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SAFETY CONTROLLER BASIC COURSE

This course is intended for beginners of safety controllers who understand safety basics.

Introduction Purpose of the Course

This course is intended for those using the MELSEC-WS series safety controller for the first time or having just started using it.

This course describes basic knowledge of the MELSEC-WS series safety controller, the system configuration method using the Setting and Monitoring Tool for the safety controller, and the error check method.

Taking this course requires basic knowledge of the safety system. We recommend that those taking this course take the following course first.

1. YOUR FIRST FACTORY AUTOMATION (SAFETY OF MACHINERY)

Introduction Course Structure

The contents of this course are as follows.
We recommend that you start from Chapter 1.

Chapter 1 - Safety Controller

This chapter provides the overview of the safety controller.

Chapter 2 - System Construction

This chapter describes the system configuration constructed in this course.

Chapter 3 - Connection Check of Safety Controller and Personal Computer

This chapter provides the setting method to connect a safety controller and personal computer and the check method.

Chapter 4 - New Project Creation

This chapter provides how to create projects for a safety controller.

Chapter 5 - Project Download

This chapter provides how to download projects to a safety controller and verify the projects.

Chapter 6 - Safety Controller Connection/Disconnection

This chapter provides how to connect and disconnect a safety controller.

Chapter 7 - System Operation Check

This chapter provides how to check the safety controller operation.

Final Test

6 sections in total (6 questions) Passing grade: 60% or higher.

Introduction How to Use This e-Learning Tool

Go to the next page		Go to the next page.
Back to the previous page		Back to the previous page.
Move to the desired page		"Table of Contents" will be displayed, enabling you to navigate to the desired page.
Exit the learning		Exit the learning. Window such as "Contents" screen and the learning will be closed.

Safety precautions

When you learn by using actual products, please carefully read the safety precautions in the corresponding manuals.

Precautions in this course

- The displayed screens of the software version that you use may differ from those in this course.

This course is for the following software version:

- Setting and Monitoring Tool for the safety controller Version 1.3.0.245

Reference materials

Below is a list of references related to the topics in this course. (Please note that these reference materials are not absolutely necessary as you can still complete this course without using them.)

Click the name of the reference file to download.

Name of reference	File format	File size
Recording paper	Compressed file	7.46 kB

Chapter 1

Safety Controller

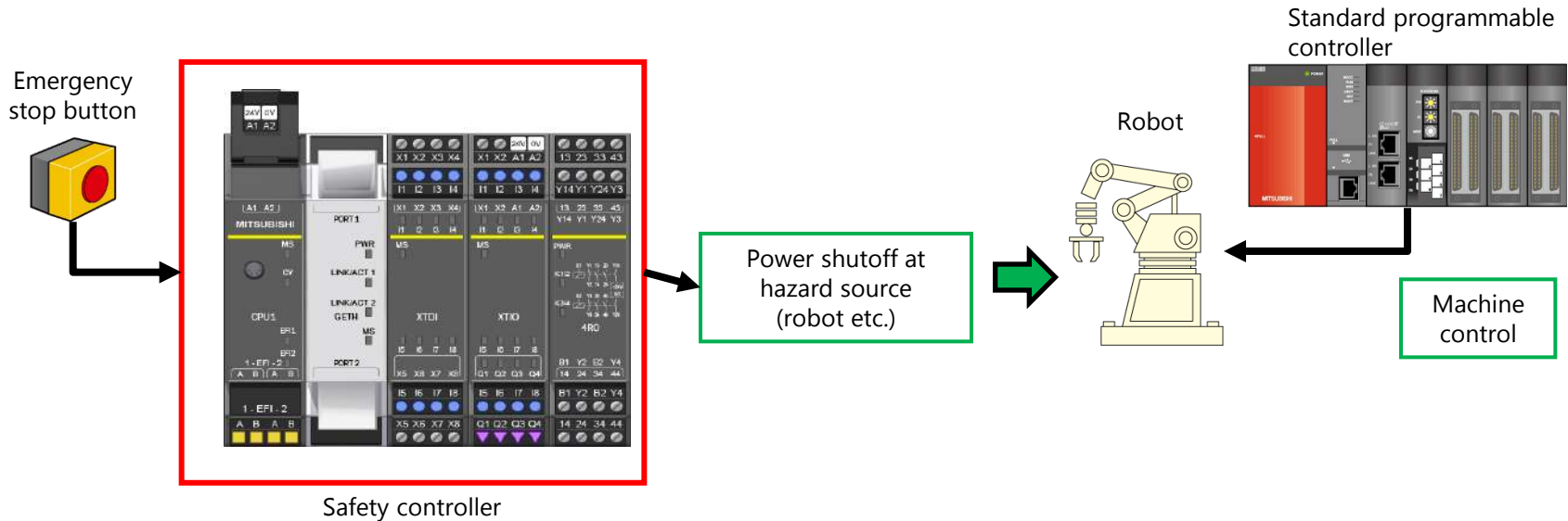
This chapter provides the overview of the safety controller.

- 1.1 Safety Controller
- 1.2 Feature of Safety Controller
- 1.3 Basic Configuration of Safety Controller
- 1.4 Safety Control can be Easily Added to Existing MELSEC Programmable Controllers (CC-Link/Ethernet)
- 1.5 Summary of This Chapter

1.1

Safety Controller

The safety controller is a controller for safety control that conforms to international safety standards. When connected with a safety device, such as an emergency stop switch or light curtain, this programmable controller executes safety control by turning the safety output OFF with a user-created program to stop the power toward a source of hazard, such as a robot. Machine control of robots and conveyors, etc., is executed with standard programmable controllers in the conventional manner.



The safety controller is an expandable compact controller suitable for the safety control of small to medium-sized devices and systems.

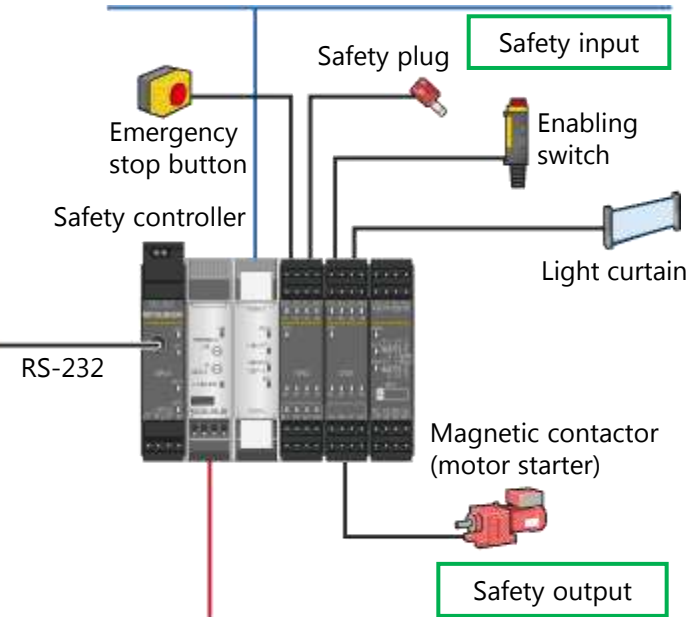
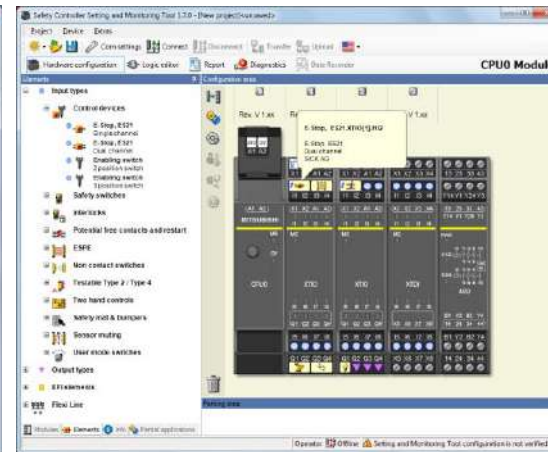
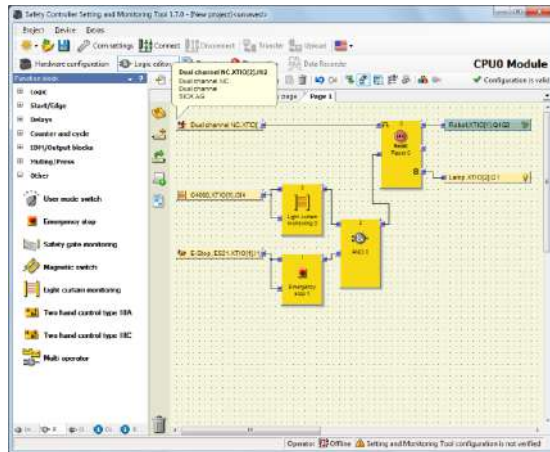
Up to 12 I/O modules and 2 network interface modules can be connected.

The safety I/O can be expanded to 144 points (input: 96 points, output: 48 points).

The dedicated "Setting and Monitoring Tool" contains is equipped with function blocks for safety sensors and switch connections and even with safety-dedicated function blocks, facilitating safety system construction. **The "Setting and Monitoring Tool" can be downloaded in the Mitsubishi Electric FA site.**

The safety controller complies with ISO 13849-1 PLe and IEC 61508 SIL3 safety standards.

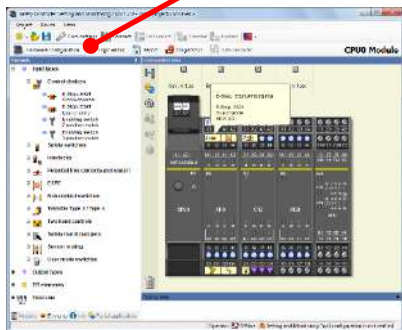
■ Dedicated "Setting and Monitoring Tool"



- Compatible with safety controller-to-safety controller network Flexi Link

Safety communications between safety controllers can be easily established at a low cost just by connecting the CPU modules with dedicated cables (Flexi Link cables). Flexi Link allows up to four safety controllers to communicate each other.

Setting and Monitoring Tool
SW1DNN-WS0ADR-B



CPU module memory plug
WS0-MPL0

Screw-in replacement terminal block WS0-TBS4
Spring clamp replacement terminal block WS0-TBC4

RS-232 cable connecting to CPU module
WS0-C20R2

USB/RS-232 conversion cable
WS0-UC-232A

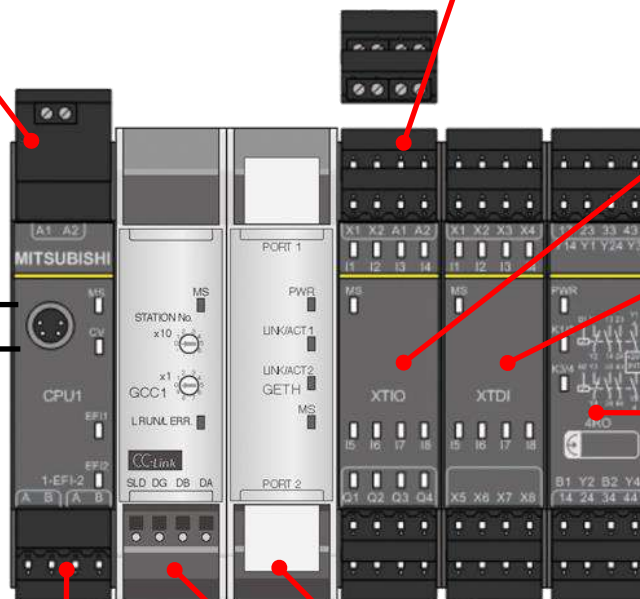


HMI (GOT)

RS-232 cable connecting to
CPU module WS0-C20R2

CPU module WS0-CPU0

CPU module (with EFI) WS0-CPU1 (compatible with Flexi Link)



Safety I/O module
WS0-XTIO

Safety input module
WS0-XTDI

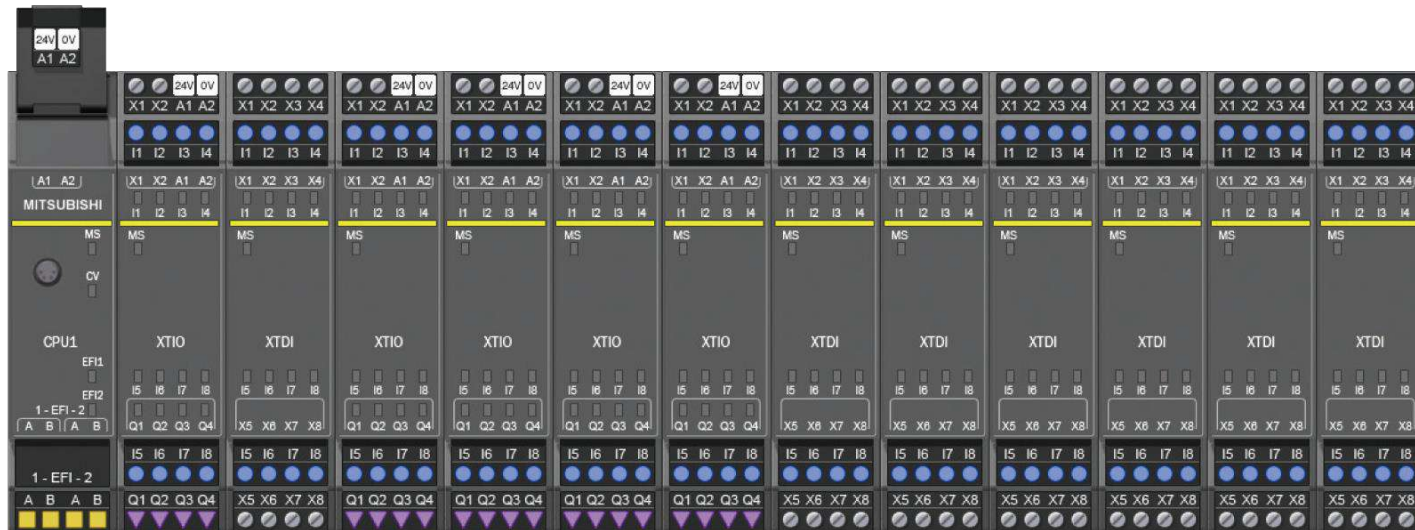
Safety relay output module
WS0-4RO

Ethernet interface module WS0-GETH

CC-Link interface module WS0-GCC1

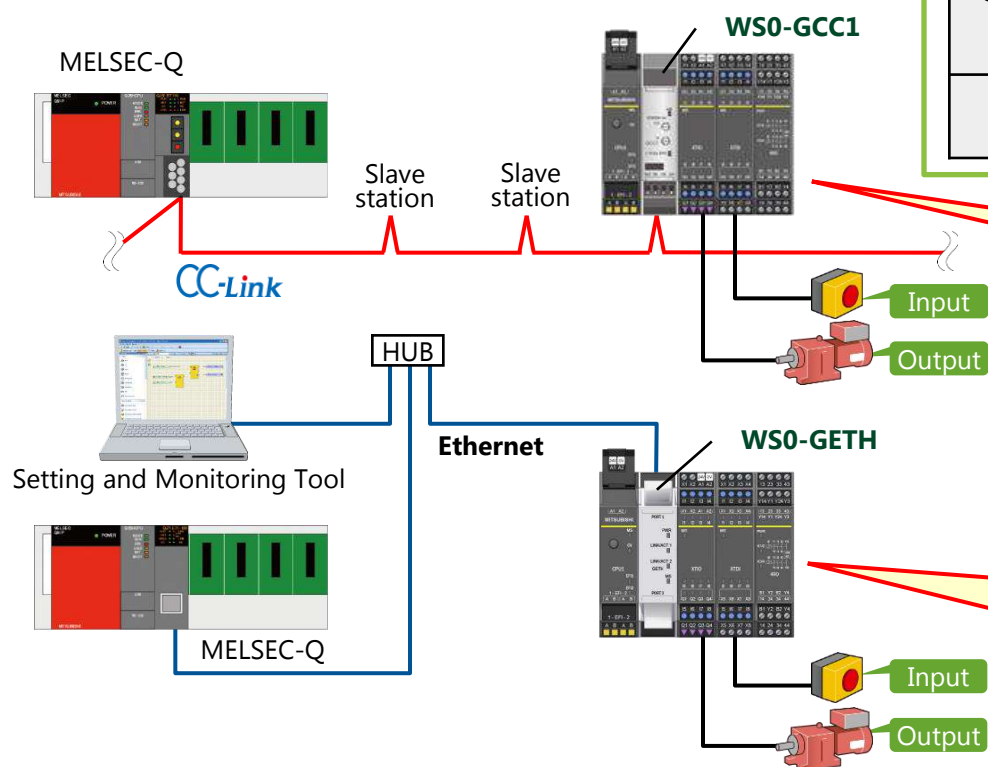
■ Compact safety controller with flexible expandability

- Up to 12 safety input modules and I/O modules, 4 safety relay output modules, and 2 network modules can be added.
- The number of I/O points can be expanded up to 144 (single input).
Safety input: 96 points (single input) + safety output: 48 points (single output)



With a safety controller connected to CC-Link, the existing MELSEC-Q/L programmable controller can execute safety control. Furthermore, operation status and error status of the safety controller can be monitored with the existing MELSEC-Q/L programmable controller.

Visualization in safety can be enhanced, and this improves the efficiency in identifying an emergency stop factor and investigating a faulty spot.



<Network interface-compatible function>

		CC-Link (WS0-GCC1)	Ethernet (WS0-GETH)
Programmable controller/personal computer	Monitoring information	○	○
	Data notification	○	○
Setting and Monitoring tool	Connection via network	-	○

CC-Link interface module WS0-GCC1

- Only with a parameter setting, this module allows the MELSEC product to monitor the safety controller and can send data to the product.
- With this module, a safety controller can be added to the existing CC-Link network as a remote device station.

Ethernet interface module WS0-GETH

- This module allows remote maintenance using the Setting and Monitoring Tool.

In this chapter, you have learned:

- Safety Controller
- Features of Safety Controller
- Basic Configuration of Safety Controller
- Safety Control can be Easily Added to Existing MELSEC Programmable Controllers (CC-Link/Ethernet)

Important points

The contents you learned in this chapter are listed below.

Safety Controller	• This section describes cases when a safety controller is used.
Features of Safety Controller	• This section describes features of the safety controller.
Basic Configuration of Safety Controller	• This section describes the basic configuration of the safety controller.
Safety Control can be Easily Added to Existing MELSEC Programmable Controllers (CC-Link/Ethernet)	• This section describes how to add safety control to the existing MELSEC programmable controller.

Chapter 2 System Construction

This chapter describes the system configuration constructed in this course.

2.1 System Image

2.2 Wiring

2.3 Summary of This Chapter

This section describes the overview of the safety system used in this course.

■ Part of an assembly line for automobile bodies

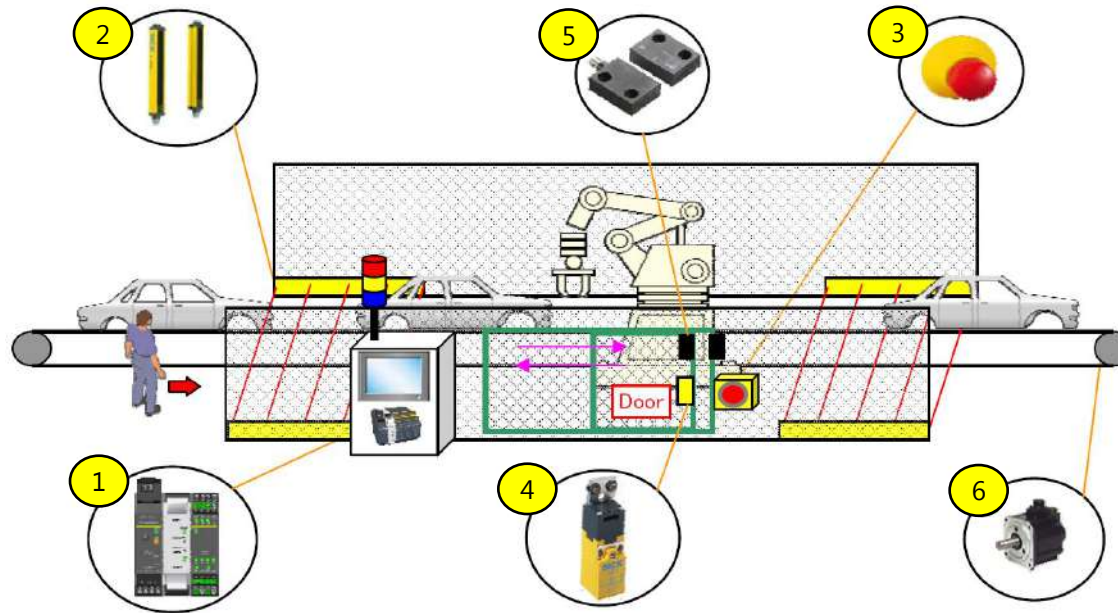


Figure. Application image

Operation

1. When light beams of the light curtain are cut off, the line stops.
 2. When the door is opened, the line stops.
 3. Pressing the emergency stop switch stops the line.
- * This e-Learning takes a simple example in which the motor is turned ON or OFF as operation control of the line.

