.1 Device Manager

1.5 Firmware Update Procedure

With DebugFactory Builder, when the error message "Please update the firmware because the firmware version is older. (Version: X.X.X)" appeared, it is necessary to update the firmware by following the procedures below.

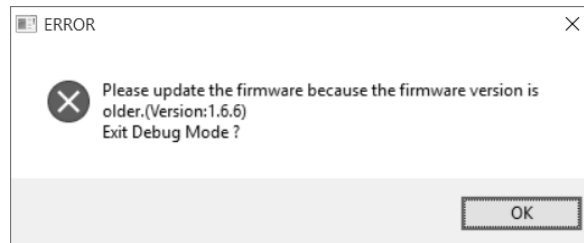


Figure 1.5.1 Firmware Version Error

Note : Once updating the firmware, you can not back to the previous state.

1. The dialog shown in Figure 1.5.2 appears. Click <Yes>.

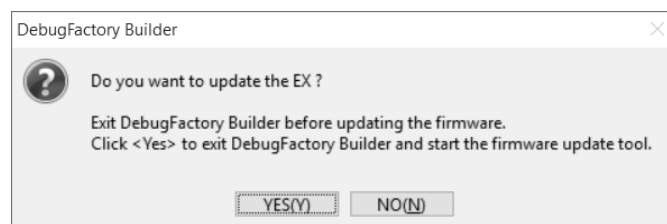


Figure 1.5.2 Firmware Update Start Check

2. The dialog shown in Figure 1.5.3 appears. Click <OK>.

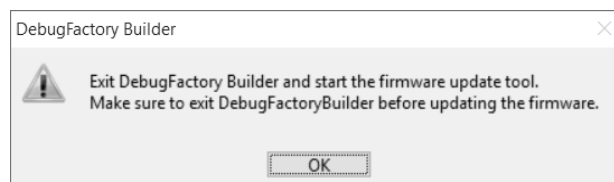


Figure 1.5.3 Firmware Update Tool Start Check

Note : - Do not update the firmware while the Nu-EX series is connected to the target board.
- Do not connect multiple Nu-EX series to one host computer when updating the firmware.
- Never unplug the USB cable connected to the Nu-EX series during updating the firmware.

3. The dialog shown in Figure 1.5.4 appears. Click <Update>. Click <Exit> to exit the update tool without updating the firmware.

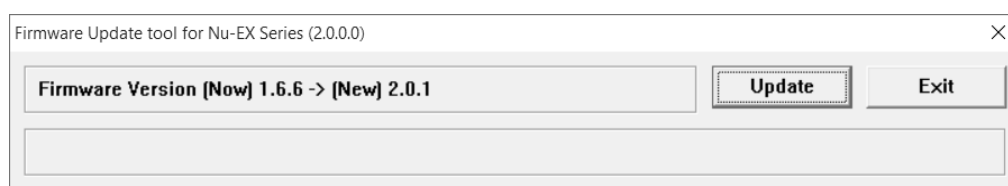


Figure 1.5.4 Startup Window of Firmware Update Tool

4. When <Update> is clicked, the display changes as shown in Figure 1.5.5. Wait until the firmware update has been completed. BUSY LED (Orange light) lights up during updating the firmware.

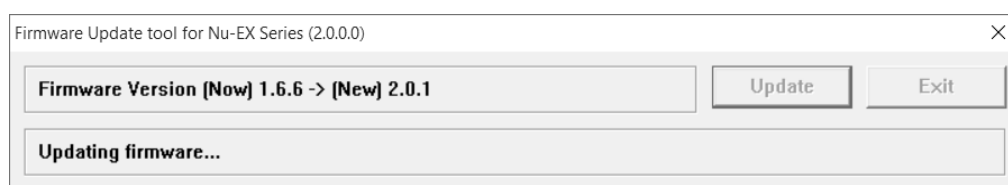


Figure 1.5.5 Firmware Update Tool Updating Screen

5. The dialog shown in Figure 1.5.6 appears. Check the LED of the Nu-series. When POWER LED (Green light) lights up, and BUSY LED (Orange light) turn off, the update has been completed. Turn off the power of the Nu-EX series and turn it on again. (Remove the USB cable from the Nu-EX series, and connect the USB cable with the Nu-EX series again.)
When BUSY LED doesn't turn off, after 3 minutes or more, they show that the firmware update has been failed.

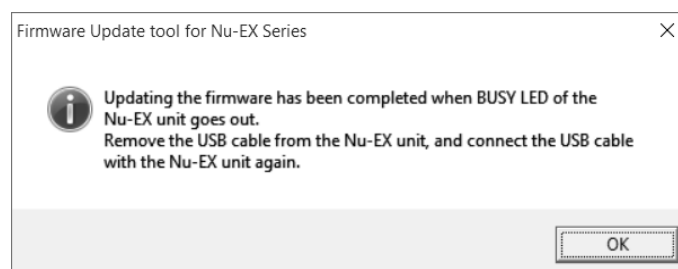


Figure 1.5.6 Completing Firmware Update

Note : In case that the firmware update is failed, turn off the power of the Nu-EX series (Remove the USB cable) immediately and contact to inquiries appears at the end of this manual.

1.6 How to link debugging monitor (101C/101E)

When using the Nu-EX series with DebugFactory Builder 5, it is necessary to link the monitor program with user program.

n Original make environment

1. Define the external reference label "MonInterrupt", and set the label in interrupt vector number 31(address 0x407c).
2. Link the debugging monitor stored in the folder "DebugFactory Builder 5 installed folder¥bin" ("C:¥Program Files¥Nuvoton¥DFBuilder5¥Bin" by default) with user program.
Use the debugging monitor "ex_mon101c.l" when target device is 101C series, otherwise "ex_mon101e.l".
Special monitor program may be necessary depending on debugging target device you use. Refer to the LSI Technical Reference Manual of the debugging target device.
The section name of the debugging monitor is "__ex_monitor".

n Internal make environment

DebugFactory Builder 5 will support the link of the monitor program. For details, refer to HELP of DebugFactory Builder 5.

1.7 Usage Notes

- The USB cable must not be unplugged while the target is connected in order to avoid improper operation of the debugger. When the debugger operates improperly, Remove the Nu-EX series and restart DebugFactory Builder.

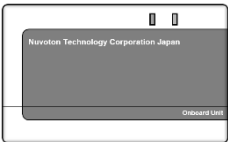
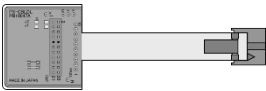

Chapter 2 Hardware

2.1 Checking Package Contents

Take out all the devices from the cartons, and check that all the items are present using the check columns in the shipping list provided. Table 2.1 shows an example of Nu-EX1 standard package contents.

Note : - Make sure not to disassemble the items for repair or reconstruction by the user.
- Do not subject the items to any form of shock.

Table 2.1 Example of Nu-EX1 standard package contents

	
Nu-EX1 Standard : PX-ODBX1N	
	
DWire10 Connecting Cable: PX-CBLXD10	USB Cable : PX-U02-AM-BM-1

2.2 Hardware Specifications

Table 2.2 Hardware Specifications

Product name (Part number)	Nu-EX1 (PX-ODBX1N, PX-ODBX1I) Nu-EX2 (PX-ODBX2N, PX-ODBX2I)			
Target devices	The thing which has any of the following interface in 101C, 101E, 101L, 103S, 103H or 103L series. (*1) DWire8, DWire13L, DWire32L, DWire32A interface			
OS (Except virtual environment)	Windows 8 (32bit / 64bit OS) Windows 10 (32bit / 64bit OS)			
Host computer interface	USB1.1 Full Speed / 2.0 HighSpeed			
Target interface (*2)	DWire10 Connecting Cable , DWire14 Connecting Cable , DWire FL Connecting Cable			
Accepted range for target power supply	Standard	+1.65 V	to	+5.5 V
	Isolated	+2.7 V	to	+5.5 V
Target current drain		[Nu-EX1]		[Nu-EX2]
	Standard	+5.0 V	MAX. 15mA	/ MAX. 15mA
		+3.3 V	MAX. 10mA	/ MAX. 10mA
	Isolated	+5.0 V	MAX. 30mA	/ MAX. 30mA
		+3.3 V	MAX. 25mA	/ MAX. 25mA
Power supply	Use the USB port power supply. +4.5V to +5.5V / MAX. 500mA Use the target board power supply. +5.0 V :220mA(LCD OFF) 130mA(LCD ON) +3.3 V :180mA(LCD OFF) 200mA(LCD ON)			
External dimensions (mm)	PX-ODBX1N, PX-ODBX1I: 102 (W) x 63 (D) x 31 (H) PX-ODBX2N, PX-ODBX2I: 102 (W) x 63 (D) x 31 (H) (Dimensions are not including protruding portions)			

*1 : When external reset input entered in the 103S, 103H series, continuation debugging is not possible.