2.2

Wiring

This section shows a device wiring diagram.

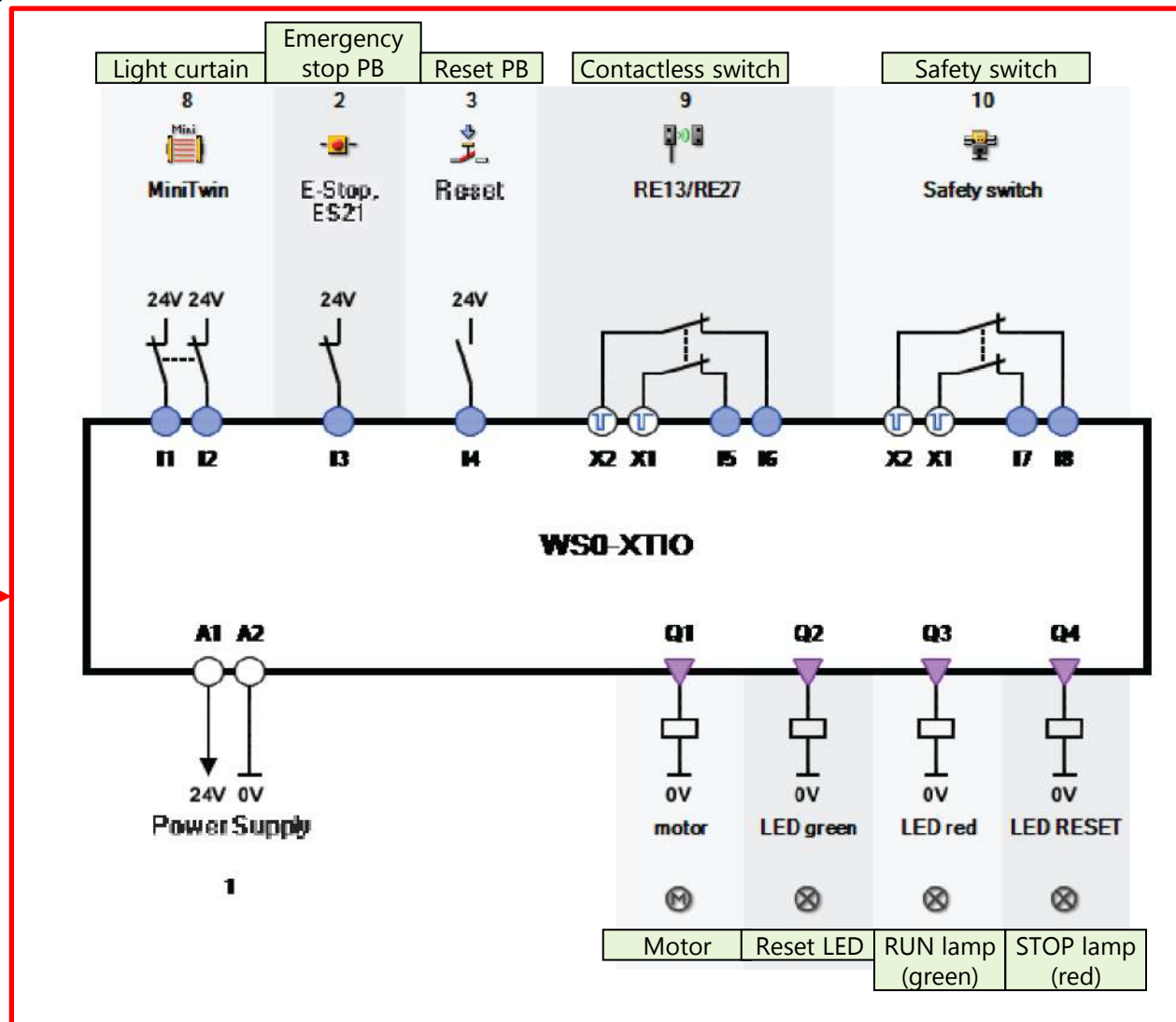


Figure. Device wiring

In this chapter, you have learned:

- System Image
- Wiring

Important points

The contents you learned in this chapter are listed below.

System Image	• This section describes the overview of the safety system used in this course.
Wiring	• This section describes the wiring of the safety system used in this course.

This chapter provides the setting method to connect a safety controller and personal computer and the check method.

3.1 Connecting Safety Controller and Personal Computer

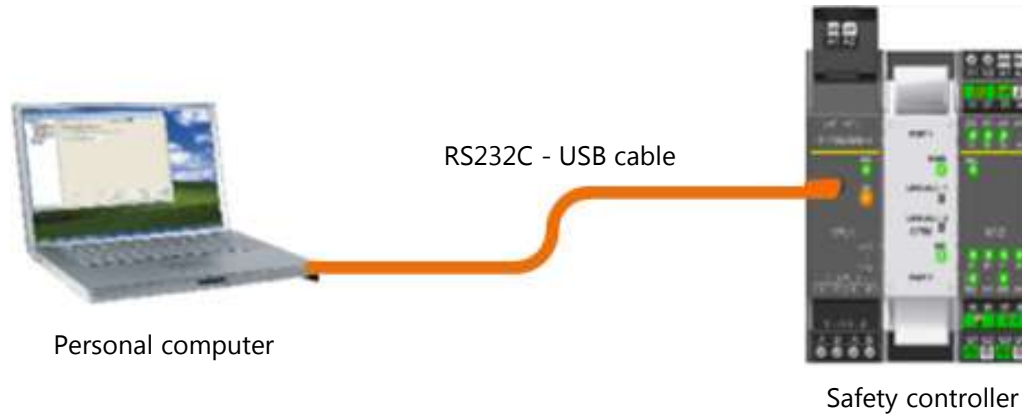
3.2 Operation on Setting and Monitoring Tool

3.3 Summary of This Chapter

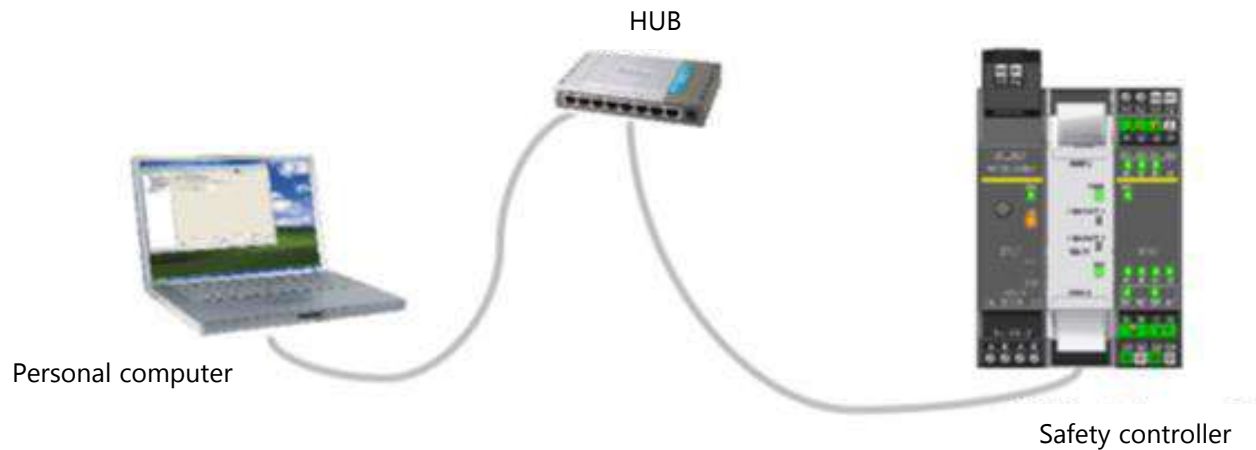
3.1 Connecting Safety Controller and Personal Computer

Connect a safety controller and personal computer in either of the following two ways.

■ RS232C connection

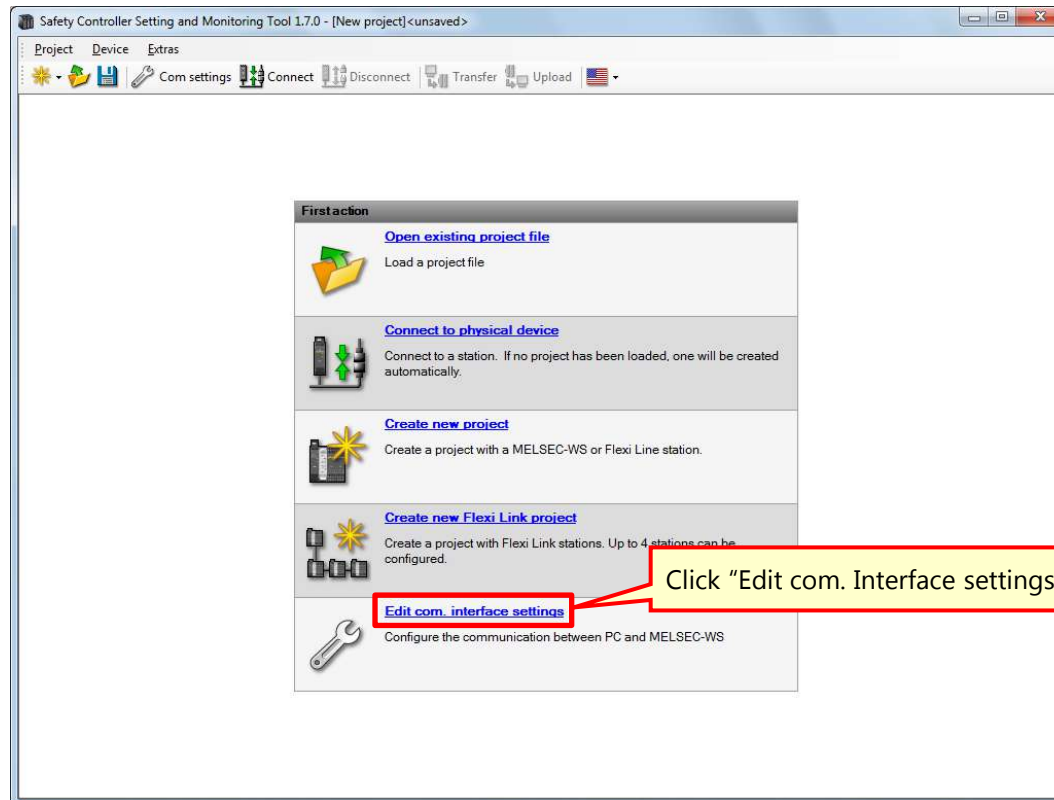


■ Ethernet connection



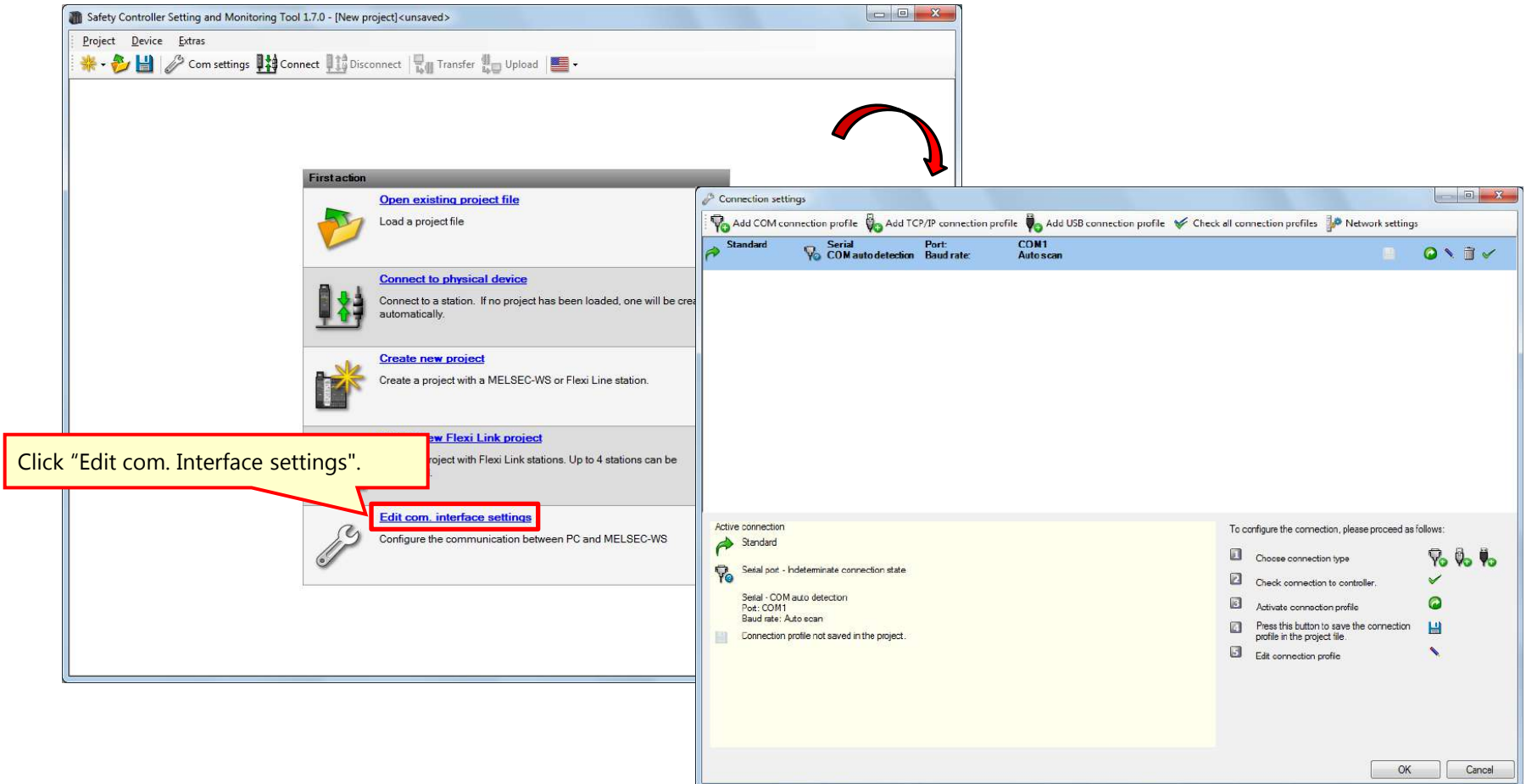
(1) Start the Setting and Monitoring tool for the safety controller.

* The following is for the RS232C connection.

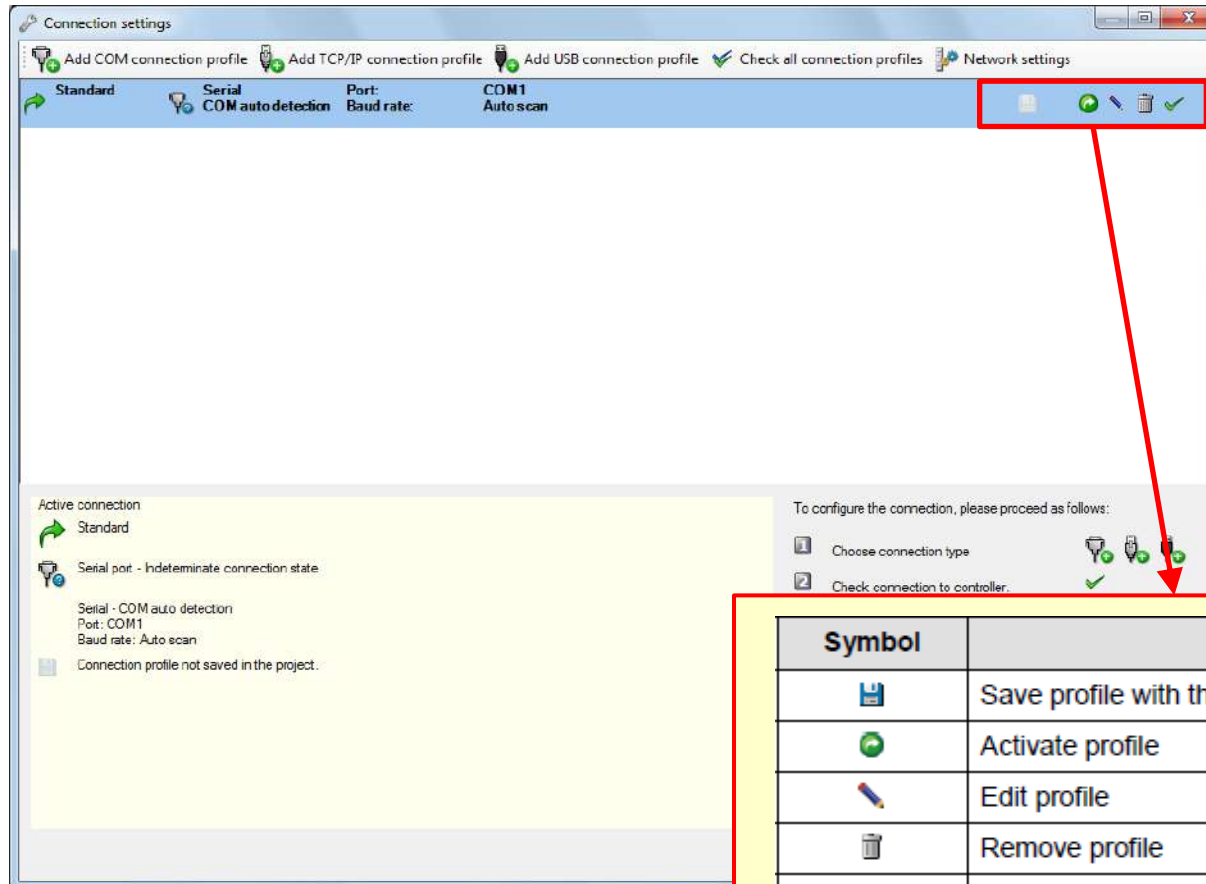


(2) Set a connection profile.

This section describes how to set a connection profile of a safety controller and personal computer.