*2 : For further details, see "2.5 Connecting to Target Board (p.43)".

2.3 Part Names and Functions of Nu-EX

Figure 2.3.1 shows the names and functions of the Nu-EX series.

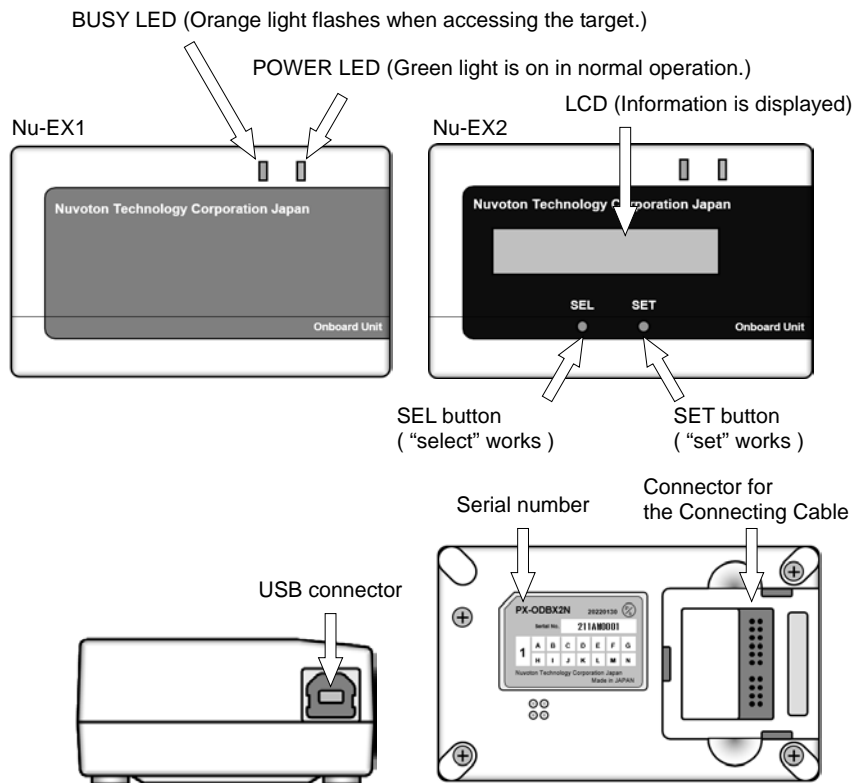


Figure 2.3.1 Names and Functions of Nu-EX series

Note :When connecting this unit to the debugging target device, always observe the precautions in "2.10 Notes on Designing Target Board (p.50)". In particular, note that short-circuiting debugging target pins with other pins or applying too high a voltage risks damaging not only the debugging target device, but also these units.

2.4 Connecting Cable

There are three types of connecting cables. This section describes the details of those connecting cable.

2.4.1 DWire Connecting Cable (PX-CBLXD10 / PX-CBLXD14 / PX-CBLXD14FL)

The DWire Connecting Cable connects the Nu-EX series with the debugging target, and support DWire8, DWire13L, DWire32L or DWire32A type debugging interface. For further details on the connections of DWire Connecting Cable and Nu-EX series, see "2.5 Connecting to Target Board (p.43)".

2.4.1.1 Part Names and Functions of DWire Connecting Cable

Figure 2.4.1, Figure 2.4.2, Figure 2.4.3 shows the names and functions of DWire Connecting Cable.

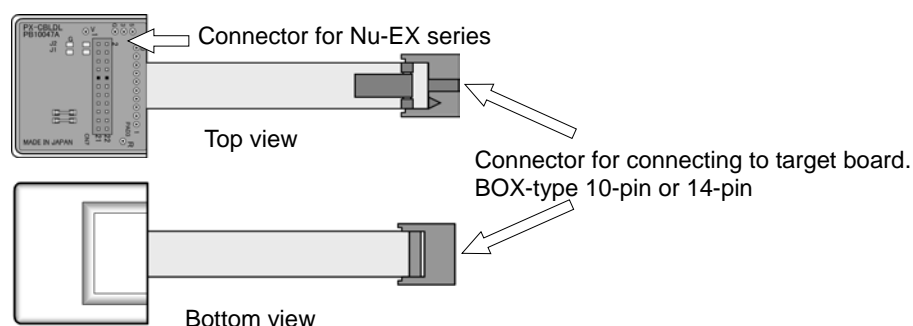


Figure 2.4.1 Names and Functions of DWire10, DWire14 Connecting Cable

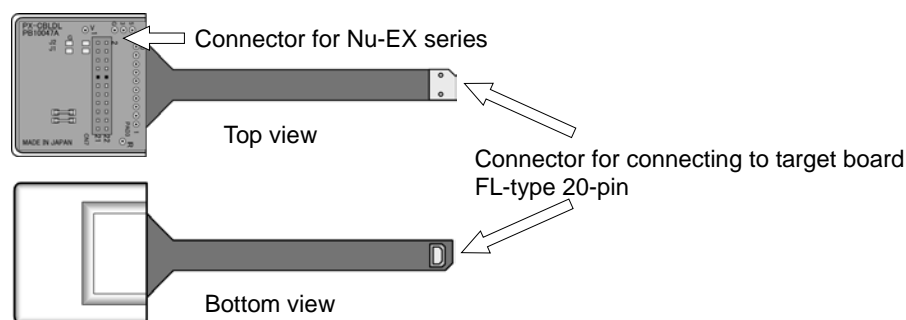


Figure 2.4.2 Names and Functions of DWire FL Connecting Cable

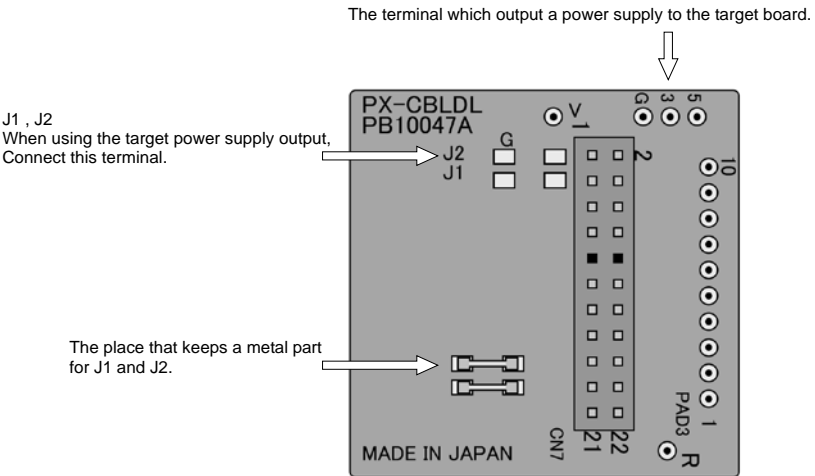


Figure 2.4.3 Board of the DWire Connecting Cable

2.5 Connecting to Target Board

When connecting the Nu-EX series to the target board containing a debugging target with a DWire debugging interface, use the provided DWire10 Connecting Cable (PX-CBLXD10) or DWire14 Connecting Cable (PX-CBLXD14). When the connector mounted on the target board is flexible type, use DWire FL Connecting Cable (PX-CBLXD14FL).

Note : Make sure to turn off both the Nu-EX series and the target board before making or breaking any connection.

n Connecting using DWire Connecting Cable

Plug the end of the DWire Connecting Cable (PX-CBLXD10 / PX-CBLXD14) into the Nu-EX series as shown in Figure 2.5.1.

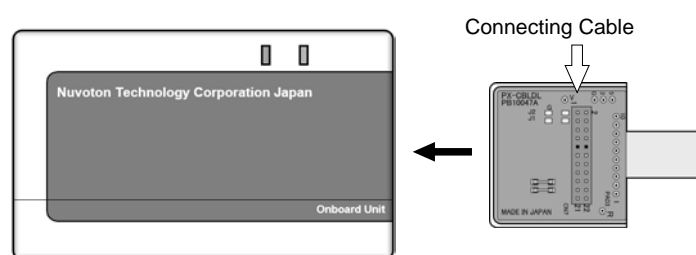


Figure 2.5.1 Connecting DWire Connecting Cable to Nu-EX series

Figure 2.5.2 illustrates the ways to connect the DWire Connecting Cable to the target board.

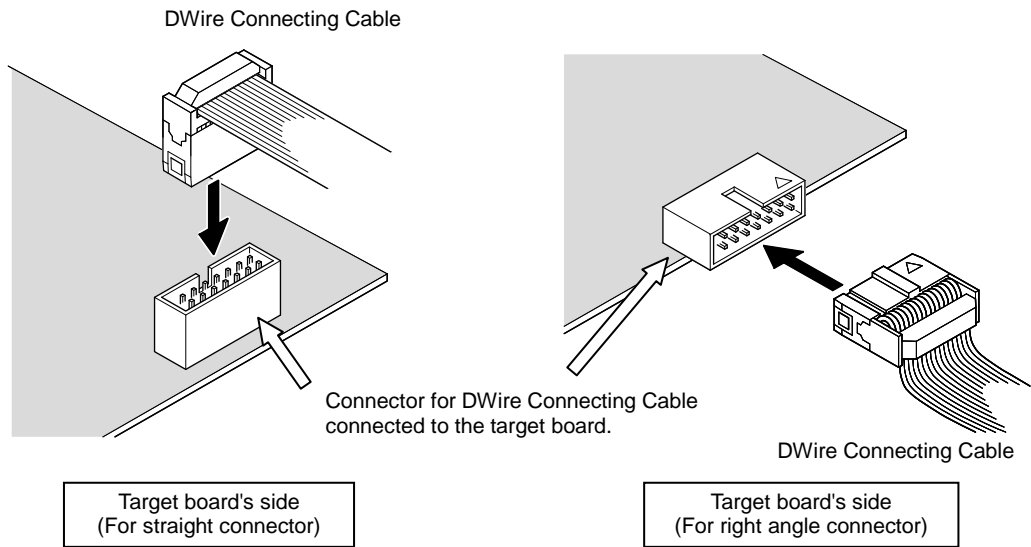


Figure 2.5.2 Connecting DWire Connecting Cable to Target Board

n Connecting using DWire FL Connecting Cable

Plug the end of the DWire FL Connecting Cable (PX-CBLXDFL) into the Nu-EX series as shown in Figure 2.5.3.

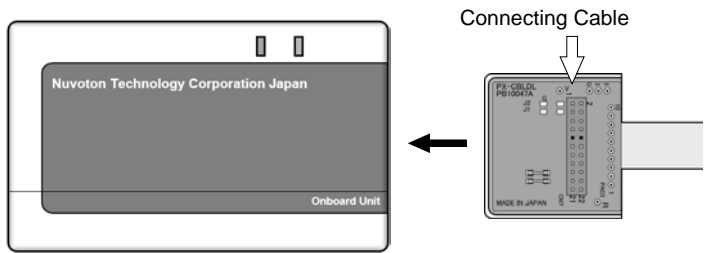


Figure 2.5.3 Connecting DWire FL Connecting Cable to Nu-EX series

Figure 2.5.4 shows connecting the DWire FL Connecting Cable to the flexible type connector mounted on the target board.

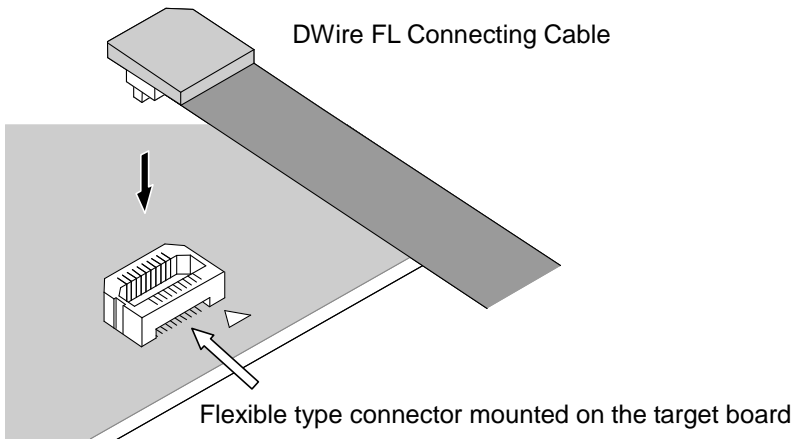


Figure 2.5.4 Connecting DWire FL Connecting Cable to Target Board

2.6 Connection Method

2.6.1 Connection and Removal with the Host Computer

Nu-EX series connects with the host computer using a USB cable. Nu-EX series and the USB cable are connected as they show it in Figure 2.6.1.

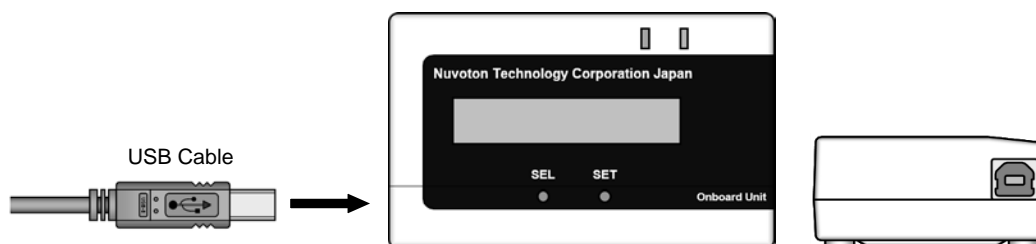


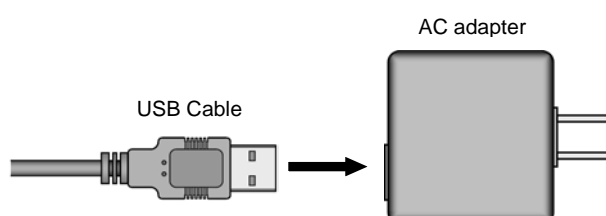
Figure 2.6.1 Connecting Nu-EX series and USB cable

2.6.2 Connection with the AC adapter

As for the Nu-EX2 standard model and the Nu-EX2 isolated model, programming by the button operation that is not connected with the host computer is possible. Explanation of the method to connect an optional AC adapter to as a power supply when the Nu-EX2 is used alone.

Nu-EX series and the USB cable are connected as they show it in Figure 2.6.1.

USB cable and the AC adapter are connected as they show it in Figure 2.6.2.



* This figure is different from the real shape.

Figure 2.6.2 Connecting USB cable and AC adapter

2.7 Method to connect the power supply output to Target Board

The standard model of the Nu-EX series can perform power supply output to the target board by software setting. The power supply can output either +3.3V or +5.0V to up to 200mA. The power supply output more than 200mA is stopped by a protection function of the Nu-EX series.

Because the USB power supply is connected to the +5.0V output from the standard model of the Nu-EX1, it is affected by the power supply stability of the host computer. Because the +5.0V output from the standard model of the Nu-EX2 is stabilized by a power supply circuit of the inside, it is not affected by the power supply stability of the host computer. Because it is stabilized by power supply circuit of the inside, the +3.3V output of the standard model of the Nu-EX1 and the standard model of the Nu-EX2 is not affected by the power supply stability of the Host Computer.

n Connecting using DWire Connecting Cable

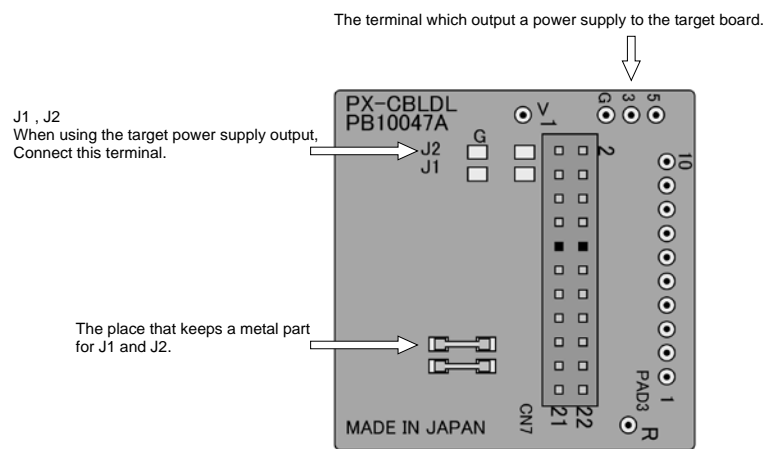


Figure 2.7.1 Board of the DWire Connecting Cable

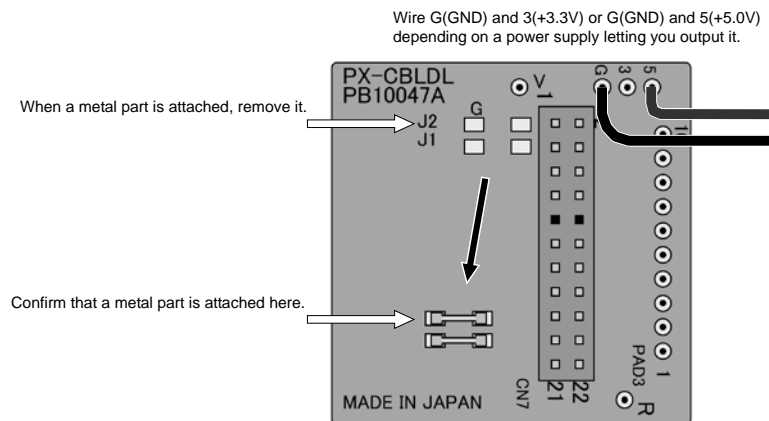


Figure 2.7.2 Connect the DWire Connecting Cable Board

Note : - As the power supply output from the Nu-EX series does not collide with the power supply output from the target board, please confirm connection. If the voltage of +7.0 V or more is applied even momentarily to the power output terminal of this unit, even if you are not currently output power from this unit, there is a possibility that this unit will fail.
- This function is compatible only EX Commander, it is not compatible the DebugFactory Builder. In addition, will need to wire the cables to the power supply to the Board of the DWire Connecting Cable.