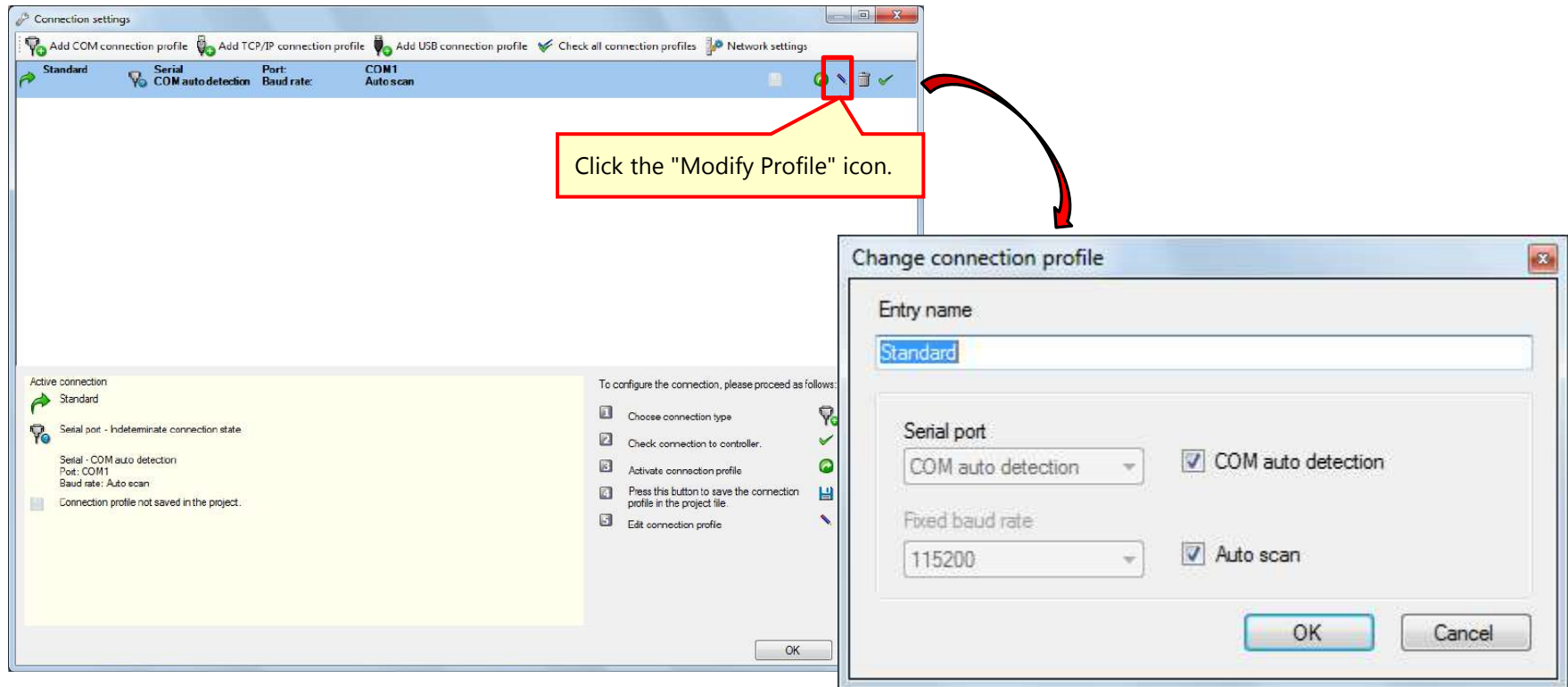
(3) Check the connection profile.



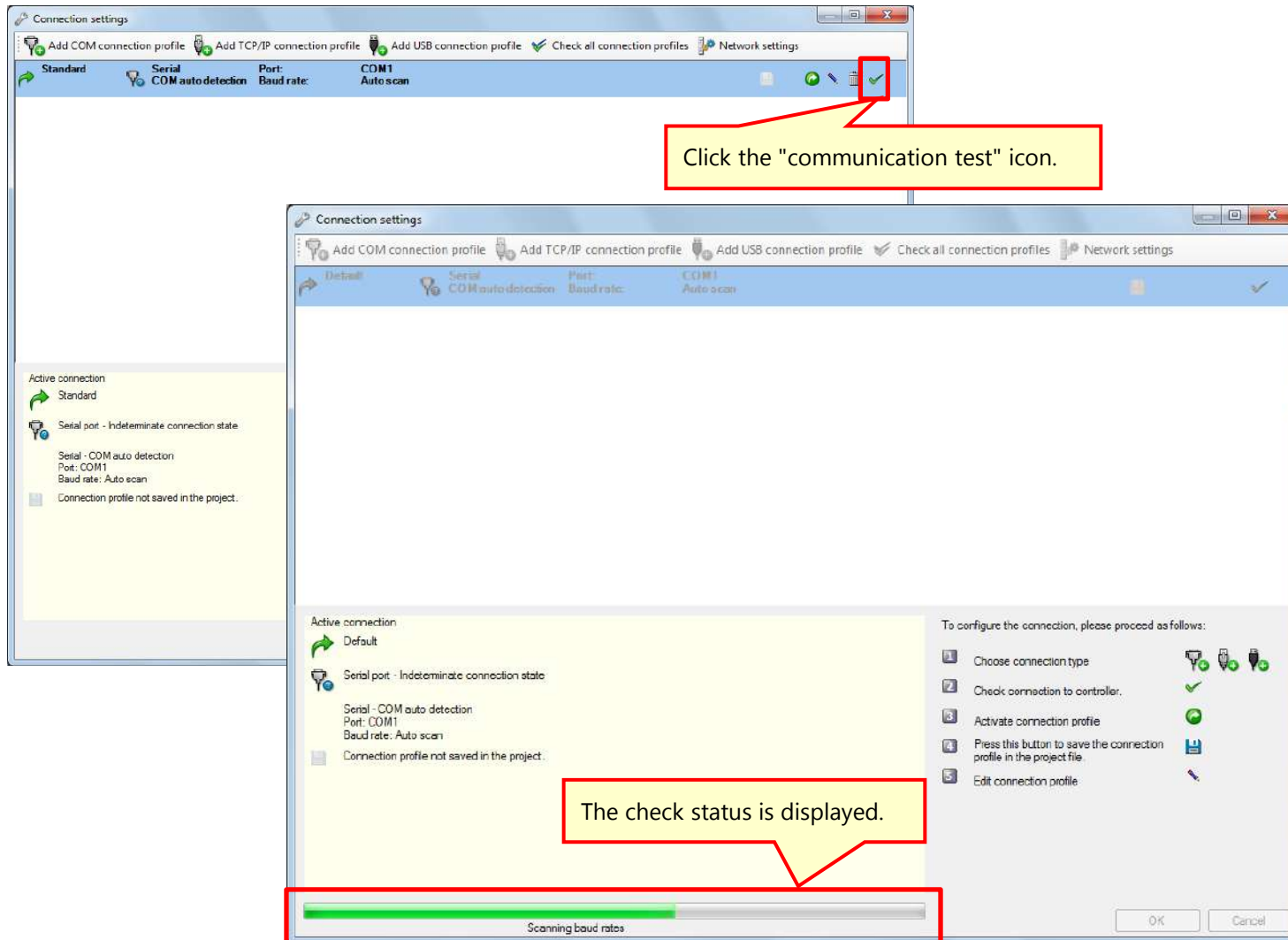
Symbols for editing the connection profiles in the Connection settings dialog box

(4) Edit the connection profile.

Select the "Modify Profile" icon.

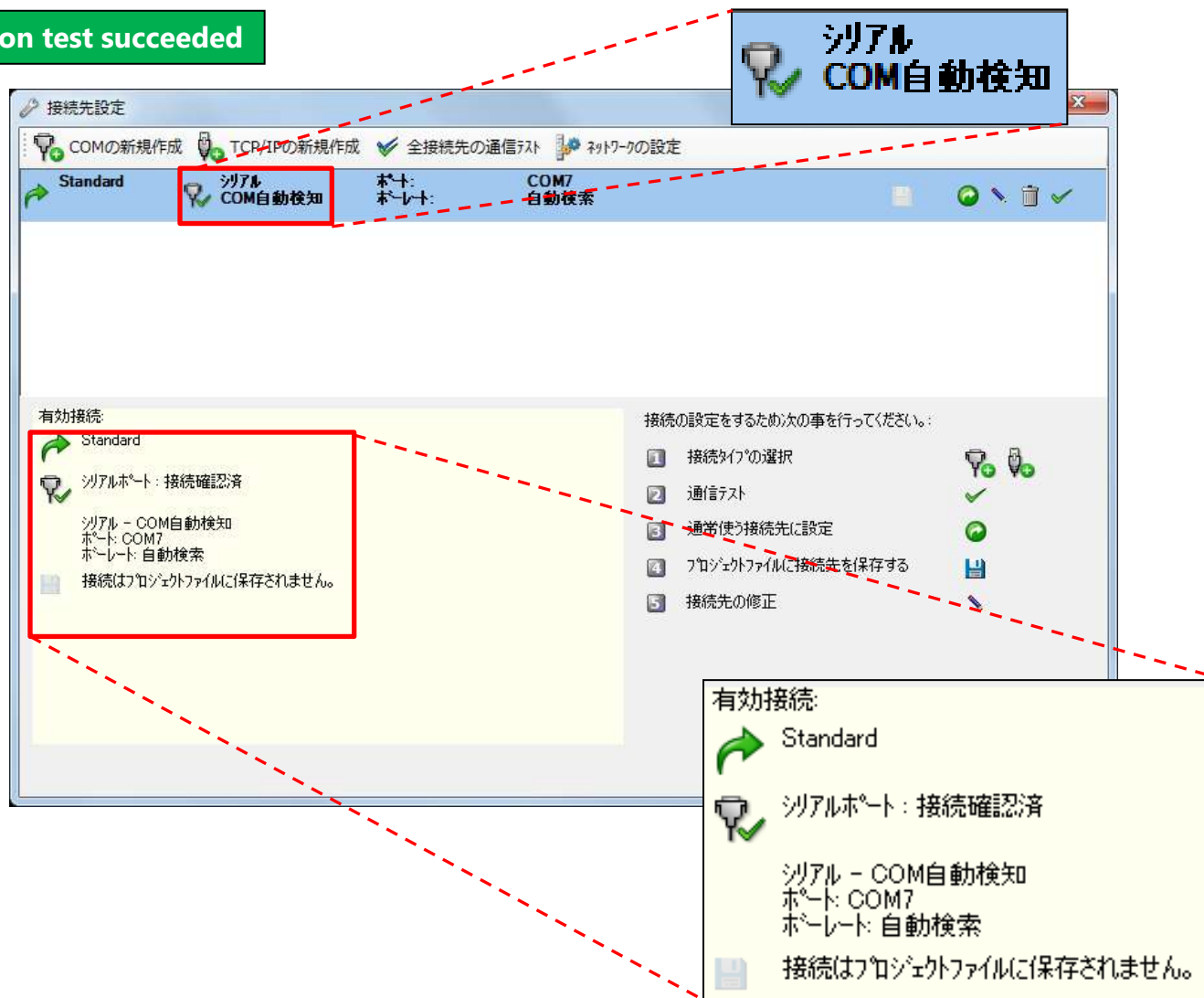


(5) Conduct a communication test.



(6) Check the communication test result (succeeded).

Communication test succeeded



(7) Check the communication test result (failed).

Communication test failed

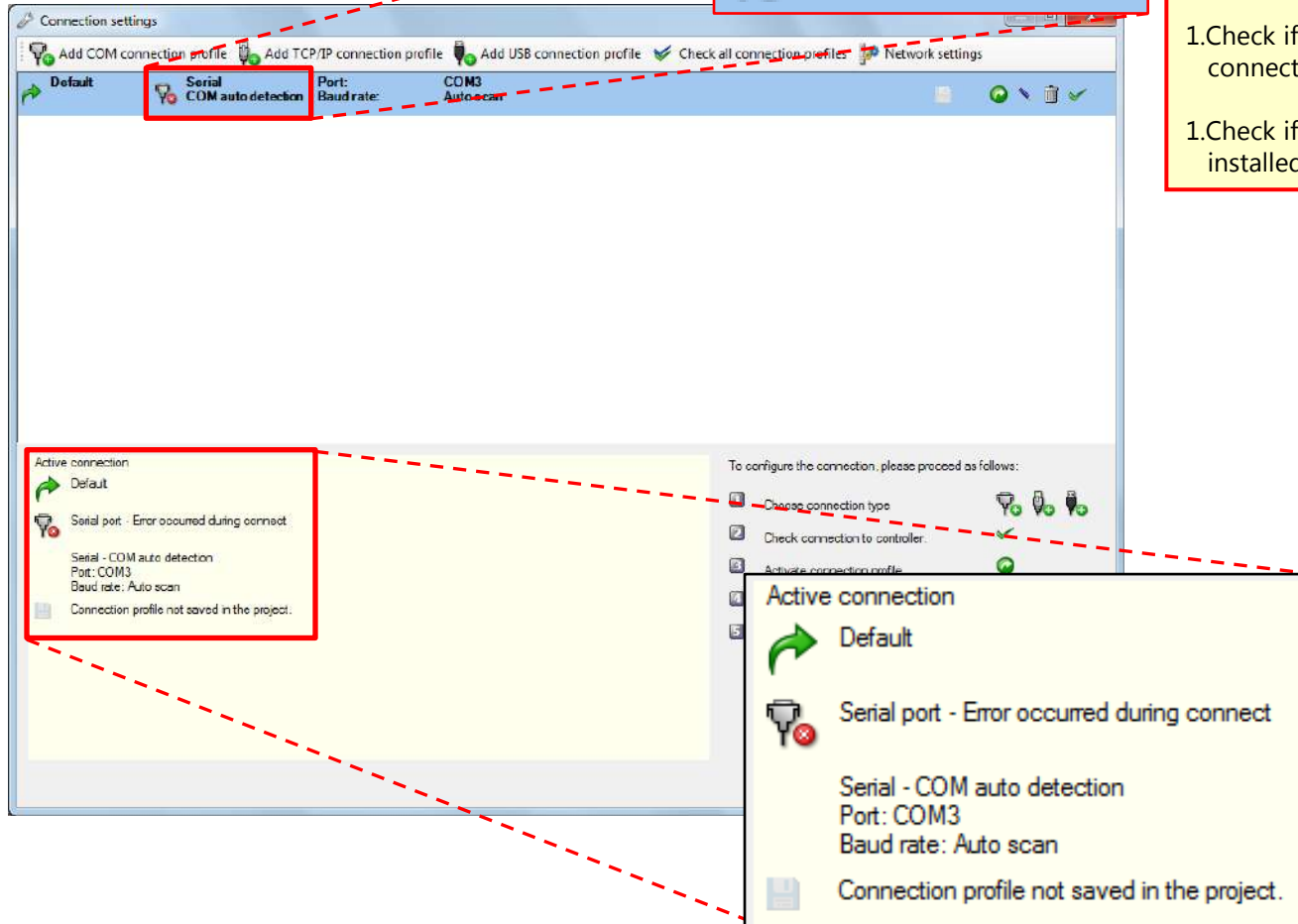
Serial
COM auto detection

Remedy

When the connection failed

1. Check if the cable is correctly connected.

1. Check if the driver is correctly installed.



In this chapter, you have learned:

- Connecting Safety Controller and Personal Computer
- Operation on the Setting and Monitoring Tool (Connection Profile Specification)

Important points

The contents you learned in this chapter are listed below.

Connecting Safety Controller and Personal Computer	• This section describes how to connect a safety controller and personal computer (RS-232C or Ethernet).
Operation on the Setting and Monitoring Tool (Connection Profile Specification)	• This section describes the operation on the Setting and Monitoring Tool.

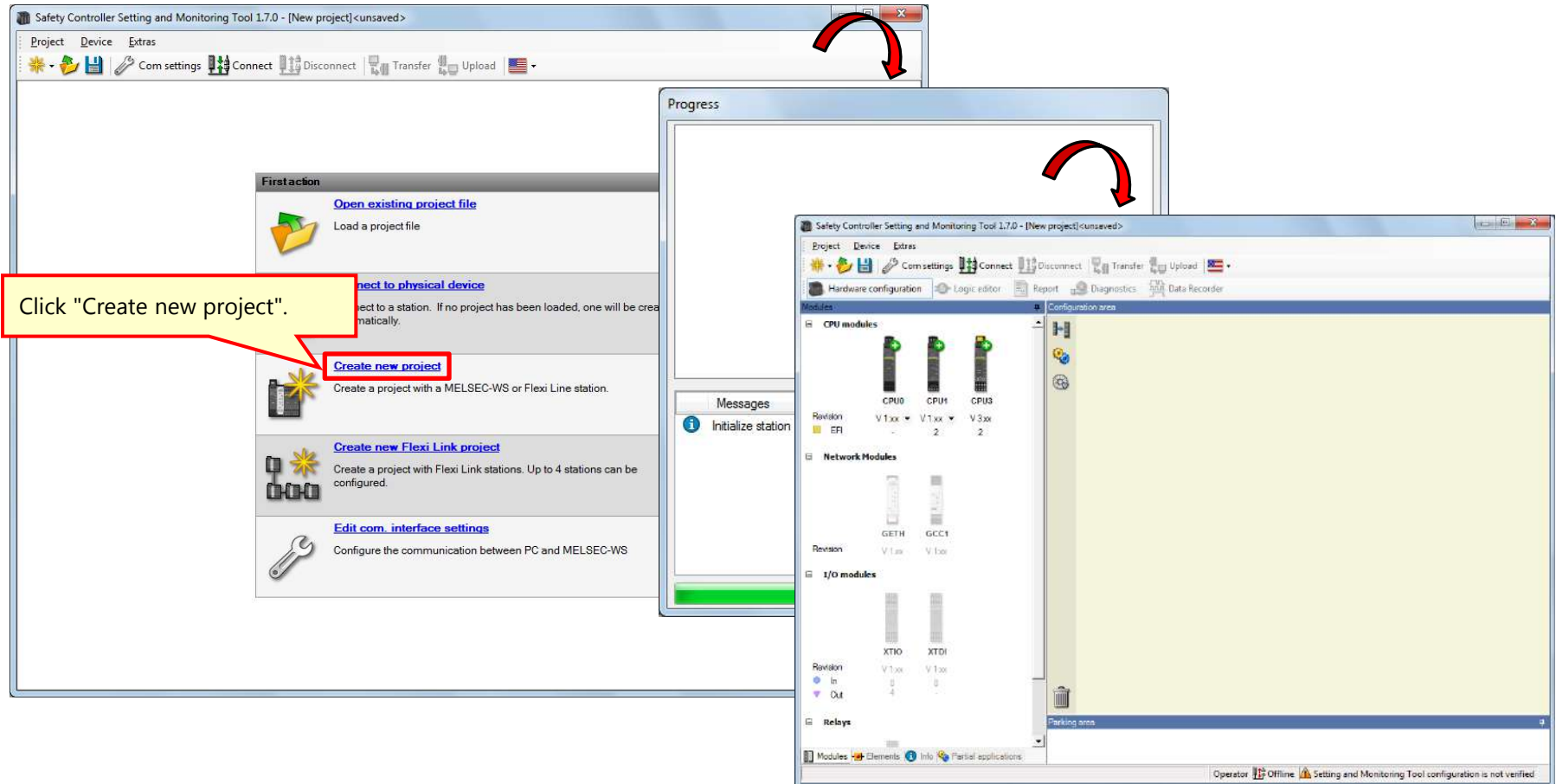
This chapter provides how to create projects for a safety controller.