2.8 Method to work with a power supply from Target Board

The standard model of the Nu-EX2 can work only by power supply from the target board not a power supply by the USB connection with the Host Computer and the connection with the AC Adapter. The range of the target board power supply that can work is +5.5V from +3.0V.

Explanation of a setting method and instructions when the standard model of the Nu-EX2 works by the power supply output from the target board.

n Connecting using DWire Connecting Cable

Remove a metal part for J1, J2 prepared on the DWire Connecting Cable Board using the Soldering Iron.

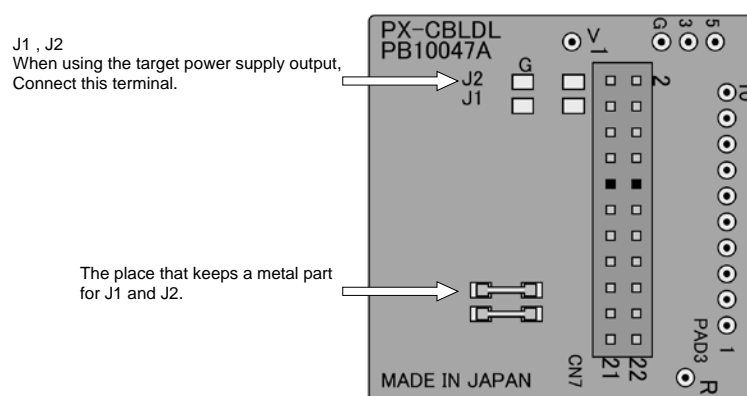


Figure 2.8.1 Board of the DWire Connecting Cable

Then, attach a metal part removed with the Soldering Iron to J1, J2.

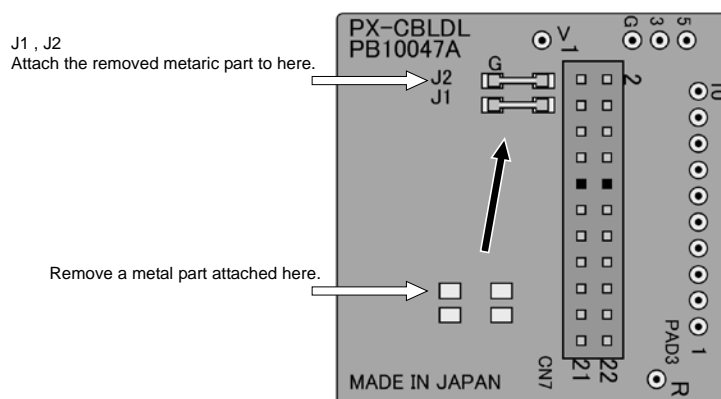


Figure 2.8.2 Connect the DWire Connecting Cable Board

Note : Insulation performance decreases when connected to the isolated model of the Nu-EX series using connecting cable where setting of J1 and J2 to connect the target power supply output was accomplished.

2.9 Customized method of the connection with the Target Board

In the Nu-series, an optional board to customize it to use environment is prepared. For the Nu-EX series and the connection using a cable and the connector out of the designation using this.

Note : When an optional board is used, the Nu-EX series product is out of the guarantee. Every phenomenon that occurred by using the optiona board is not guaranteed. Customize it by the responsibility of the customer.

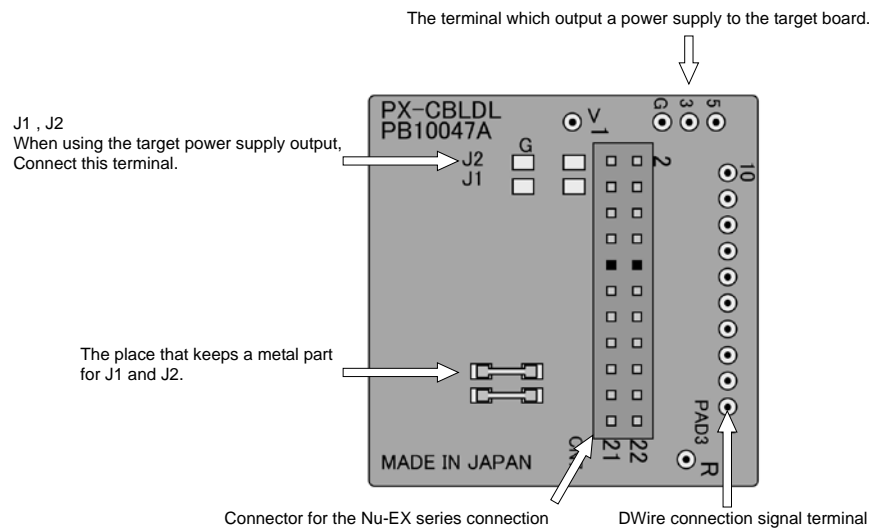


Figure 2.9.1 DWire Connecting Board

Table 2.3 Connector for the Nu-EX series connector

Pin number	Signal name	Pin number	Signal name
1	+3.3V output	2	+5.0V output
3	UGND (Nu-EX GND)	4	UGND (Nu-EX GND)
5	VDDin (Power supply input)	6	VDDin (Power supply input)
7	N.C.(Reserved)	8	N.C.(Reserved)
9	N.C.(There is no pin)	10	N.C.(There is no pin)
11	VDD	12	VDD
13	SCLK	14	GND
15	SDATA	16	GND
17	N.C.	18	N.C.
19	EXTRG (DMOD / NOCDMOD)	20	N.C.
21	NRST	22	GND

Table 2.4 DWire connection signal terminal (optional board)

Pin number	Signal name	Pin number	Signal name
1	GND	2	SCLK
3	GND	4	NRST
5	VDD	6	EXTRG (DMOD / NOCDMOD)
7	PRSM (N.C.)	8	GND
9	SDATA	10	GND

Note :The connector pin assignment is different from the DWire10 Connecting Cable (PX-CBLXD10).

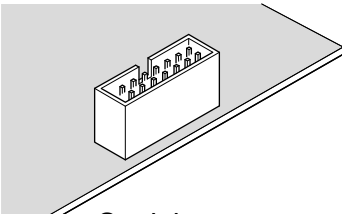
2.10 Notes on Designing Target Board

This Section describes specifications for the connectors that the target board needs to provide and signal wiring methods for connecting to the Nu-EX series. It concludes with important notes on wiring design.

2.10.1 Specification of Target Board Connector for DWire Target Connecting Cable

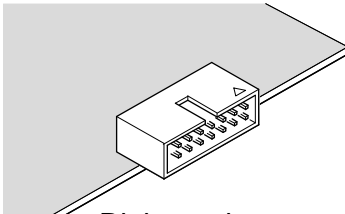
When using the Nu-EX series through a DWire interface along with the DWire Connecting Cable, mount a connector for DWire Connecting Cable on the target board. Figure 2.10.2 shows the connector pin layout for DWire Connecting Cable. And Table 2.6 shows the pin numbers and signal names.

Note : Use a pin header or a box type connector (male) for the connector. The connector is restricted to a male general-purpose 14-pin or 10-pin pin header or box type connector (The manufacturer does not matter as long as there are two rows of seven or five pins each, the pins are 2.54 mm apart, and the pins are 5 to 6 mm long).



Straight type

Connector for PX-CBLD14
Example: HRS HIF3FC-14PA-2.54DSA (71)
KEL 6231-014-257-F
Connector for PX-CBLD10
Example: HRS HIF3FC-10PA-2.54DSA (71)
KEL 6231-010-257-F
Connector for PX-CBLD14 is shown as an example.