- 4.1 New Project Creation
- 4.2 Hardware Setting
- 4.3 Pasting Elements and Setting Parameters
- 4.4 Tag Name Edit
- 4.5 Logic Creation
- 4.6 Project Simulation
- 4.7 Project Report Creation
- 4.8 Summary of This Chapter

4.1

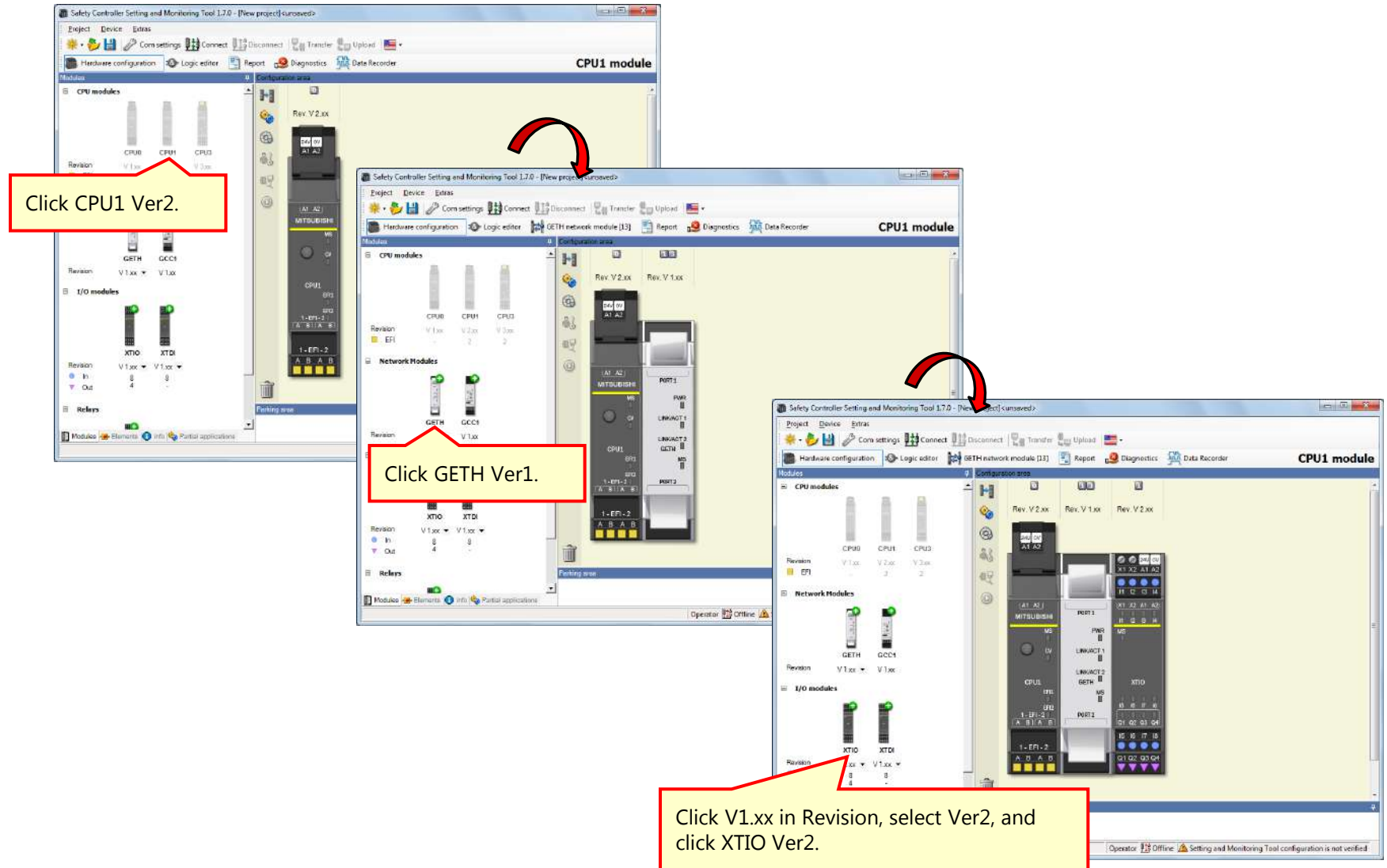
New Project Creation

Select "Create new project".



Hardware Setting

Select modules (CPU1, GETH, and XTIO) used in the hardware setting. (Clicking the icon of a module pastes the module on the right edge.)

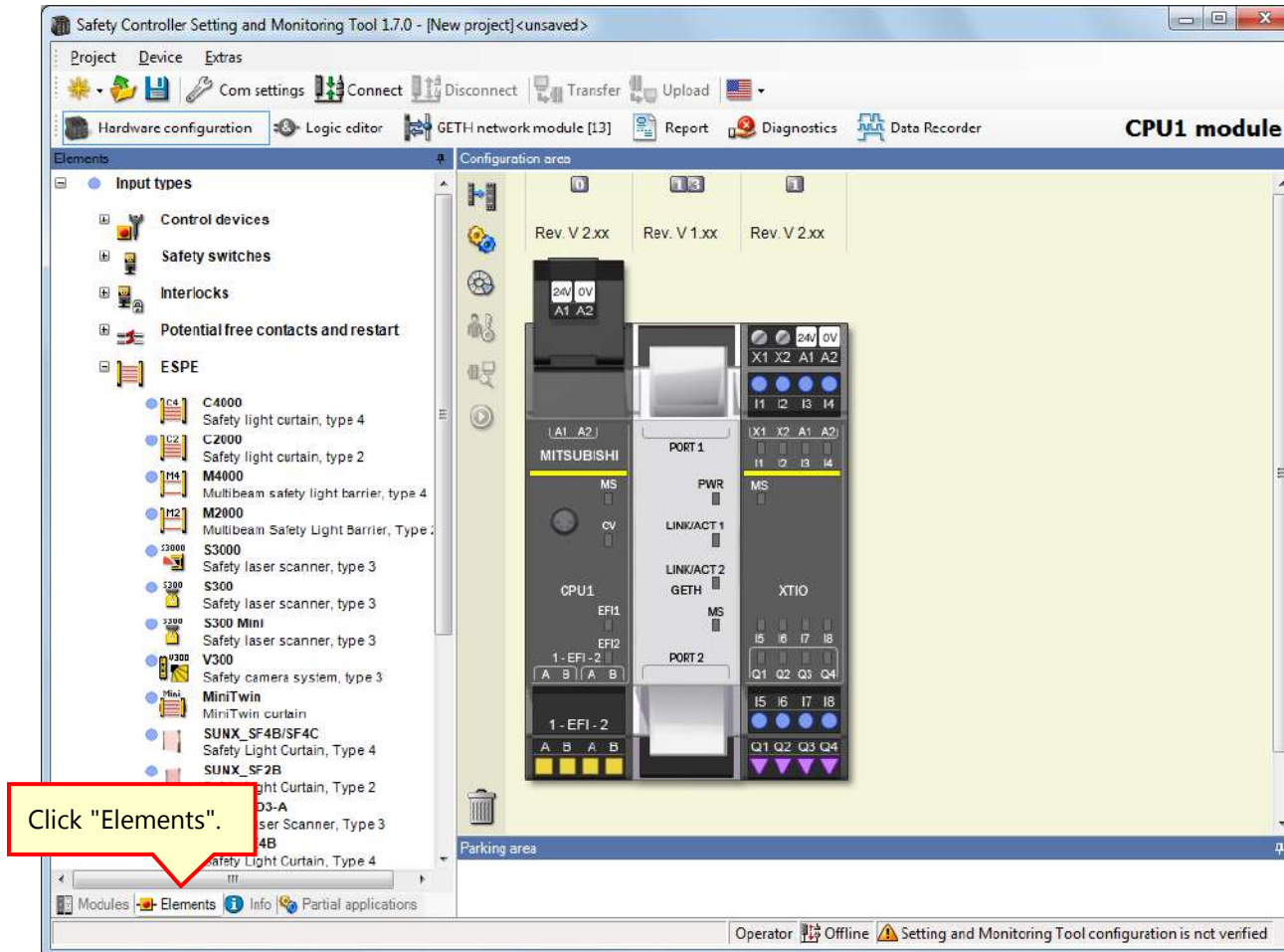


4.3

Pasting Elements and Setting Parameters

Set elements on the safety controller according to the device wiring.

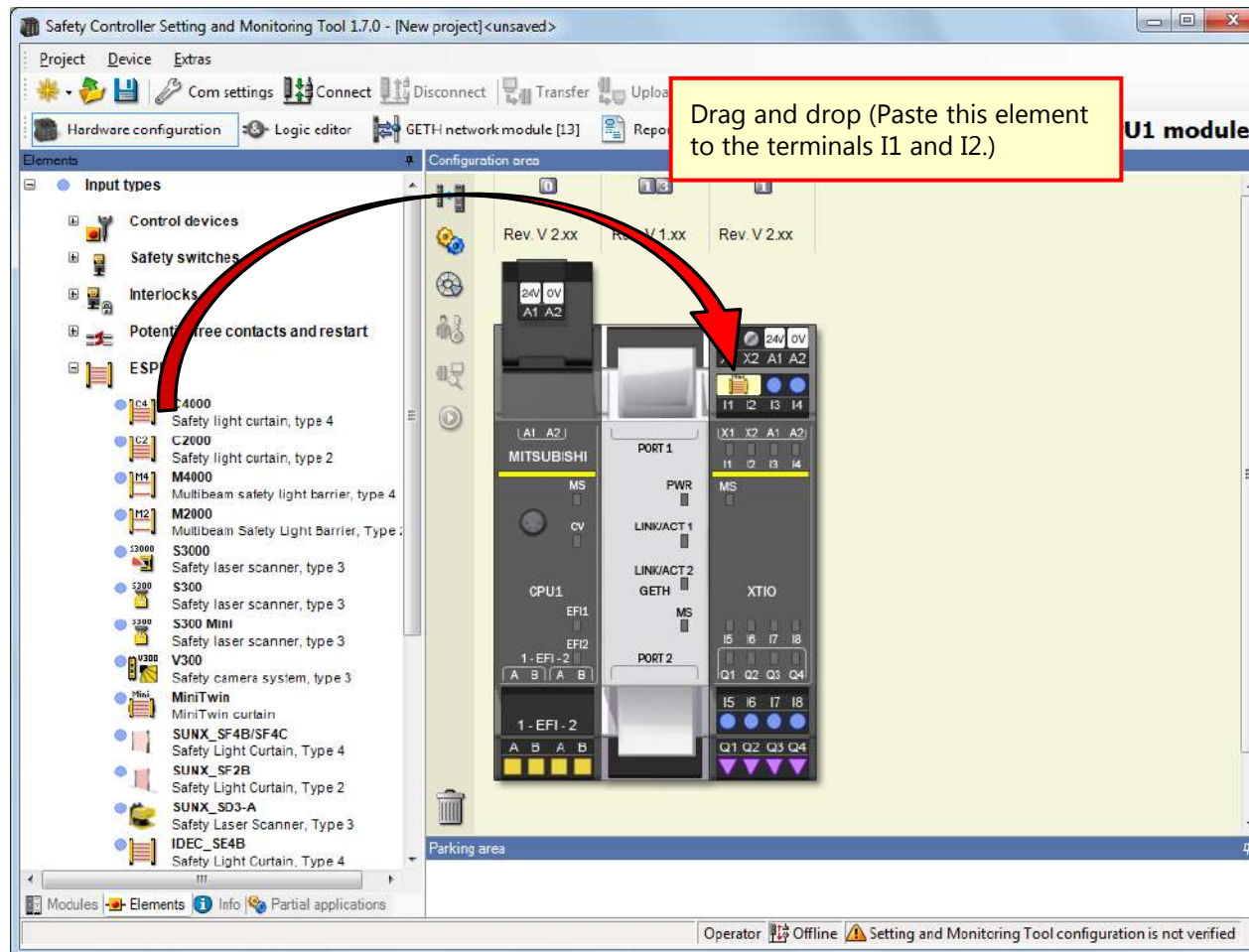
→ Activate the "Elements" tag.



4.3.1

Pasting an Element of the Light Curtain

→ Select [Input types] - [ESPE], and paste [**MiniTwin, MiniTwin curtain**] to the **terminals I1 and I2**.



4.3.2

Setting the Parameter of the Light Curtain

Double-click the element of the light curtain to set the parameter.

The screenshot displays the 'Safety Controller Setting and Monitoring Tool 1.7.0' interface. The main window shows a hardware configuration for a 'CPU1 module'. A red arrow points from a yellow callout box to the 'MiniTwin' element in the configuration area. The callout box contains the text: 'Double-click "MiniTwin curtain".'

The 'Element settings' dialog box is open, showing the 'Settings' tab. The dialog title is 'MiniTwin: "MiniTwin" I1 I2: MiniTwin curtain'. The settings include:

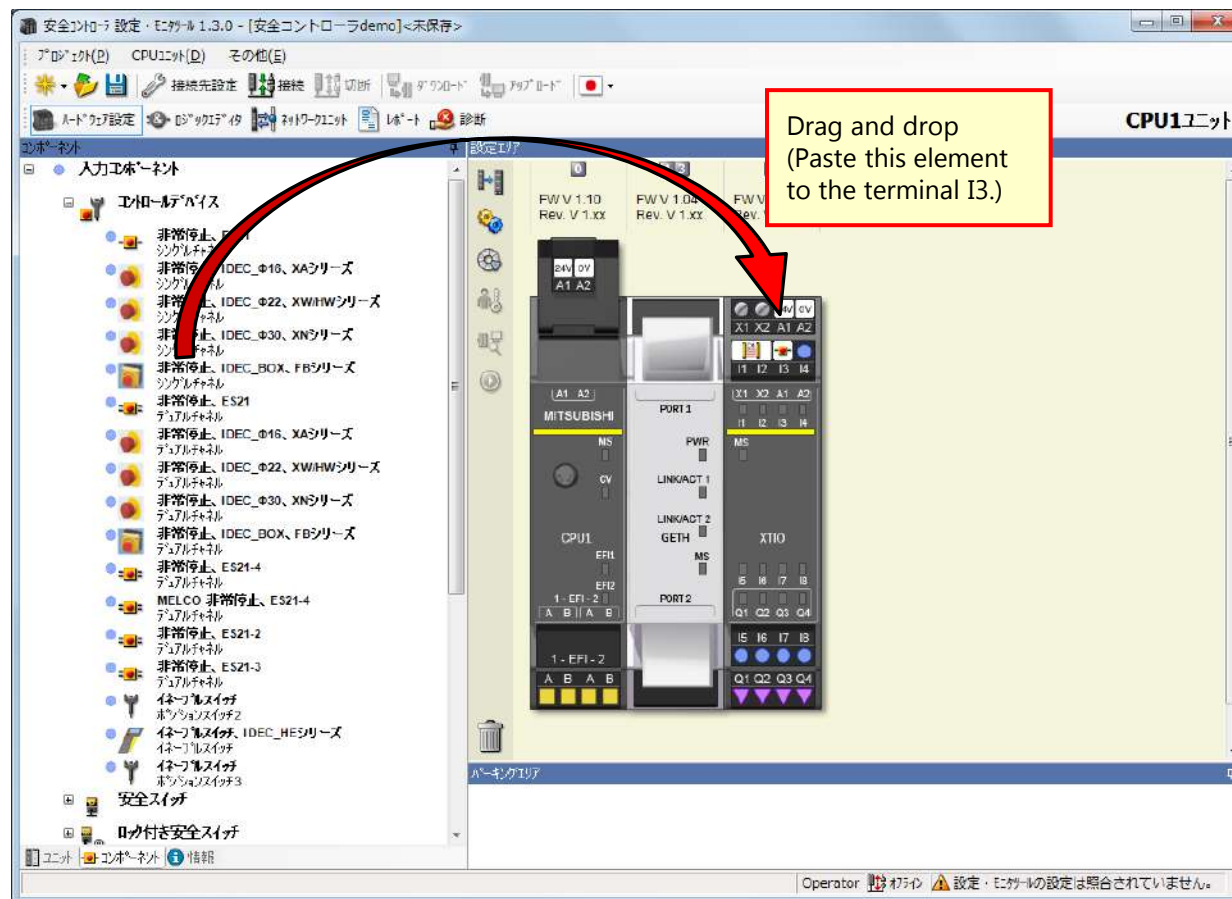
- Tag name: [Empty text field]
- Nr. of devices: 1
- ☒ Safety element
- ☒ Discrepancy time
- Value: 3000 ms

At the bottom of the dialog are 'OK' and 'Cancel' buttons.

4.3.3

Pasting an Element of the Emergency Stop Push-Button Switch

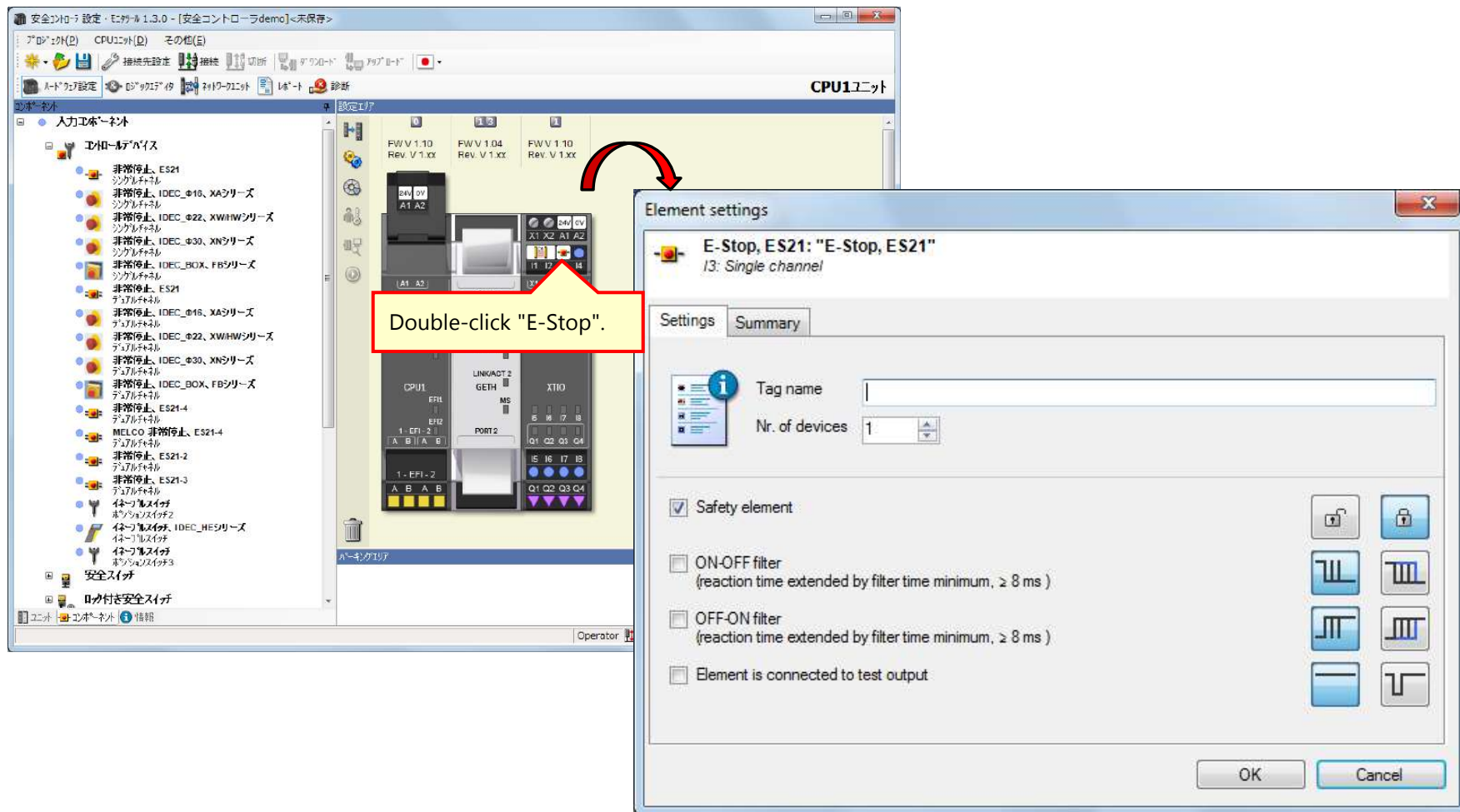
Select [Input types] - [Control devices], and paste [**E-Stop, ES21, Single channel**] to the **terminal I3**.



4.3.4

Setting the Parameter of the Emergency Stop Push-Button Switch

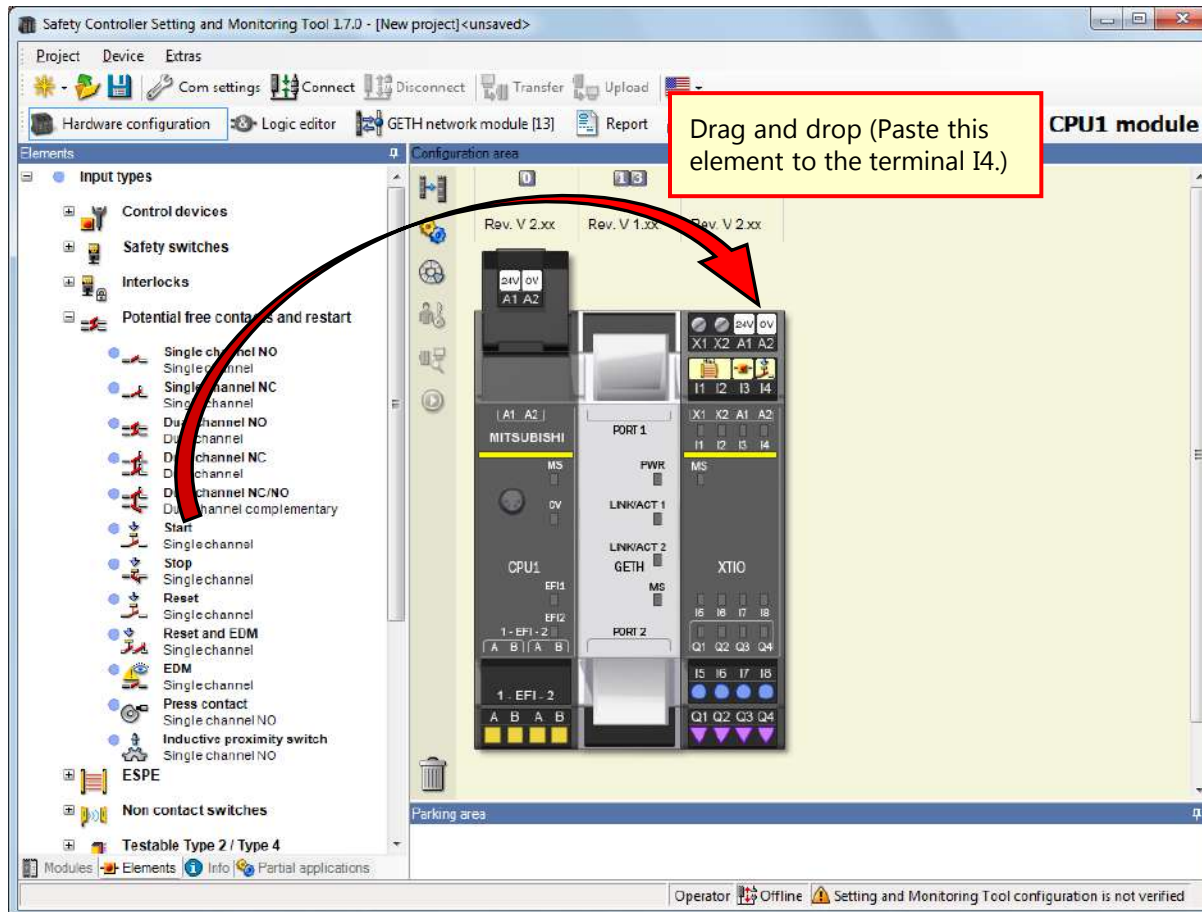
Double-click the element of the emergency stop push-button switch to set the parameter.