Right angle type

Connector for PX-CBLD14
Example: HRS HIF3FC-14PA-2.54DS (71)
KEL 6231-014-255
Connector for PX-CBLD10
Example: HRS HIF3FC-10PA-2.54DS (71)
KEL 6231-010-255
Connector for PX-CBLD14 is shown as an example.

Figure 2.10.1 Target Board Connectors for DWire Connecting Cable

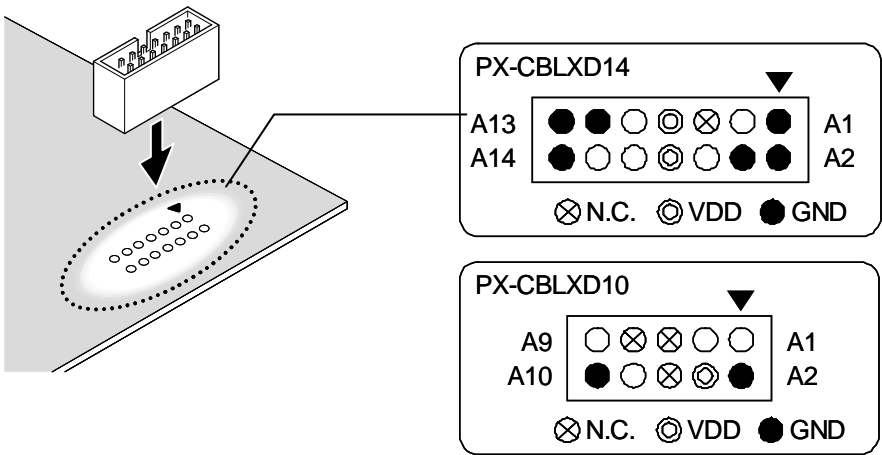


Figure 2.10.2 Pin Layout for DWire Connecting Cable (connector mounting side on the board)

Table 2.5 Connector Pin Layout (for PX-CBLXD14)

Pin number	Signal name	Pin number	Signal name
A1	GND	A2	GND
A3	SCLK (OCD_CLK)	A4	GND
A5	N.C.	A6	NRST
A7	VDD	A8	VDD
A9	EXTRG (DMOD / NOCDMOD)	A10	PRSML (N.C.)
A11	GND	A12	SDATA (OCD_DATA)
A13	GND	A14	GND

Table 2.6 Connector Pin Layout (for PX-CBLXD10)

Pin number	Signal name	Pin number	Signal name
A1	NRST	A2	GND
A3	SDATA (OCD_DATA)	A4	VDD
A5	N.C.	A6	N.C
A7	N.C	A8	EXTRG (DMOD / NOCDMOD)
A9	SCLK (OCD_CLK)	A10	GND

2.10.2 Specification of Target Board Connector for Flexible type DWire Connecting Cable

Figure 2.10.3 shows the connector pin layout to mount on the target board for using Flexible type DWire Connecting Cable. Table 2.7 shows the pin numbers and signal names.

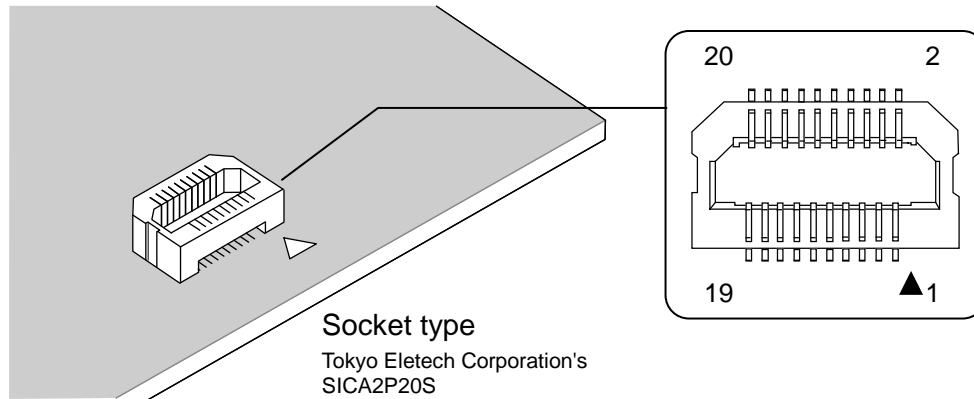


Figure 2.10.3 Target Board Connectors for DWire FL Connecting Cable
(connector mounting side on the board)

Table 2.7 Connector Pin Layout (for DWire FL Connecting Cable)

Pin number	Signal name	Pin number	Signal name
1	N.C.	2	N.C.
3	GND	4	GND
5	GND	6	SCLK (OCD_CLK)
7	N.C.	8	N.C.
9	NRST	10	EXTRG (DMOD / NOCDMOD)
11	N.C.	12	N.C.
13	VDD	14	PRSML (N.C.)
15	VDD	16	N.C.
17	SDATA (OCD_DATA)	18	GND
19	GND	20	GND