4.3.5

Pasting an Element of the Reset Switch

Select [Input types] - [Potential free contacts and restart], and paste [**Reset, Single channel**] to the **terminal I4**.



4.3.6

Setting the Parameter of the Reset Switch

Double-click the element of the reset switch to set the parameter.

The screenshot displays the 'Safety Controller Setting and Monitoring Tool 1.7.0' interface. The main window shows a 'Configuration area' with a diagram of the safety controller hardware. A red arrow points from a yellow callout box labeled 'Double-click "Reset"' to the 'Reset' switch element in the diagram. The 'Element settings' dialog is open, showing the 'Reset: "Reset"' configuration. The dialog has two tabs: 'Settings' and 'Summary'. The 'Settings' tab is active, showing the following options:

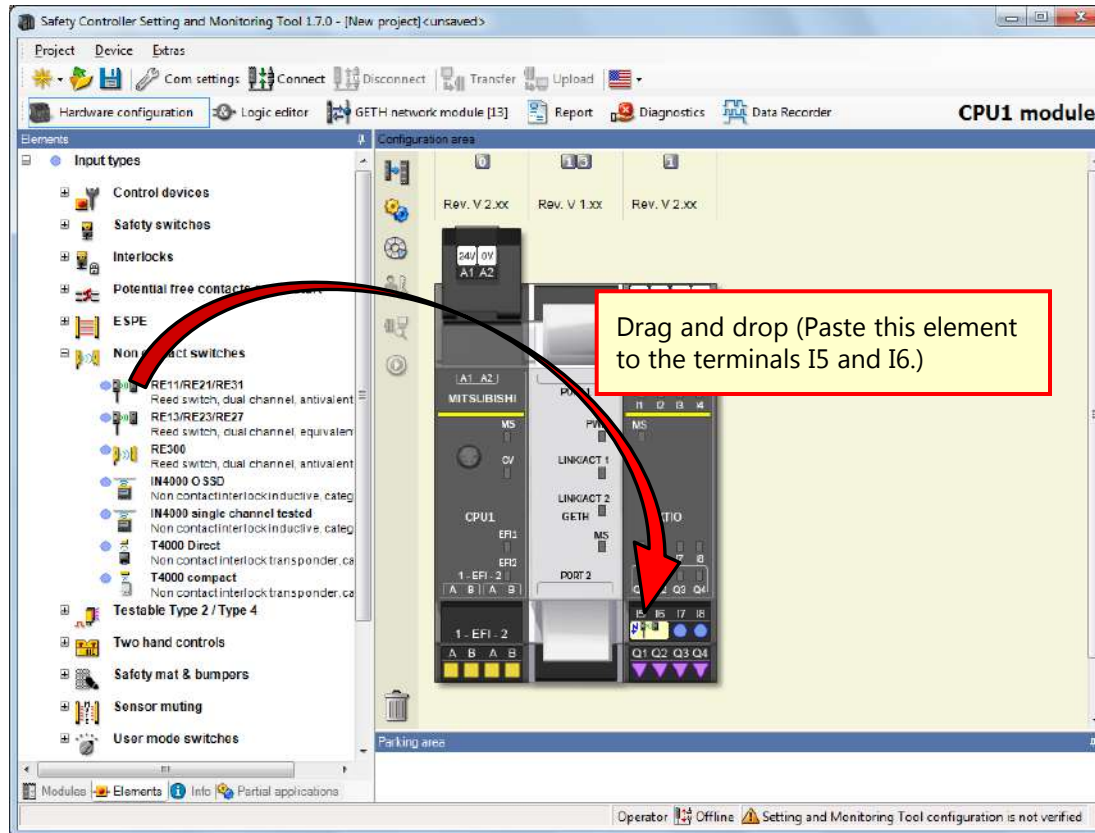
- ☒ Safety element
- ☐ ON-OFF filter (reaction time extended by filter time minimum, ≥ 8 ms)
- ☐ OFF-ON filter (reaction time extended by filter time minimum, ≥ 8 ms)
- ☐ Element is connected to test output

The 'Summary' tab shows the 'Tag name' field and the 'Nr. of devices' set to 1. The dialog also includes a 'Parking area' section with various icons for signal types. The 'OK' and 'Cancel' buttons are at the bottom right.

4.3.7

Pasting an Element of the Contactless Safety Door Switch

Select [Input types] - [Non contact switches], and paste [**RE13/RE23/RE27, Reed switch, dual channel, equivalent**] to the **terminals I5 and I6**.



4.3.8

Setting the Parameter of the Contactless Safety Door Switch

Double-click the element of the contactless safety door switch to set the parameter.

The screenshot displays the 'Safety Controller Setting and Monitoring Tool 1.7.0' interface. The main window shows a 'Configuration area' with a rack of modules. A red arrow points from the 'RE13/RE23/RE27' module in the rack to the 'Element settings' dialog box.

Element settings

RE13/RE23/RE27: "RE13/RE23/RE27"
I5 I6: Reed switch, dual channel, equivalent

Settings | Test outputs | Summary

Tag name:
Nr. of devices: 1

☒ Safety element

☐ ON-OFF filter
(reaction time extended by filter time minimum, ≥ 8 ms)

☐ OFF-ON filter
(reaction time extended by filter time minimum, ≥ 8 ms)

☒ Element is connected to test output

☒ Discrepancy time

Value: 3000 ms

OK Cancel

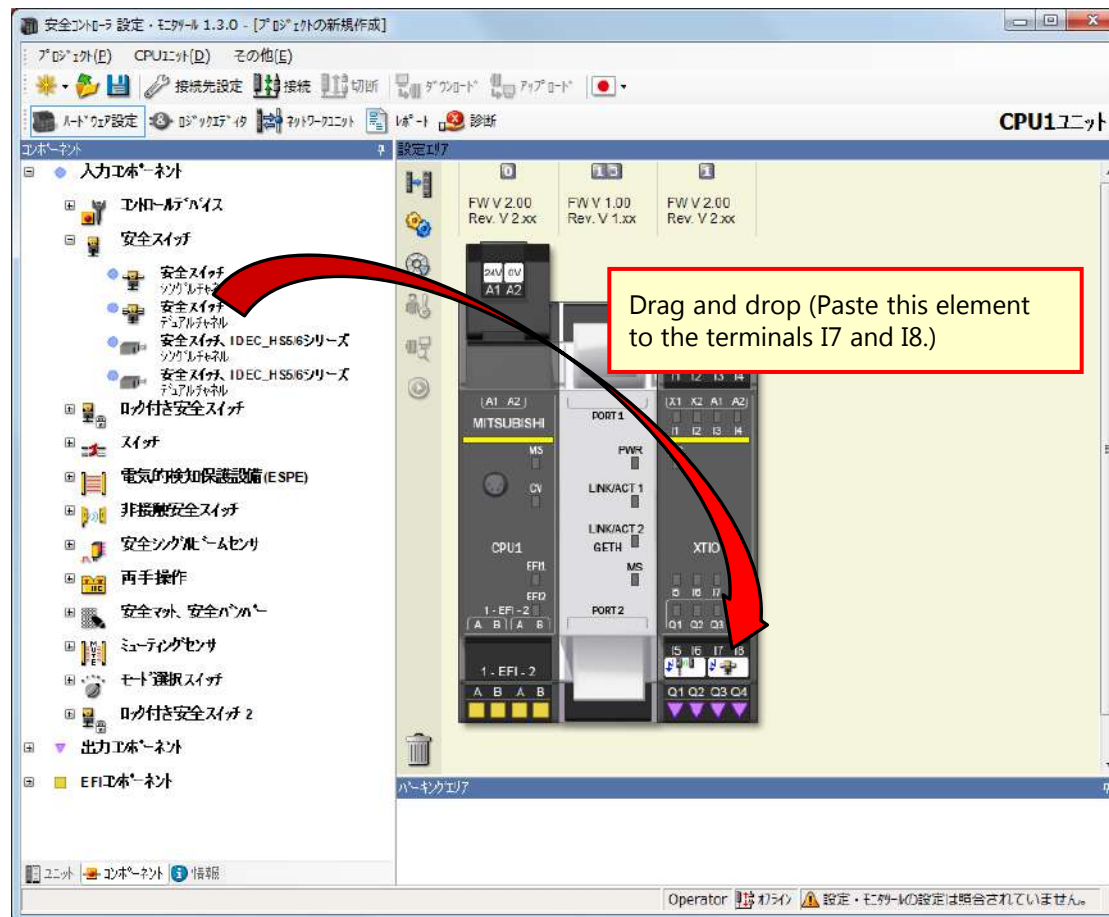
Double-click "RE13/RE23/RE27".

4.3.9

Pasting an Element of the Safety Door Switch

Set an element to the safety controller, like the real device.

→ Select [Input types] - [Safety switches], and paste [**Safety switches, Dual channel**] to the **terminals I7 and I8**.



4.3.10

Setting the Parameter of the Safety Door Switch

Double-click the element of the safety door switch to set the parameter.

The screenshot shows the '安全コンポーネント設定' (Safety Component Setting) window for 'モジュール 1.3.0'. The left sidebar lists various components, including '安全スイッチ' (Safety Switch) and '安全スイッチ, IDEC_HS56シリーズ' (Safety Switch, IDEC_HS56 Series). The main area displays a rack of modules, including 'MITSUBISHI' and 'XTIO'. A red arrow points from the '安全スイッチ' element in the rack to the 'Element settings' dialog box.

The 'Element settings' dialog box is titled 'Safety switch: "Safety switch"' and shows the following settings:

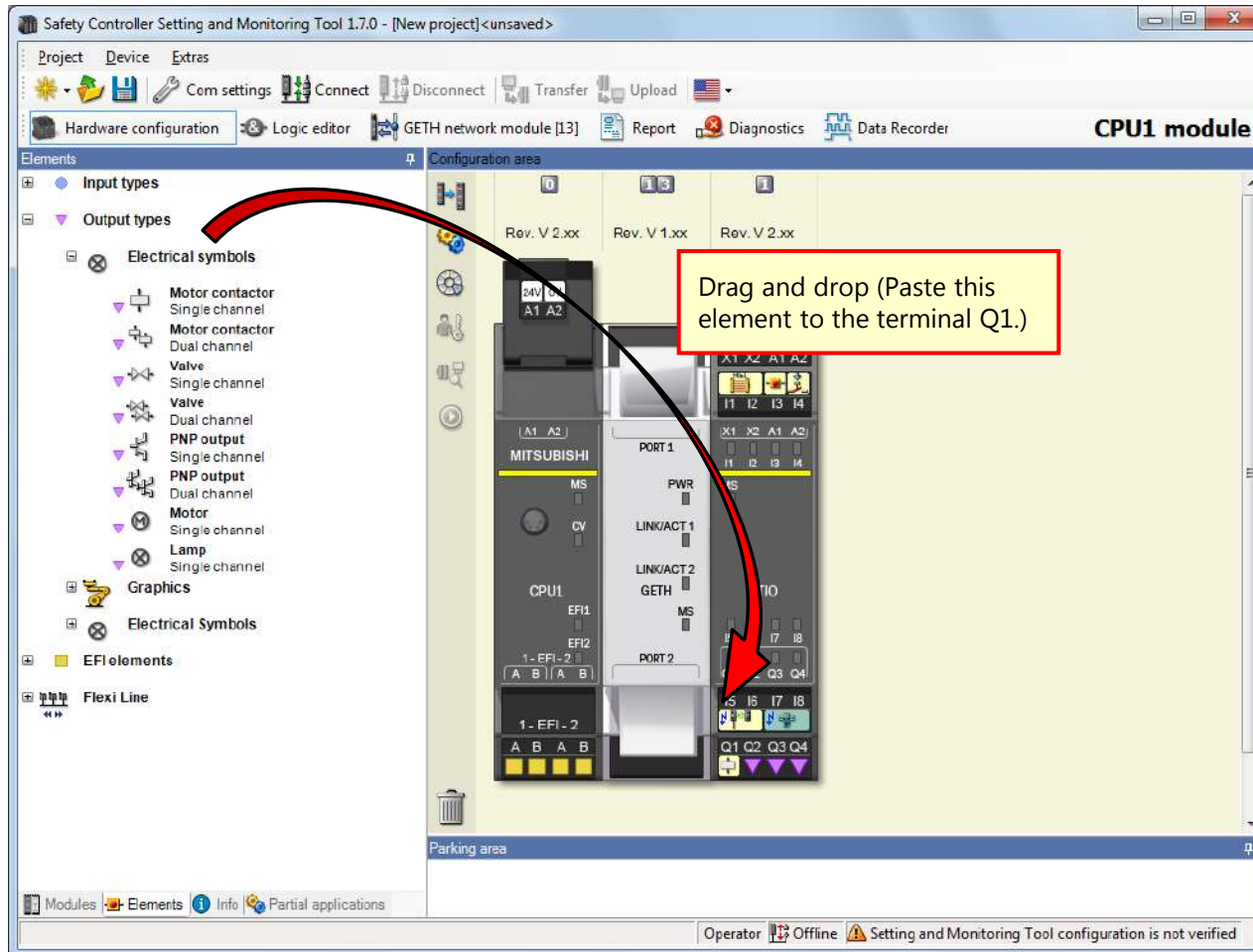
- Tag name: [Empty field]
- Nr. of devices: 1
- ☒ Safety element
- ☐ ON-OFF filter (reaction time extended by filter time minimum, ≥ 8 ms)
- ☒ Element is connected to test output
- ☒ Discrepancy time
- Value: 3000 ms

At the bottom of the dialog box are 'OK' and 'Cancel' buttons. A red callout box points to the '安全スイッチ' element in the rack with the text: 'Double-click " Safety switches ".'

4.3.11 Pasting an Element of the Motor

Set an element to the safety controller, like the real device.

→ Select [Output types] - [Electrical symbols], and paste [**Motor contactor, Single channel**] to the **terminal Q1**.



4.3.12

Setting the Parameter of the Motor

Double-click the element of the motor to set the parameter.

The screenshot displays the 'Safety Controller Setting and Monitoring Tool 1.7.0' interface. The main window shows a 'Configuration area' with a rack of modules including a MITSUBISHI CPU, PORT1, PORT2, and XTIO. A red arrow points from the 'Motor' element in the 'Elements' list to the 'Element Settings' dialog box.

(1) Double-click "Motor".

The 'Element Settings' dialog box is titled 'Motor contactor: "Motor contactor"'. It has two tabs: 'Settings' and 'Summary'. The 'Settings' tab is active, showing the 'Tag name' field set to 'motor'. A red box highlights this field with the annotation **(2) Input a tag name.**

Other settings in the dialog include:

- Nr. of devices: 1
- ☒ Safety element
- ☒ Enabling Test pulses of this output. Attention: Disabling the test pulses may lead to a reduction of the safety values of all outputs of this module. For the precise values see the user's manual (hardware).

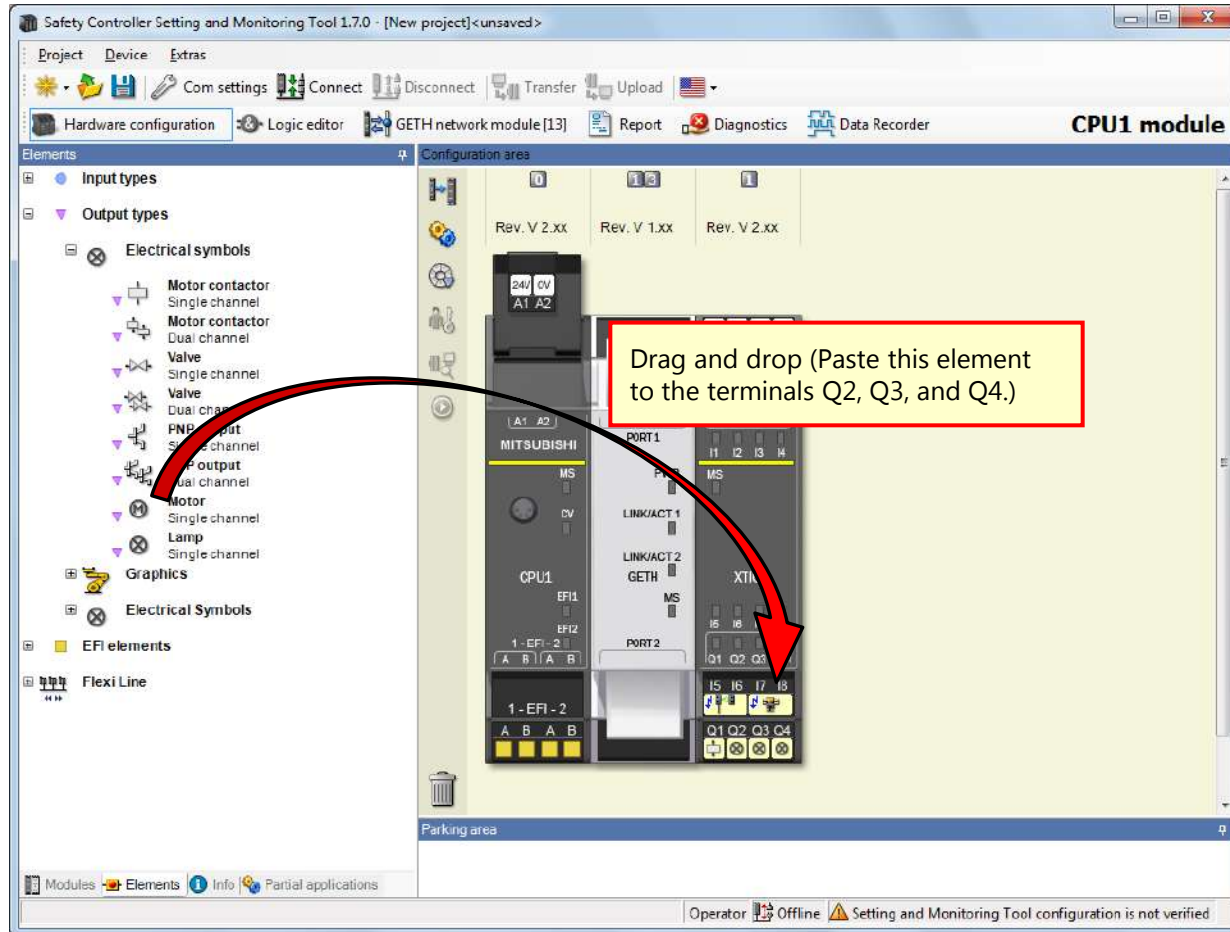
The dialog box has 'OK' and 'Cancel' buttons at the bottom right.

4.3.13

Pasting an Element of the Lamp

Set an element to the safety controller, like the real device.

→ Select [Output types] - [Electrical symbols], and paste [**Lamp, Single channel**] to the **terminals Q2, Q3, and Q4**.



4.3.14

Setting the Parameter of the Lamp

Double-click the element of the lamp to set the parameter.

(1) Double-click "LED".

(2) Input a tag name.

The type of these elements is the same, but you can assign different names to each of them.

Tag name	LED green	Tag name of the LED of the terminal Q2
Tag name	LED red	Tag name of the LED of the terminal Q3
Tag name	LED RESET	Tag name of the LED of the terminal Q4

Element settings
 Lamp "Lamp"
 Q2: Single channel

Settings Summary

Tag name: LED green

Nr. of devices: 1

☒ Safety element

☒ Enabling Test pulses of this output.
 Attention: Disabling the test pulses may lead to a reduction of the safety values of all outputs of this module.
 For the precise values see the user's manual (hardware). *

OK Cancel

Edit tag names as necessary.

(2) Click an active section on the left side, and select an item having an edit-target name.
(Here, "Local I/O" is taken as an example.)

(1) Click "Edit tag names".

(3) The tag names of the selected item are listed in the tree on the right side of the window.
Select the bit having an edit-target tag name on the tree view, and input a name in the input field. If a bit already has a tag name, the name can be edited as necessary.
(Tag names input in the parameter setting are displayed.)

The screenshot shows the 'Safety Controller Setting and Monitoring Tool 1.7.0' interface. The 'Edit tag names' button is highlighted in the toolbar. The 'Local I/O' section is selected in the hardware rack. The 'XTIO[1]' tree view on the right lists the following components:

- 17/18 Safety switch
- 15/16 RE13/RE23/RE27
- 14 Reset
- 13 E-Stop, ES21
- 11/12 MiniTwin
- Q4 Lamp
- Q3 Lamp
- Q2 Lamp
- Q1 Motor contactor

The 'XTIO[1]' tree view on the left lists the following components:

- 17/18 Safety switch
- 15/16 RE13/RE23/RE27
- 14 Reset
- 13 E-Stop, ES21
- 11/12 MiniTwin
- Q4 Lamp
- Q3 Lamp
- Q2 Lamp
- Q1 Motor contactor

4.5

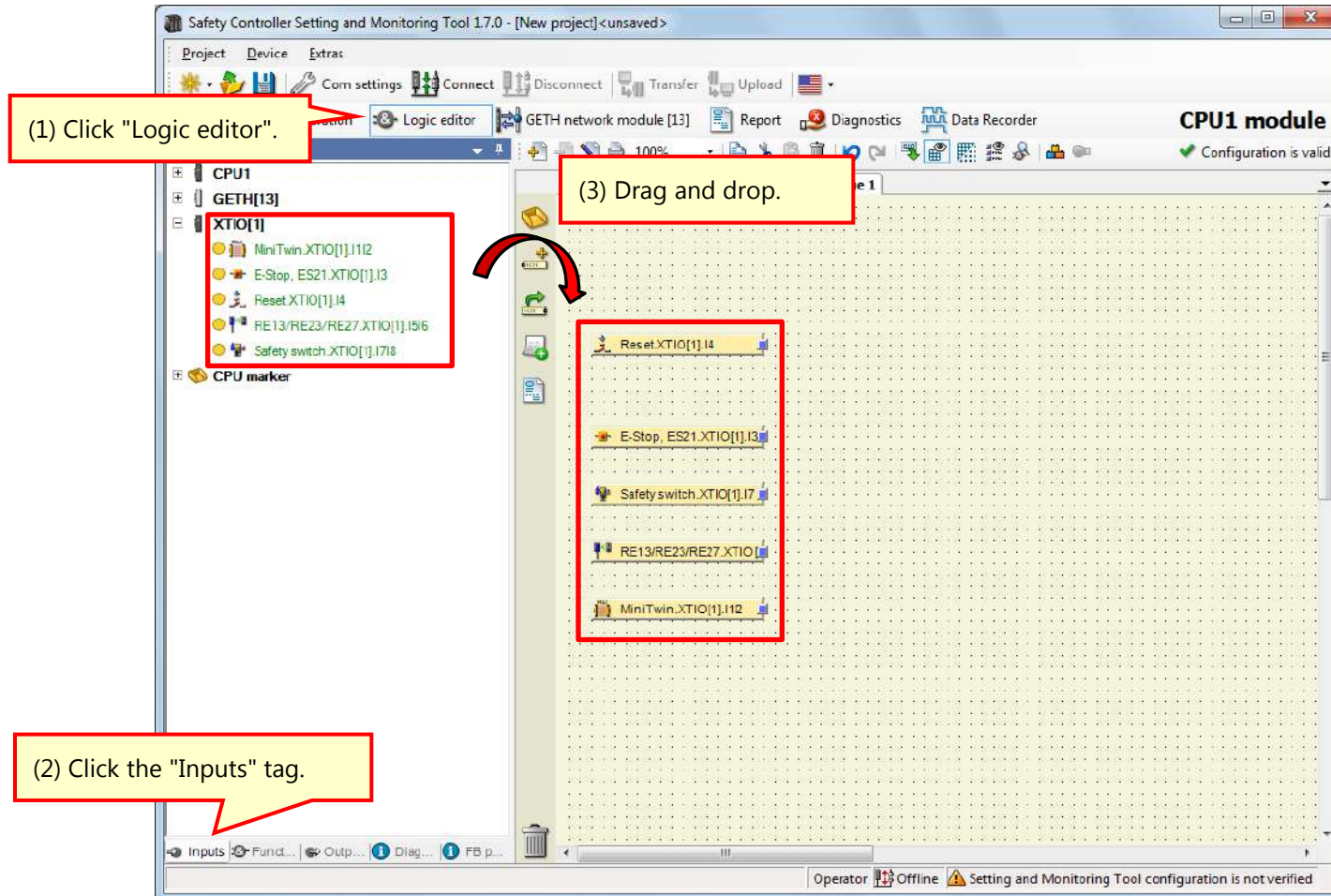
Logic Creation

Program on the Logic editor.

4.5.1

Programming (Pasting Inputs)

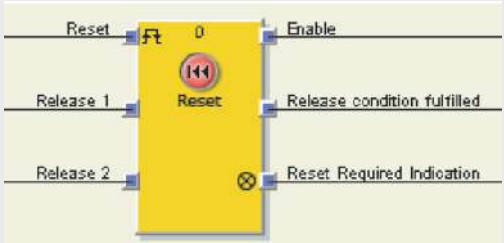
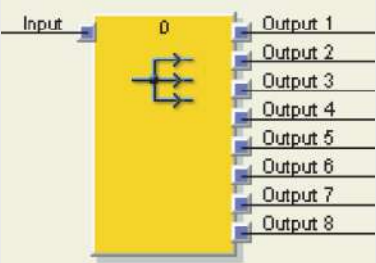
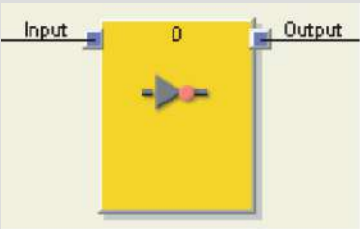
(1) Switch the view to the Logic editor view. → (2) Click the "Inputs" tag. → (3) Register the inputs.



Programming (Pasting Function Blocks)

4.5.3

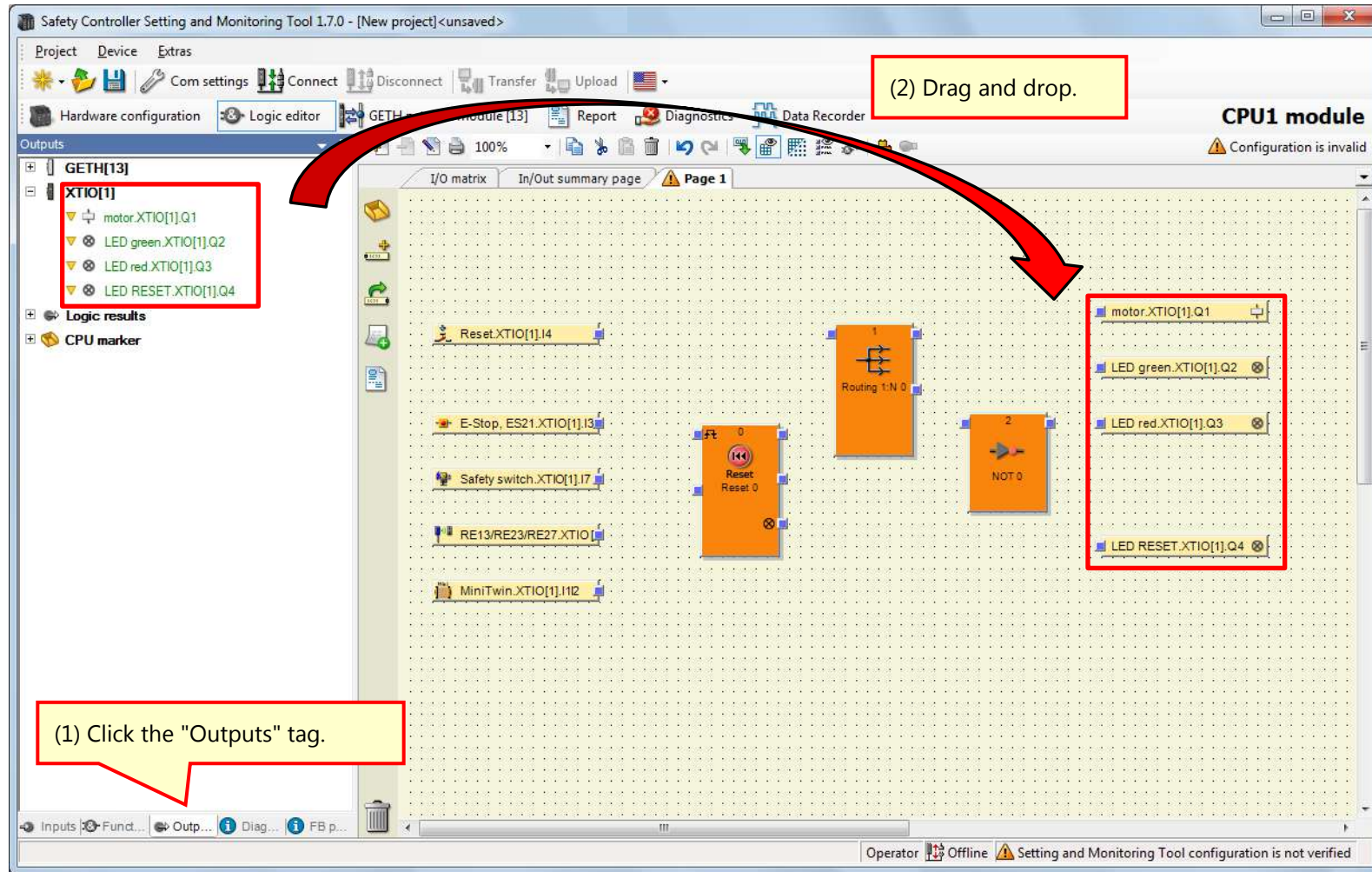
Description of FBs Used

FB used	Overview	Registration hierarchy
Reset FB 	FB for reset	[Start/Edge] - [Reset]
Routing 1:N FB 	The Routing 1: N function block passes an input signal from a preceding function block to up to eight output signals.	[Logic] - [Routing 1:N]
NOT FB 	The inverted input value applies at the output.	[Logic] - [NOT]

4.5.4

Programming (Pasting Outputs)

(1) Activate the "Outputs" tag. → (2) Register the outputs.



4.5.5

Programming (Changing the Number of Input Fields of Function Blocks)

→ Increase the number of input fields of the Reset function block.

(1) Double-click the Reset FB.

(2) Change the number of inputs to 5 in "Input/Output Settings".

4.5.6

Programming (Changing the Number of Output Fields of Function Blocks)

→ Increase the number of output fields of the Routing function block.

The image consists of three screenshots of the 'Safety Controller Setting and Monitoring Tool 1.7.0' software interface, illustrating the steps to change the number of output fields of a Routing function block.

Screenshot 1 (Left): Shows the main workspace with a 'Routing 1:N' function block. A red callout bubble points to it with the text: (1) Double-click the Routing 1:N FB.

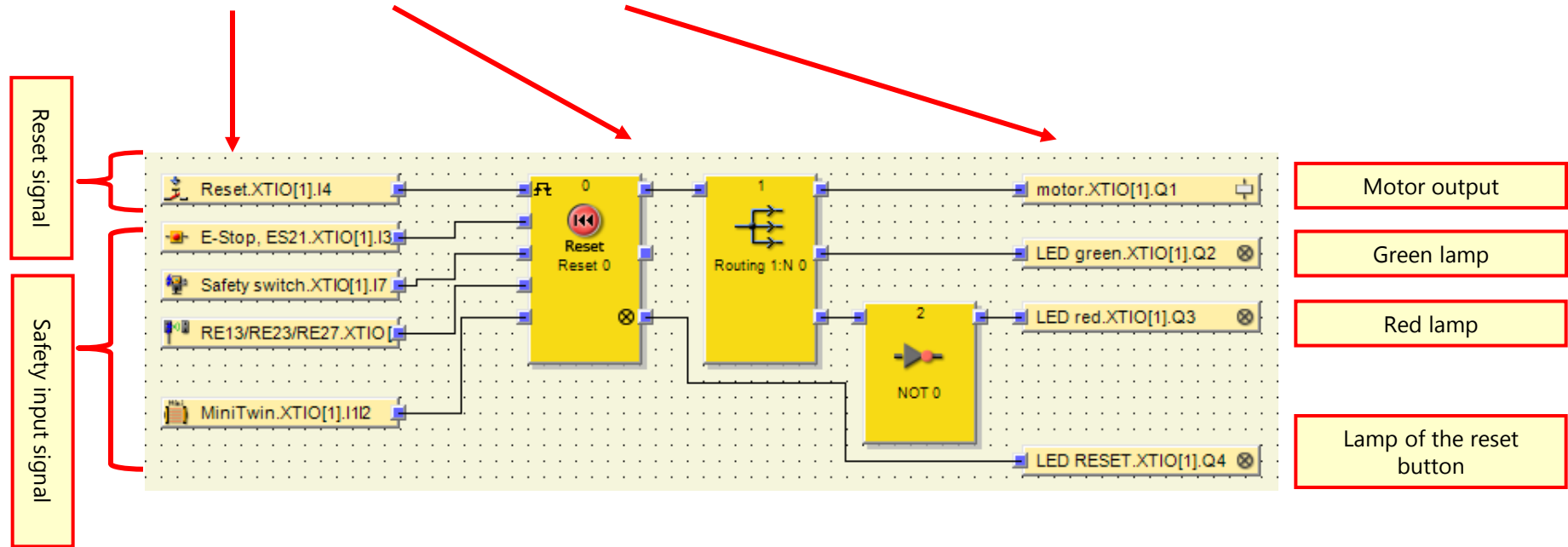
Screenshot 2 (Middle): Shows the 'Input / Output Settings' dialog box for the 'Routing 1:N' block. The 'Number of outputs' is set to 3. A red callout bubble points to the dropdown menu with the text: (2) Change the number of outputs to 3 in "Input/Output Settings".

Screenshot 3 (Right): Shows the main workspace after the change. The 'Routing 1:N' block now has three output fields connected to three different LED outputs: 'LED green.XTIO[1]Q2', 'LED red.XTIO[1]Q3', and 'LED RESET.XTIO[1]Q4'. A red callout bubble points to the block with the text: (3) The number of output fields of the Routing 1:N FB has been changed to 3.

4.5.7

Programming (Connecting Inputs, FBs, and Outputs)

→ Connect the **inputs**, **function blocks**, and **outputs** as shown in the following figure.



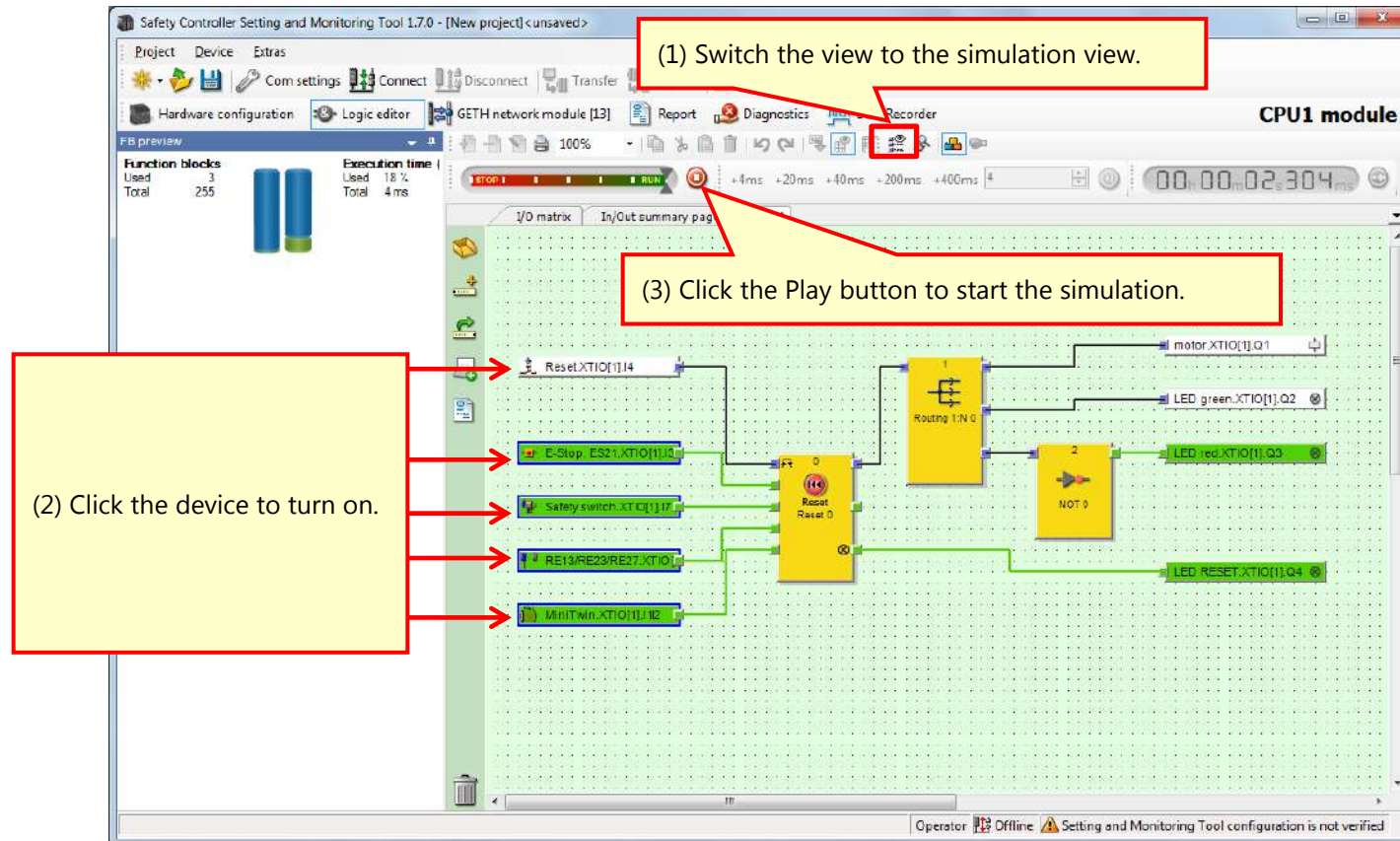


Figure. Simulation view

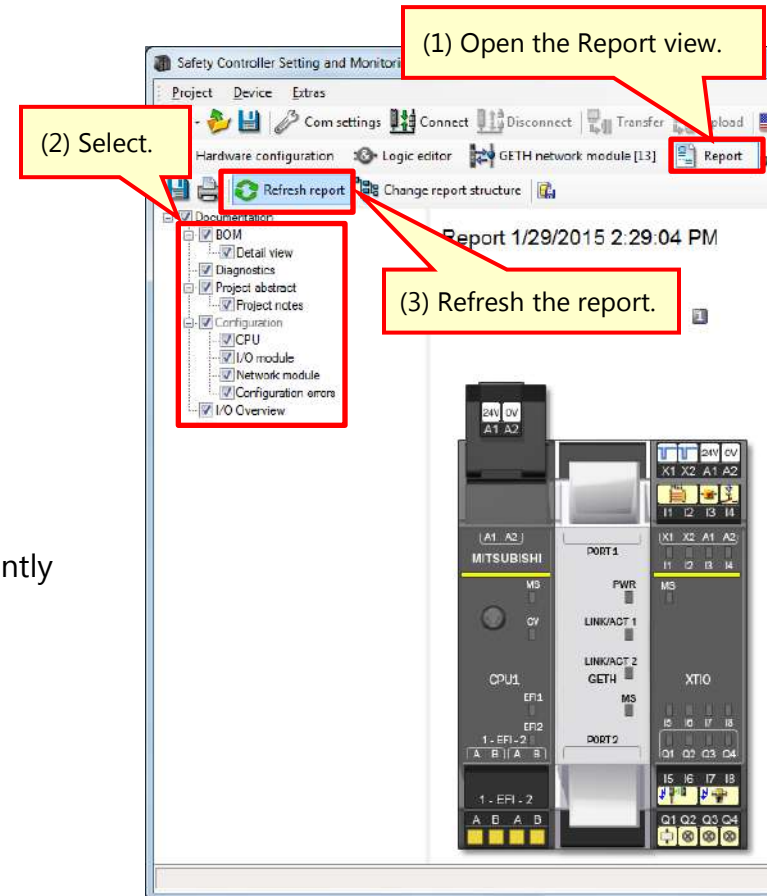
■ Report creation procedure

- (1) Click the Report button to open the Report view.
- (2) Activate or deactivate the check boxes for the components that shall be included in the report in the selection list on the left-hand side.
- (3) After you have completed your selection, click Refresh report. The report is now assembled and displayed in the right-hand window section.