2.10.3 Drawing of Flexible type Target Board Connector (SICA2P20S)

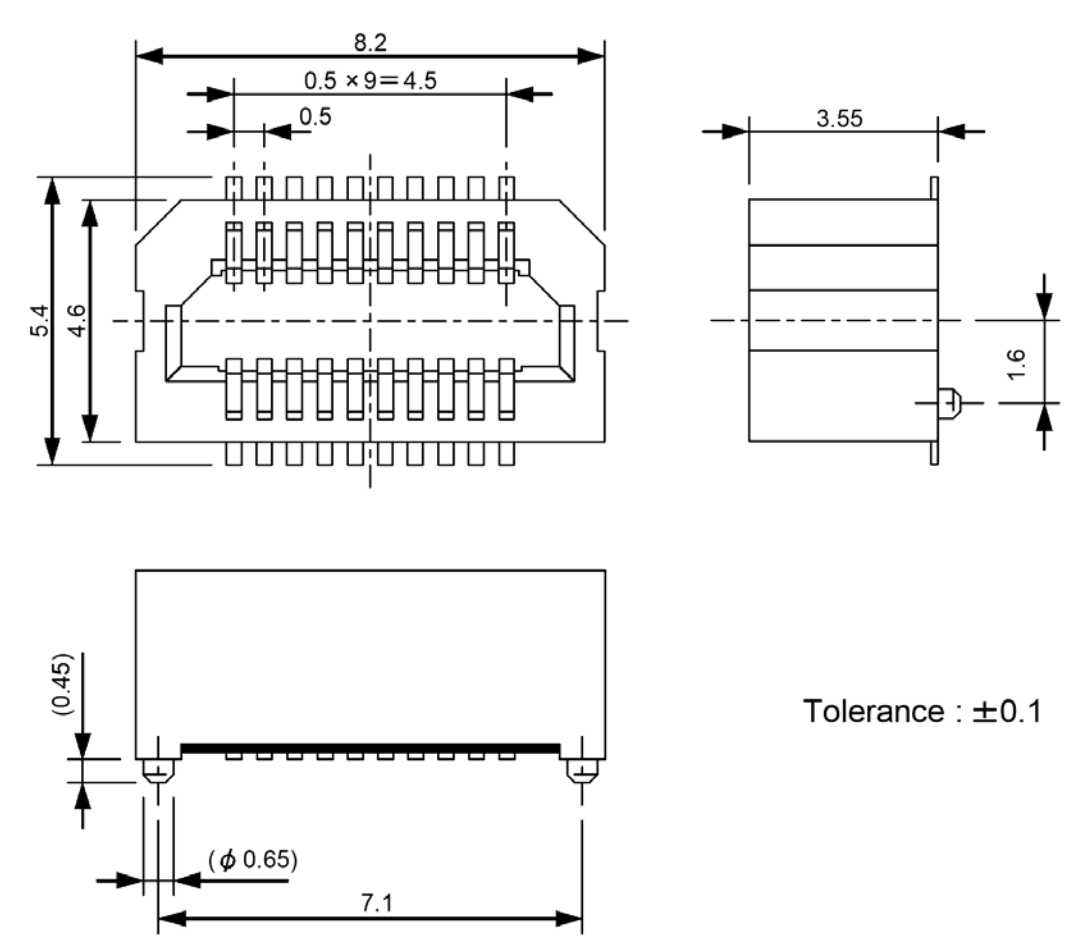


Figure 2.10.4 Drawing of SICAP20S

2.10.4 Recommended pattern of Flexible type Target Board Connector (SICA2P20S)

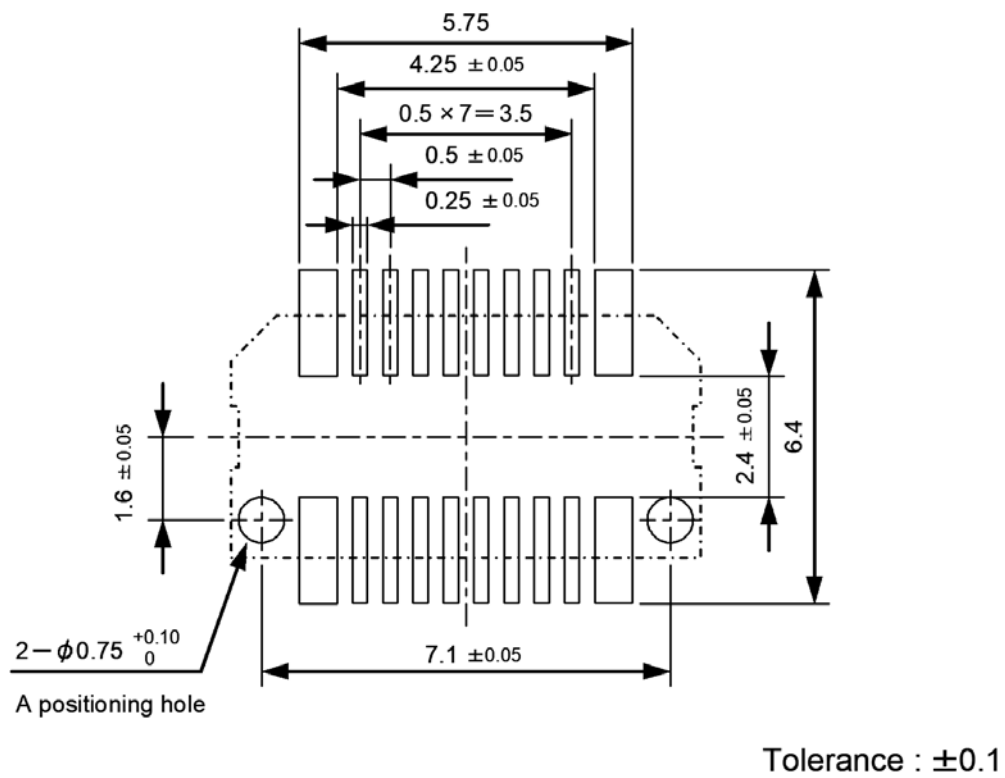


Figure 2.10.5 Recommended pattern of SICA2P20S

2.10.5 DWire Signal Wiring

Connecting the Nu-EX series to the target board with the debugging target device through the DWire interface requires a preparation of either a connector for DWire Connecting Cable or test pins (bead type not supported) that meets the design criteria shown below on the target board (Refer to "2.10.1 Specification of Target Board Connector for DWire Target Connecting (p.50)"). Please observe the Notes on wiring to the connector for DWire Connecting Cable on the target board shown in Figure 2.10.6, Figure 2.10.7 and Figure 2.10.8.

The DWire uses two pins, which are the communication clock pin (SCLK) and the communication data pin (SDATA), to perform serial data transmission/reception between the debugging target device and the Nu-EX series. Table 2.8 shows the pin names and pin functions.

Table 2.8 DWire Pin Names and Pin Functions

Pin Name	Pin Function
SCLK (OCD_CLK)	DWire communication clock (unit => debugging target device) The actual frequency of the communication clock signal varies according to the settings of the debugging target device and the debugger. When a debugger is connected, this pin needs to be pulled up with a register of 4.7k to 100k ohms (10k ohms recommended).
SDATA (OCD_DATA)	DWire communication data (unit <=> debugging target device) When a debugger is connected, this pin needs to be pulled up with a register of 4.7k to 100k ohms (10k ohms recommended).
NRST	Reset signal of the debugging target device The reset circuit needs to have an open drain output that is pulled up with a resistor of 1.5k to 100k ohms (10k to 100k ohms recommended) while the debugger is used.
DMOD (NOCDMOD)	DWire mode setting (unit => debugging target device) Set the DWire mode of the debugging target device while the debugger is used. This pin needs to be pulled up with a resistor of 1.5k to 100k ohms (10k to 100k ohms recommended). This pin needs to be pulled down depending on debugging target device you use. Refer to the LSI Technical Reference Manual of the debugging target device.
EXTRG	External trigger input (used for measuring times)
PRSM (N.C.)	Monitor protection at resetting DWire32A (this pin is not used by the current tool.)
VDD	Target I/O power voltage (+1.65 to +5.5 V)
GND	Target ground

n DWire target design criteria

- The power supplied to the VDD pin must be the same as that supplied to the I/O PAD that device the SCLK(OCD_CLK) and SDATA(OCD_DATA) signals for the debugging target device.
(e.g. Supply a power of +3.3V to the VDD pin when a power of +3.3V is supplied to the I/O pins.)
- Connect the GND pin to the target board's ground.
- Wire the SCLK(OCD_CLK) and SDATA(OCD_DATA) signals in the same layer as much as possible while minimizing the usage of vias.
- Do not put other signals near the SCLK(OCD_CLK) and SDATA(OCD_DATA) wiring patterns as much as possible. Especially, do not put components or circuits that can be a noise source such as oscillators, regulators, inverter circuits, or a large current circuit such as motors near the wiring patterns.
- Do not insert serial resistance in the SCLK(OCD_CLK) and SDATA(OCD_DATA) signals.
(Make sure to insert a resistor of 100 ohms or lower if necessary.)

- Make the SCLK(OCD_CLK) and SDATA(OCD_DATA) wiring patterns short as much as possible (length: 150 mm or less, difference in wiring length: 10 mm or less), and put ground lines on the both sides of the SCLK(OCD_CLK) and SDATA(OCD_DATA) signals to shield the signals. Do not connect signals with branching or connectors.
- When a debugger is connected, this pin needs to be pulled up with a register of 4.7k to 100k ohms (10k ohms recommended). For further details, see the LSI Technical Reference Manual of the debugging target device.
- To use the time measurement function of the debugger with the debugging target that has two or more external trigger input and output pins, connect the EXTRG0 pin of the debugging target to the connector for DWire Connecting Cable or the EXTRG pin of the test pin. (The time measurement function of the debugger can be used only with the EXTRG0 pin of the debugging target.)
- When the EXTRG pin is also used as the user pin, design the wiring so that the debugging target device can be isolated from other devices as shown in Figure 2.10.7.
- Design the reset circuit connected to NRST pin so that it has an open-drain output. Figure 2.10.8 shows a wiring example.
- Leave the PRSML pin open because it is not used by the current debugger.
- In the actual designing, termination of pins may be required when the debugger is not used. Design the circuit according to the system with referring to the LSI Technical Reference Manual of the debugging target device.

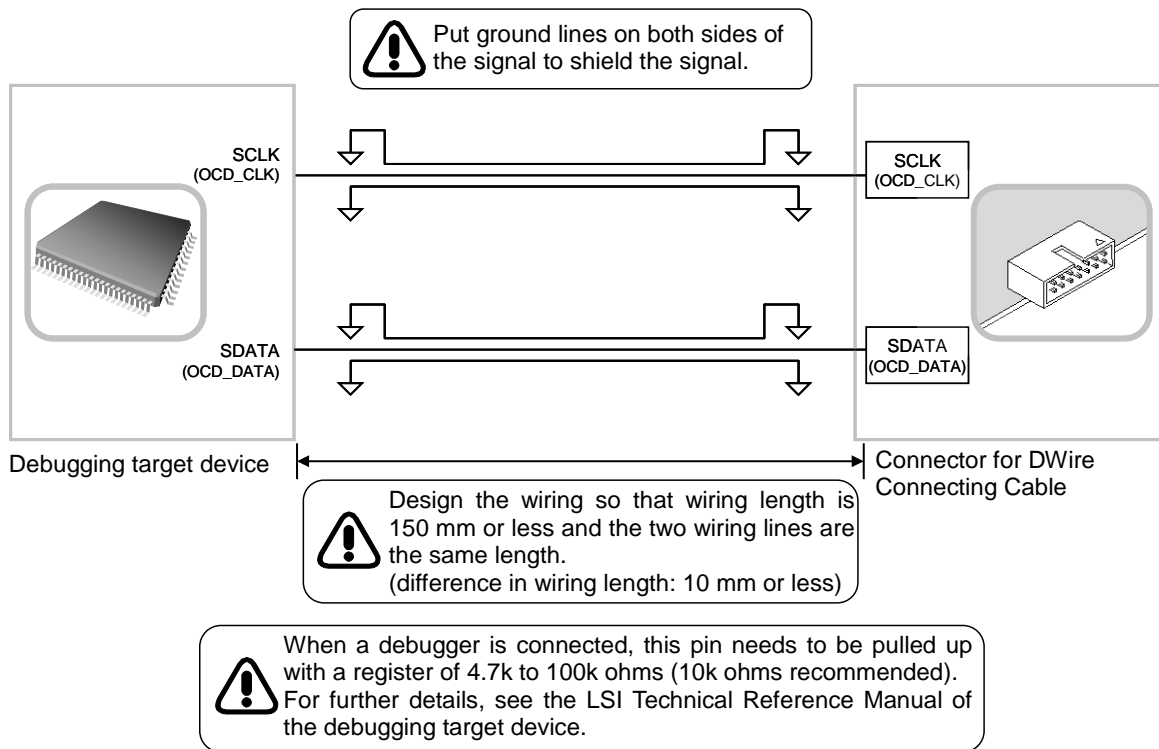


Figure 2.10.6 DWire Signal Wiring

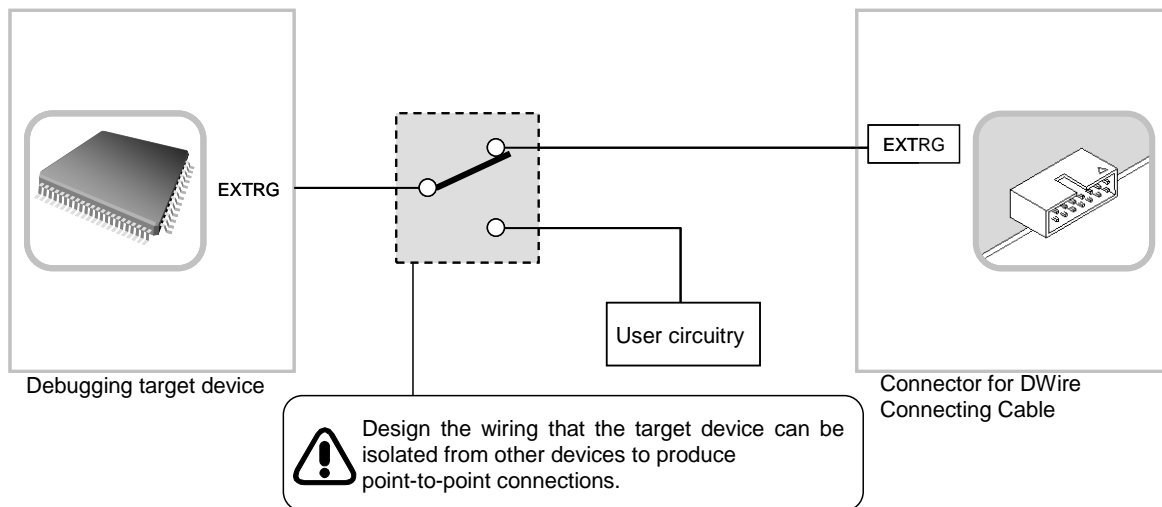


Figure 2.10.7 External Trigger Input Signal Wiring

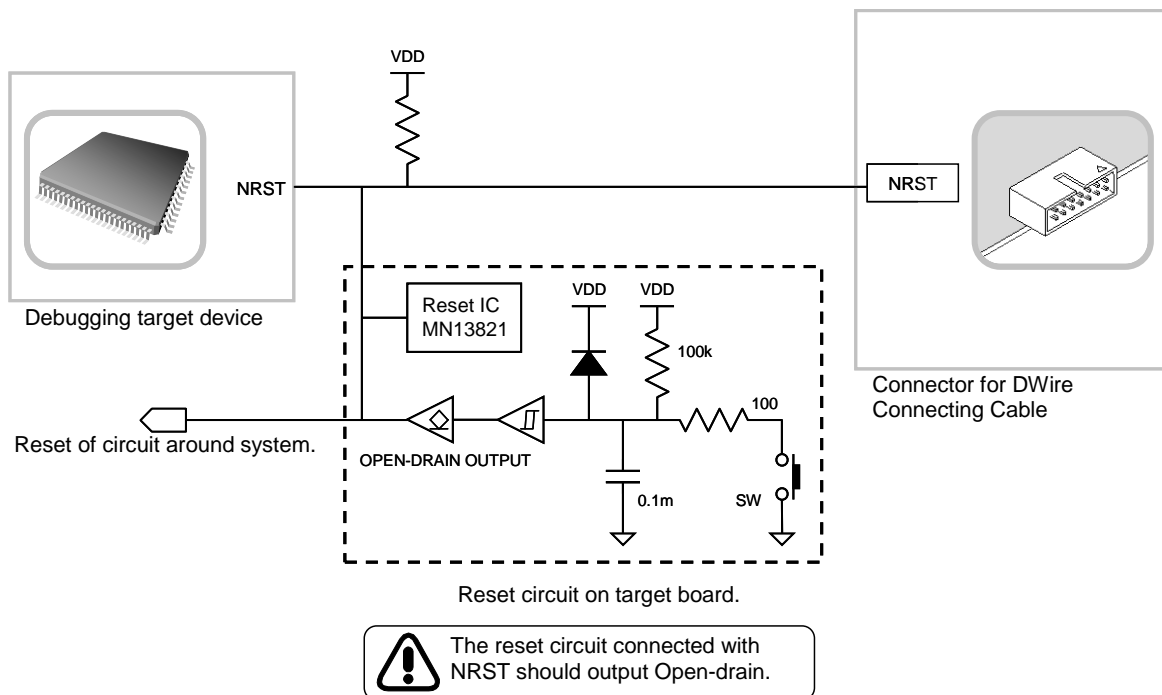


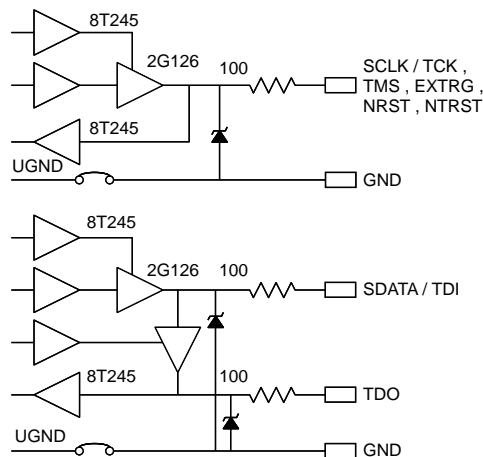
Figure 2.10.8 Wiring Example of Reset Signal

2.10.6 Equivalent Circuit of Connection to Target in Nu-EX series

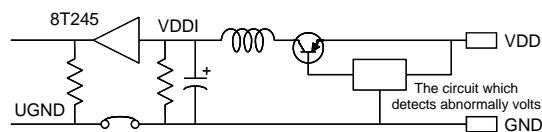
Equivalent circuits of the connection to the target in Nu-EX series are shown below.

- Nu-EX1 Standard model
- Nu-EX2 Standard model

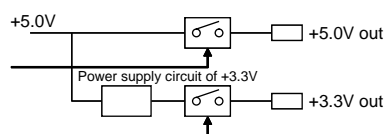
Signal Input / Output



The target power supply (VDD) detection

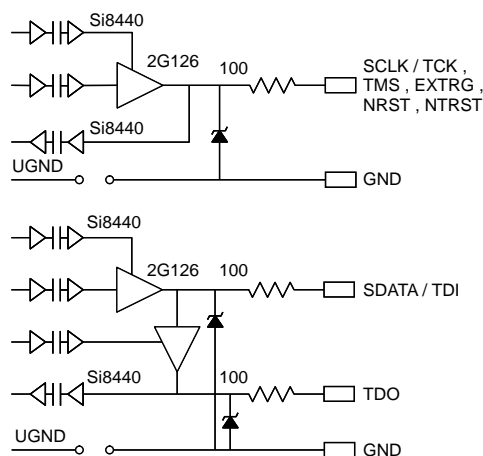


Power supply output

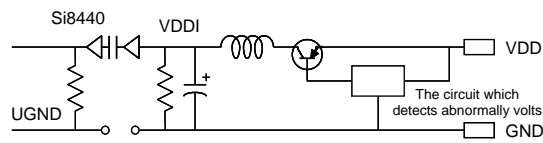


- Nu-EX1 Isolated model
- Nu-EX2 Isolated model

Signal Input / Output

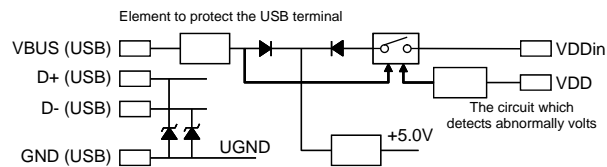


The target power supply (VDD) detection



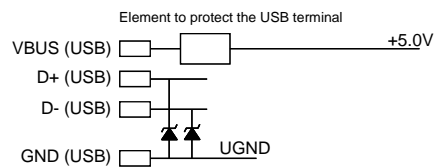
- Nu-EX2 Standard model

Power supply for the USB connector outskirts and movement



- Nu- EX1 Standard model
- Nu-EX1 Isolated model
- Nu-EX2 Isolated model

Power supply for the USB connector outskirts and movement



Record of Changes

Nu-EX User Manual Record of Changes

Revised on April 22, 2011

Definition	Previous Edition (--- Edition)			New Edition (1st Edition)
	Page	Section	Details of Changes	Details of Changes
New	--	--	---	New making of the manual

Revised on May 27, 2011

Definition	Previous Edition (1.0)			New Edition (1.1)
	Page	Section	Details of Changes	Details of Changes
Addition	18	6	---	Note: You can set Compiler / Real-time OS up if you have purchased them.