■ How to save or print a report

The report can be printed or saved as PDF.

- To save the report as PDF, click the Save button.
- To print the report, click the Print button.
A PDF preview of the report will be created that you can subsequently print.



Report view (part)

In this chapter, you have learned:

- New Project Creation
- Hardware Setting
- Pasting Elements and Setting Parameters
- Tag Name Edit
- Logic Creation
- Project Simulation
- Project Report Creation

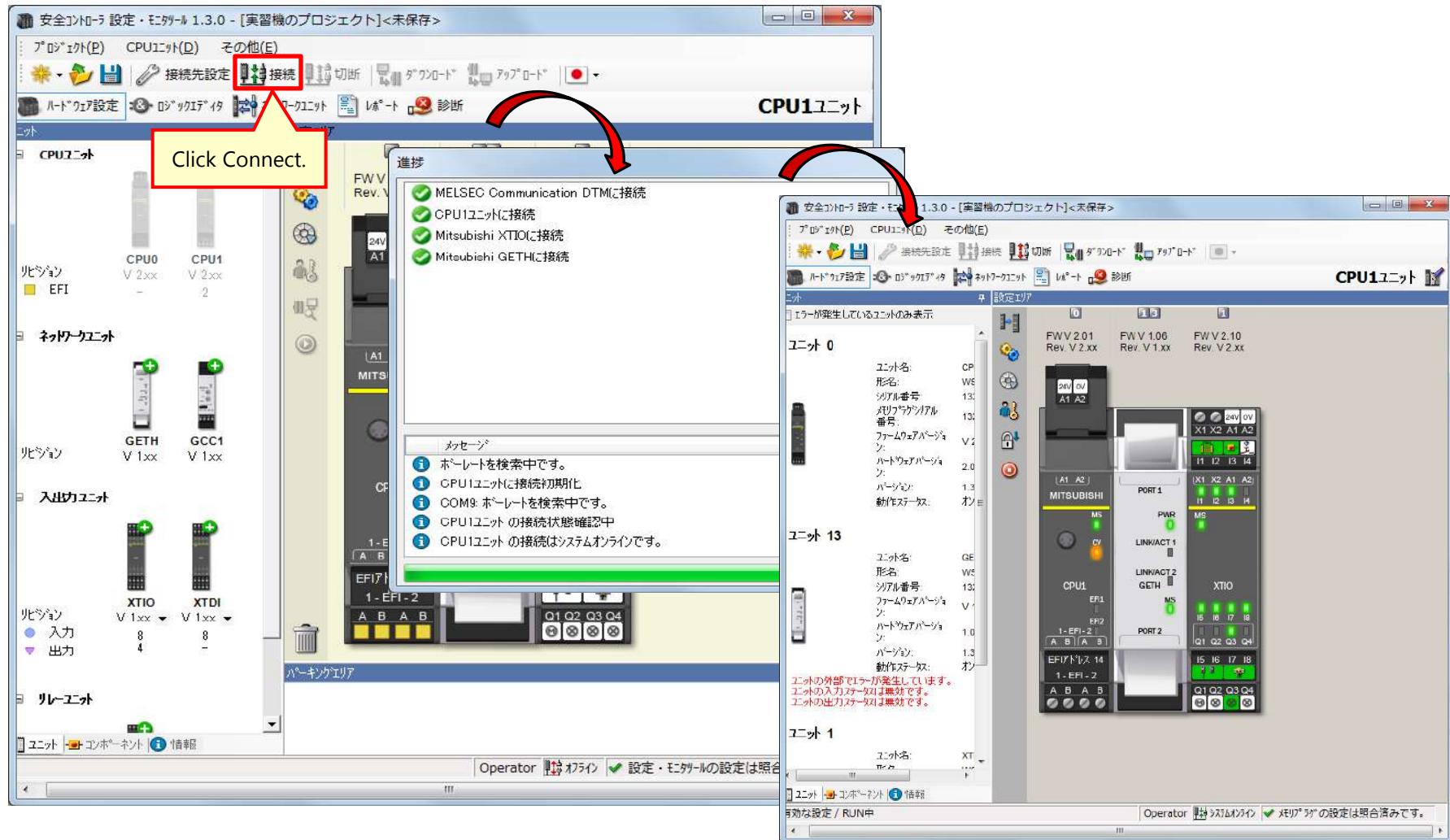
Important points

The contents you learned in this chapter are listed below.

New Project Creation	• This section describes how to create a new project using the Setting and Monitoring Tool.
Hardware Setting	• This section describes how to select modules in the hardware setting.
Pasting Elements and Setting Parameters	• This section describes how to paste elements and set parameters.
Tag Name Edit	• This section describes how to edit tag names.
Logic Creation	• This section describes how to program on the Logic editor.
Project Simulation	• This section describes how to simulate projects.
Project Report Creation	• This section describes how to create and save or print project reports.

This chapter provides how to download projects to a safety controller and verify the projects.

- 5.1 Connection with Safety Controller
- 5.2 Project Download
- 5.3 Project Verification
- 5.4 Project Comparison between Safety Controller and Tool
- 5.5 Summary of This Chapter



(1) Click Transfer.

(2) Input the password.
Default: "MELSECWS"

(3) Click Log On.

(4) Click "Yes".

安全コントローラ設定・モジュール 1.3.0 - [実習機のプロジェクト]<未保存>

ダウンロード

ユーザーグループの変更

デバイスタイプ
タイプキー
シリアル番号

安全コントローラ
WS0-CPU1
1323 0004

ユーザーグループ
Administrator

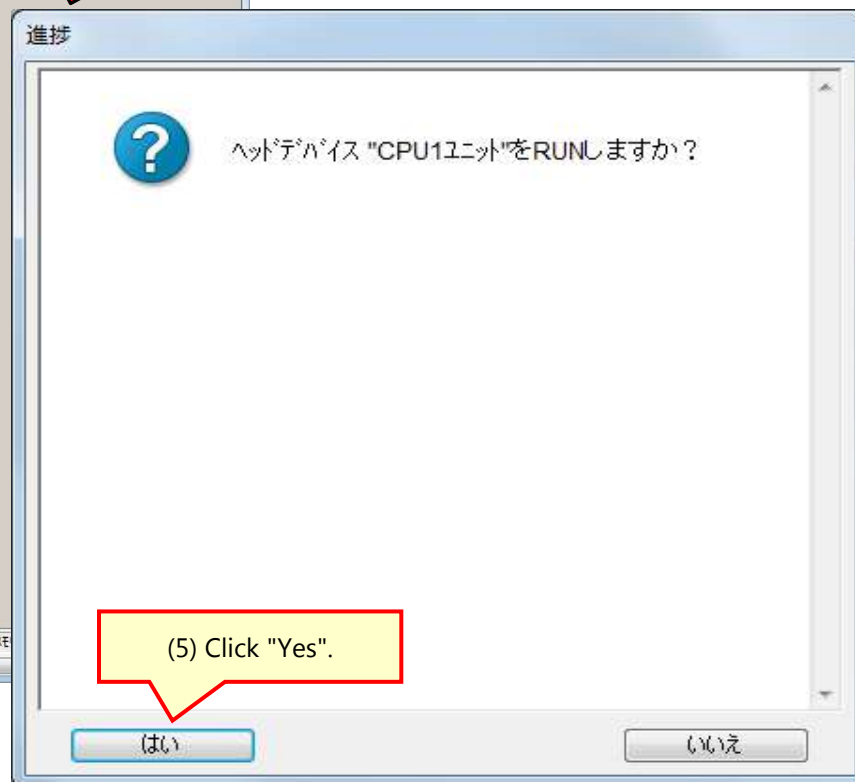
パスワード

ログイン

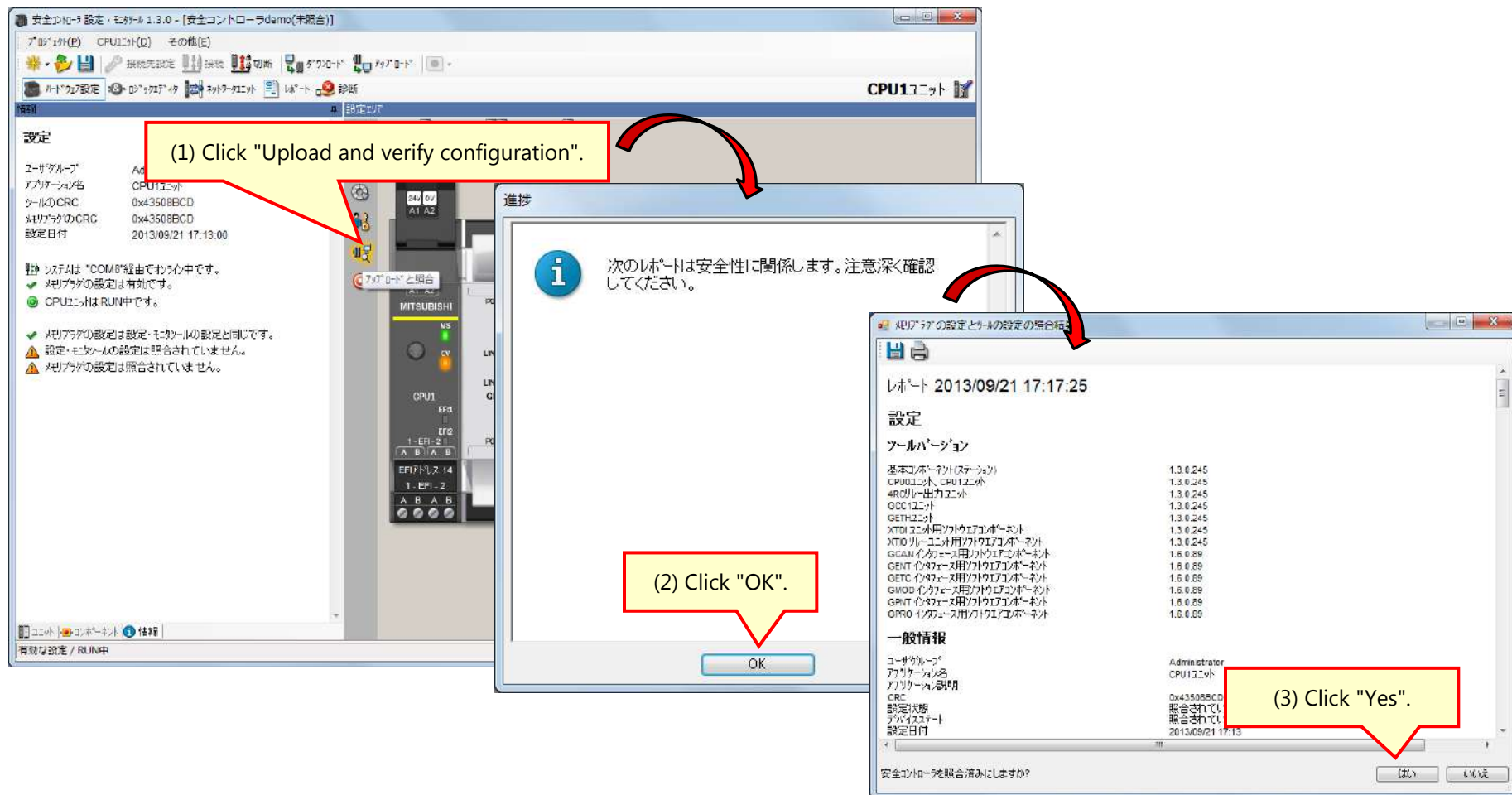
進捗

ヘッドデバイス "CPU1ユニット" は現在確定されています。
設定をダウンロードしますか？

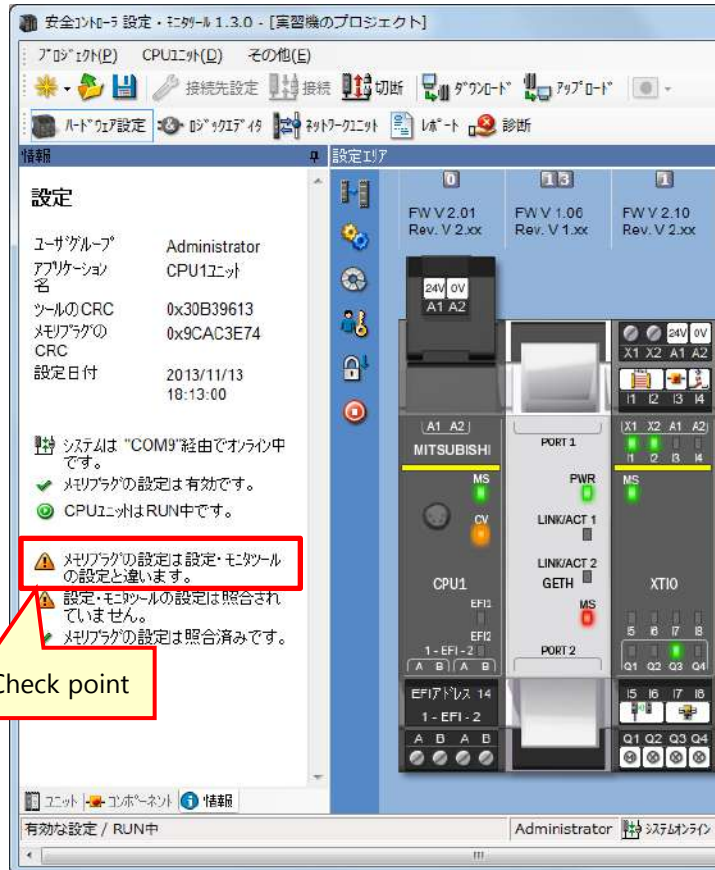
はい いいえ



- * If verification processing has not been completed, the CPU module remains in the STOP state at the next power-on.
To run the CPU module at the next power-on, verification processing is required.



■ Mismatch



■ Match or verified



- If a verified project is downloaded, the verification-completed status is kept. Verifying the project again is not required.
- If a project that is not verified yet is downloaded, the verification is required.

In this chapter, you have learned:

- Connection with Safety Controller
- Project Download
- Project Verification
- Project Comparison between Safety Controller and Tool

Important points

The contents you learned in this chapter are listed below.

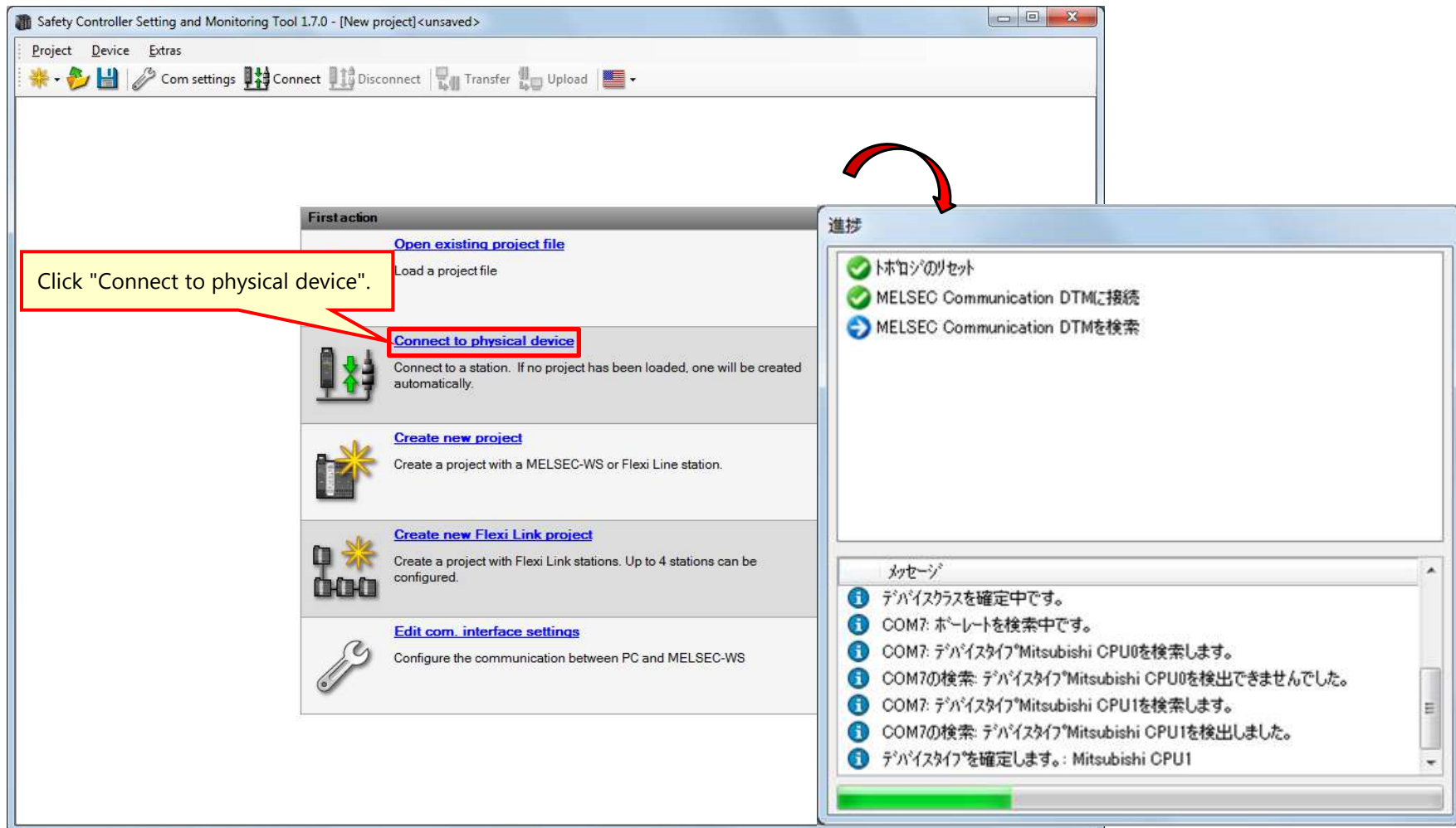
Connection with Safety Controller	• This section describes how to connect a personal computer and safety controller.
Project Download	• This section describes how to download projects.
Project Verification	• This section describes how to verify projects.
Project Comparison between Safety Controller and Tool	• This section describes project comparison views corresponding to the verification results.

This chapter provides how to connect and disconnect a safety controller.