Revised on August 01, 2011

Definition	Previous Edition (1.1)			New Edition (1.2)
	Page	Section	Details of Changes	Details of Changes
Addition	24,25	---	---	(Explanation of the target setting was added to a chapter of the Checking operations of DebugFactory Builder)

Revised on November 30, 2011

Definition	Previous Edition (1.2)			New Edition (1.3)
	Page	Section	Details of Changes	Details of Changes
Change	10	8	Windows Vista / 7 (32bit OS only)	Windows Vista (32bit OS only) Windows 7 (32bit / 64bit OS)
Change	34	4	Installation of USB driver on Windows Vista	Installation of USB driver on Windows Vista or Windows 7
Change	49	11	Windows XP(after SP2) / Vista / 7 (32bit OS only)	Windows XP(after SP2) / Vista (32bit OS only) Windows 7 (32bit / 64bit OS)
Delete	59	11	The software performing power supply output setting to the target board is not ready now.	---

Revised on December 20, 2011

Definition	Previous Edition (1.3)			New Edition (1.4)
	Page	Section	Details of Changes	Details of Changes
Addition	10	23	---	Software is revised for function improvement at any time, please use the latest version. Log into our Semiconductor Support System, confirm the latest version. (Refer to "1.1.3 Update to Latest Information (p.22)".)
Change	11	2	Select a series name to start installation.	Select a series name.
Addition	11	3	---	If you select 103S, Figure 1.1.4 appears. Click <EX1 / EX2 / NEO> to install DebugFactory Builder. If you select other than 103S, installation is started immediately.

Definition	Previous Edition (1.3)			New Edition (1.4)
	Page	Section	Details of Changes	Details of Changes
Addition	22	12	---	In addition, download the Flash Definition File from our Semiconductor Support System as needed.
Addition	22	15	---	In the environment setting of EX Commander, if your debugging target (microcomputer or system LSI) is not found in the microcomputer product type list, download the EX Commander definition file in the site above.

Revised on October 29, 2012

Definition	Previous Edition (1.4)			New Edition (1.5)
	Page	Section	Details of Changes	Details of Changes
Addition	46	12	---	Special monitor program may be necessary depending on debugging target device you use. Refer to the LSI specifications of the debugging target device.
Change	51	Table 2.2.1	MAX.150mA	MAX.160mA
Addition	51	31	---	*1: When external reset input entered in the 103S series, continuation debugging is not possible.
Addition	74	Table 2.10.6	---	This pin needs to be pulled down depending on debugging target device you use. Refer to the LSI specifications of the debugging target device.

Revised on April 11, 2014

Definition	Previous Edition (1.5)			New Edition (1.6)
	Page	Section	Details of Changes	Details of Changes
Addition	10	Table 1.1.1	---	Windows 8 (32bit / 64bit OS)
Addition	15	1.1.2.1	---	1.1.2.1 Setting up Integrated Development Environment (DebugFactory Builder 5)
Change	71	Table 2.2.1	Windows XP(after SP2) / Vista (32bit OS only) Windows 7 (32bit / 64bit OS)	Windows Vista (32bit OS only) Windows 7 (32bit / 64bit OS) Windows 8 (32bit / 64bit OS)
Change	51	Table 2.2.1	+3.0V to +5.5V / MAX.160mA	+5.0 V :220mA(LCD OFF) 130mA(LCD ON) +3.3 V :180mA(LCD OFF) 200mA(LCD ON)

Revised on January 16, 2015

Definition	Previous Edition (1.6)			New Edition (1.7)
	Page	Section	Details of Changes	Details of Changes
Change	80	Figure 2.6.2	---	Replaced a figure (AC adapte)

Revised on March 31, 2016

Definition	Previous Edition (1.7)			New Edition (1.8)
	Page	Section	Details of Changes	Details of Changes
Change	32	18	In the environment setting of EX Commander, if your debugging target (microcomputer or system LSI) is not found in the microcomputer product type list, download the EX Commander definition file in the site above. Please extract the compressed file (PEXCommander_DefFiles.zip) that downloaded, and overwrite the content of the extracted folder (DefFiles) to "DefFiles" folder under the EX Commander installed folder.	On Table 1.4 of the check, download and run the Definition File Update Program from our Semiconductor Support System.
Addition	32	Table 1.4	---	List of Definition File Update Program
Change	68	Table 2.1	---	CD-ROM delete

Revised on June 30, 2016

Definition	Previous Edition (1.8)			New Edition (1.9)
	Page	Section	Details of Changes	Details of Changes
Change	8	18	Setup disk installs Integrated Development Environment (DebugFactory Builder), Flash memory programmer (EX Commander) and the compiler.	This section describes how to install Integrated Development Environment (DebugFactory Builder), Flash memory programmer (EX Commander), the compiler and the Real-time OS.

Revised on September 30, 2016

Definition	Previous Edition (1.9)			New Edition (2.0)
	Page	Section	Details of Changes	Details of Changes
Change	8	Table 1.1	Windows 8 (32bit / 64bit OS)	Windows 8.1 (32bit / 64bit OS)
Addition	8	Table 1.1	---	Windows 10 (32bit / 64bit OS)

Revised on May 31, 2017

Definition	Previous Edition (2.0)			New Edition (2.1)
	Page	Section	Details of Changes	Details of Changes
Change	---	--	---	URL change

Revised on December 22, 2017

Definition	Previous Edition (2.1)			New Edition (2.2)
	Page	Section	Details of Changes	Details of Changes
Delete	8	Table 1.1	Windows Vista (32bit OS only)	---
Delete	54	7	in Windows Vista	---

Revised on June 28, 2019

Definition	Previous Edition (2.2)			New Edition (2.3)
	Page	Section	Details of Changes	Details of Changes
Change	62	Table 2.1	USB Cable : PX-IFC-USB-20C10B	USB Cable : PX-U02-AM-BM-1

Revised on January 29, 2021

Definition	Previous Edition (2.3)			New Edition (2.4)
	Page	Section	Details of Changes	Details of Changes
Change	8	Table 1.1	Windows 7 (32bit / 64bit OS) Windows 8.1 (32bit / 64bit OS) Windows 10 (32bit / 64bit OS)	Windows 8.1 (32bit / 64bit OS) Windows 10 (32bit / 64bit OS)
Change	47	Table 2.2	Windows 7 (32bit / 64bit OS) Windows 8.1 (32bit / 64bit OS) Windows 10 (32bit / 64bit OS)	Windows 8.1 (32bit / 64bit OS) Windows 10 (32bit / 64bit OS)
Delete	--	---	---	Deleted the description related to DebugFactory Builder 4.

Revised on January 28, 2022

Definition	Previous Edition (2.4)			New Edition (2.5)
	Page	Section	Details of Changes	Details of Changes
Change	---	--	---	The product name has changed (Nu-EX) The application name has changed (EX Cmmander)
Change	19	1	1.1.2.4 Setting up Real-time OS	Changed to the explanation of the installation method using the installer.
Change	33	1	1.4 Installation of USB Driver	1.4 USB Driver Change USB driver to WinUSB

Revised on September 30, 2022

Definition	Previous Edition (2.5)			New Edition (2.6)
	Page	Section	Details of Changes	Details of Changes
Change	---	--	Nuvoton homepage (https://nuvoton.com)	Nuvoton Semiconductor Support System (https://nuvoton.co.jp/semi-spt/general/)

Inquiries

If you have questions regarding technical information on this manual, please visit the following URL.

Nuvoton Technology Corporation Japan

URL: <https://nuvoton.co.jp/semi-spt/general/>

I Microcontroller Home Page
<https://nuvoton.co.jp/e-micom/>

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