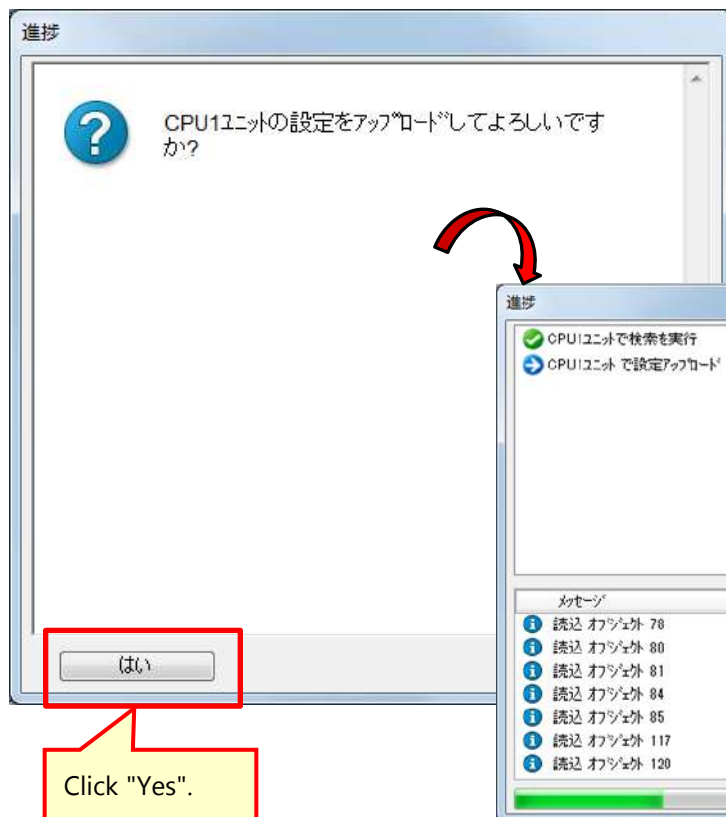
- 6.1 Connection with Safety Controller
- 6.2 Disconnection
- 6.3 Reconnection
- 6.4 Summary of This Chapter

Connect a safety controller and personal computer by RS-232, and power on the safety controller. Then, start the Setting and Monitoring Tool, and select the following "Connect to physical device".

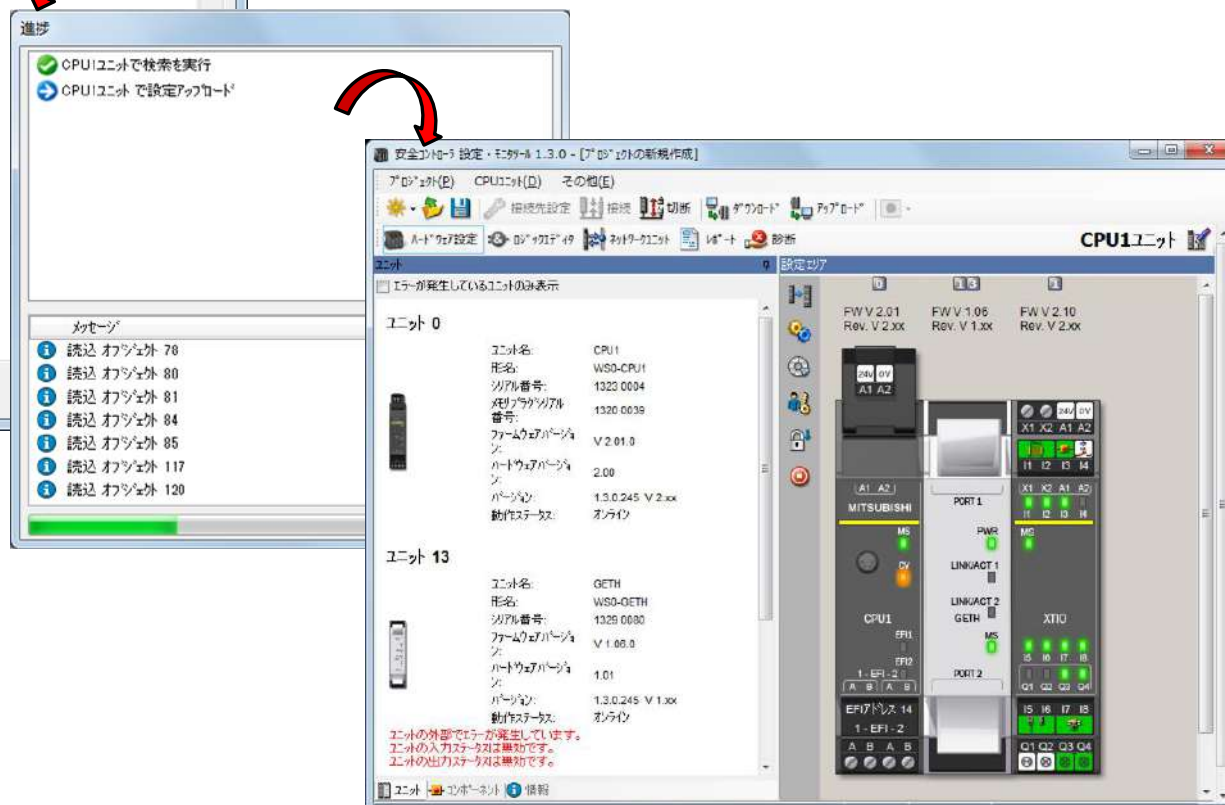
(1) Select Connect to physical device.



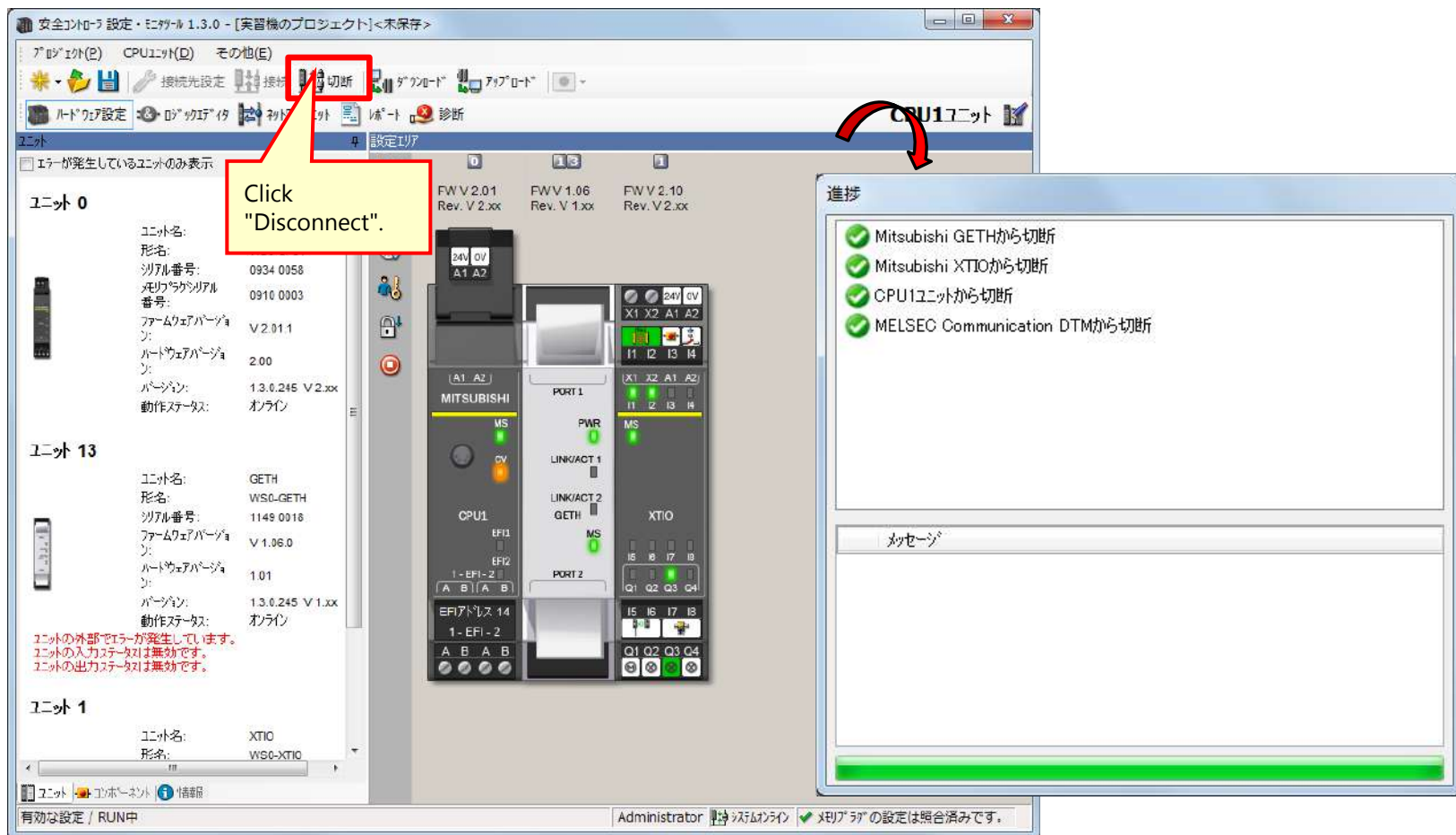
(2) Upload the setting.

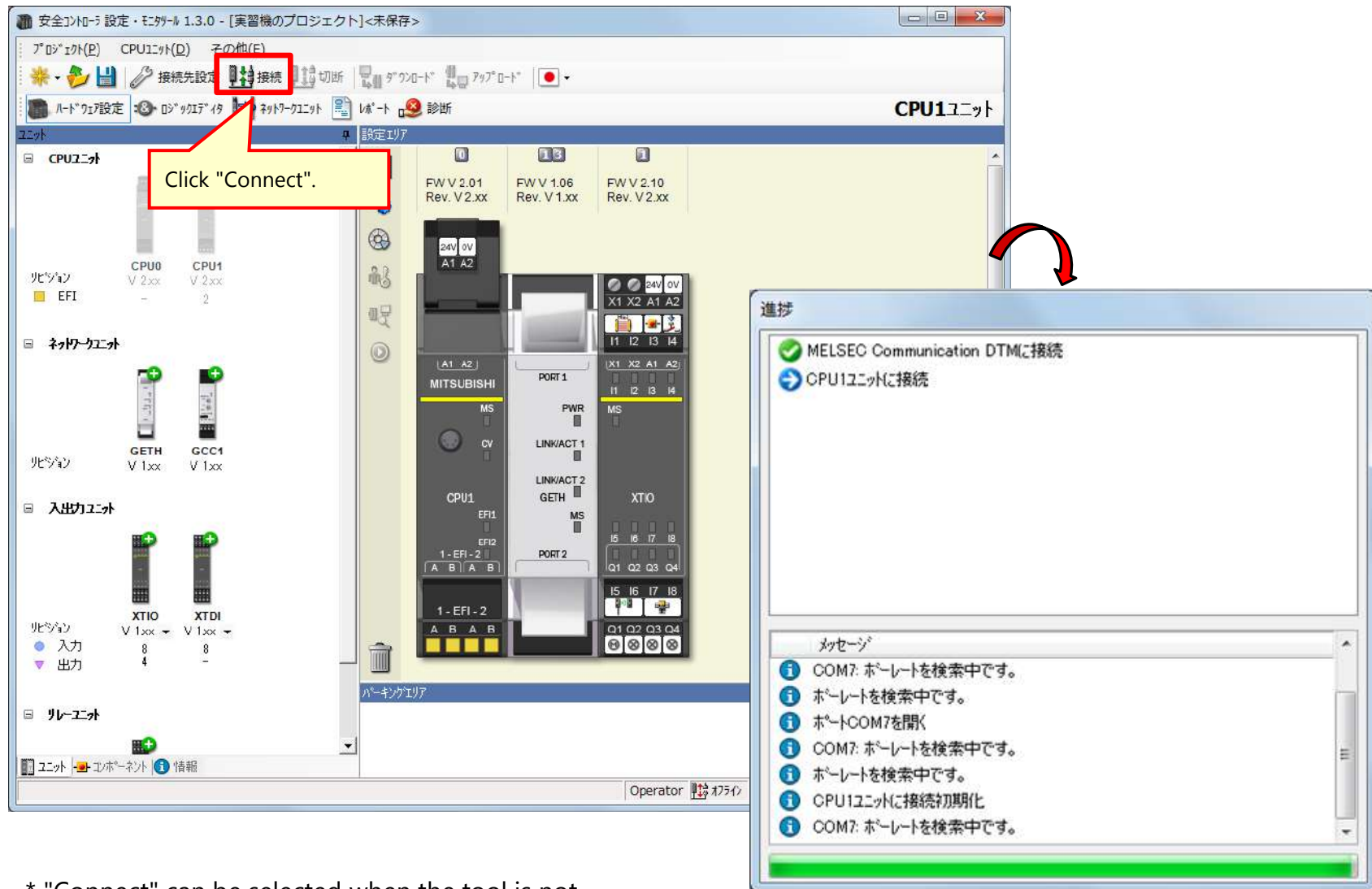


The Setting and Monitoring Tool will ask whether the setting shall be uploaded.
Click "Yes" to upload the setting.



To change the setting, activate the offline mode by clicking Disconnect.





* "Connect" can be selected when the tool is not connected with a controller.

In this chapter, you have learned:

- Connection with Safety Controller
- Disconnection
- Reconnection

Important points

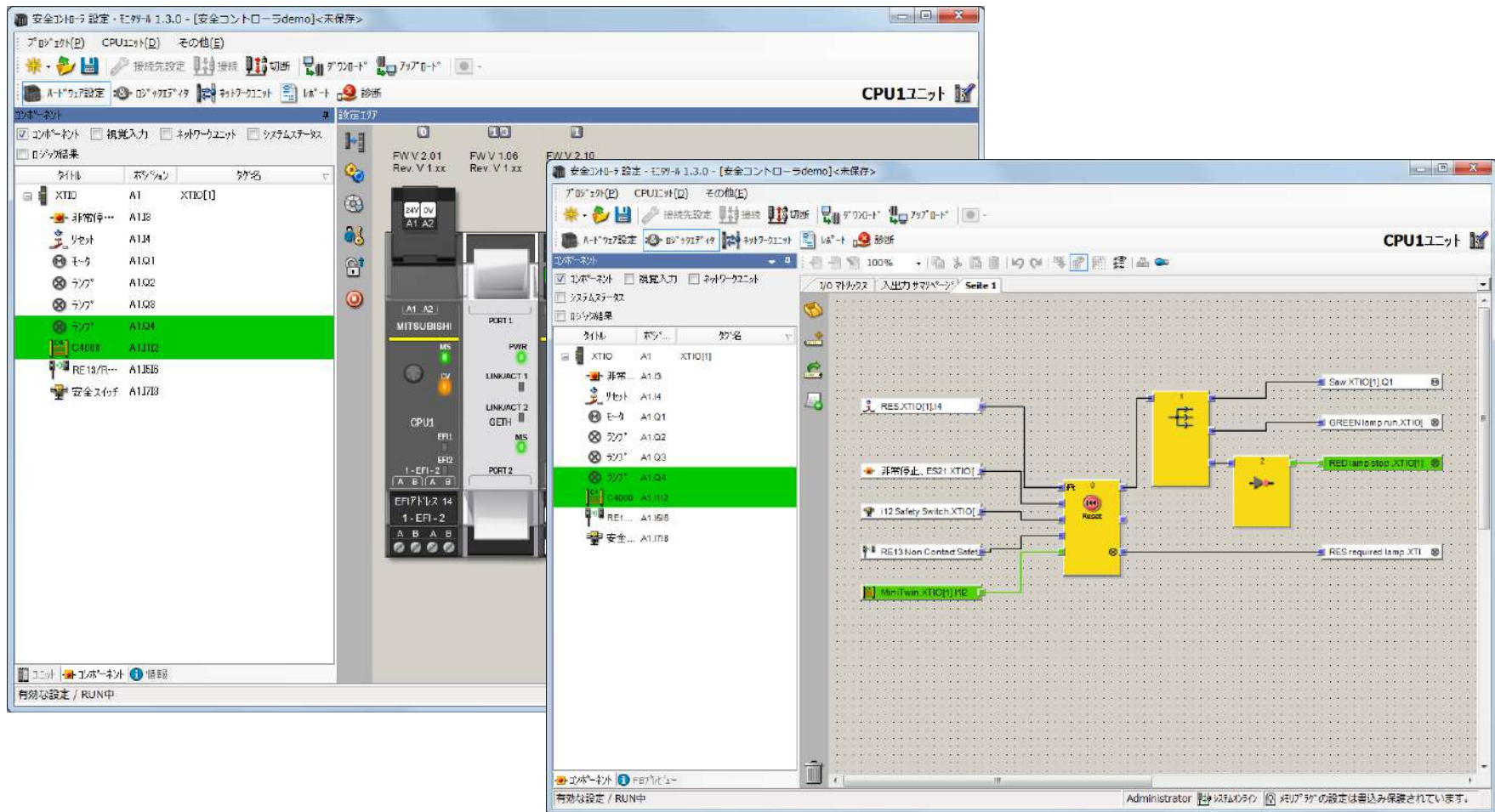
The contents you learned in this chapter are listed below.

Connection with Safety Controller	• This section describes how to connect a safety controller and personal computer
Disconnection	• This section describes how to disconnect a safety controller from a personal computer
Reconnection	• This section describes how to reconnect a safety controller and personal computer

Chapter 7 **System Operation Check**

This chapter provides how to check the safety controller operation.

- 7.1 System Operation Check
- 7.2 Program Description
- 7.3 Operating Safety Input Devices
- 7.4 Transition of System Operating State
- 7.5 Program Description
- 7.6 Error Diagnostics
- 7.7 Summary of This Chapter

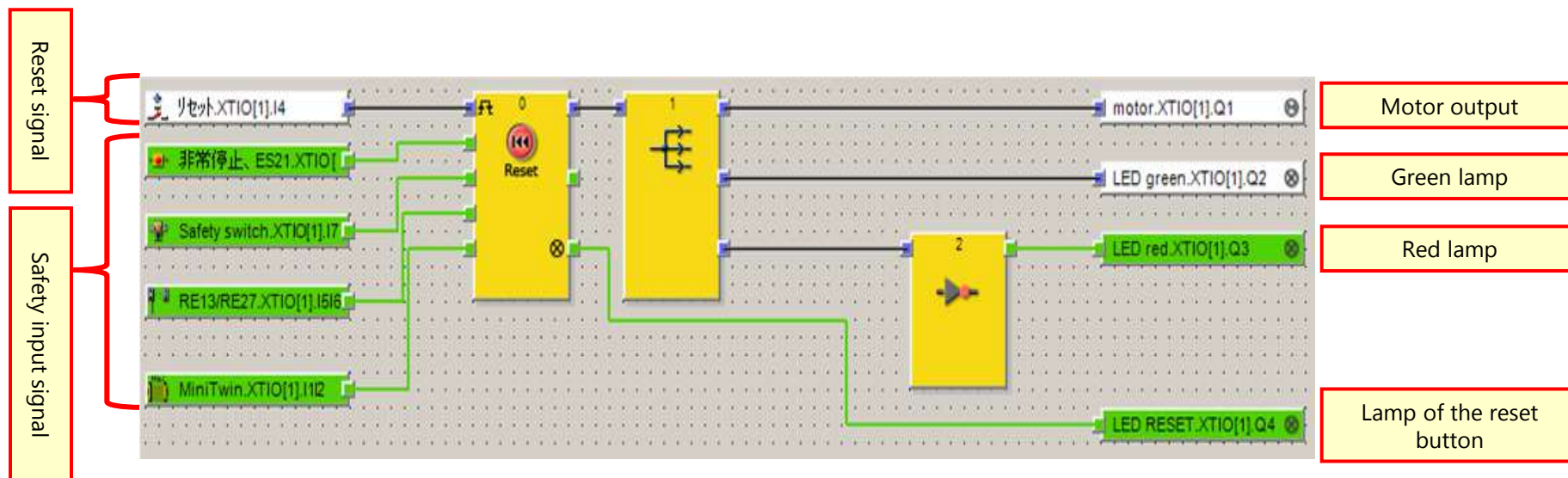


7.2

Program Description

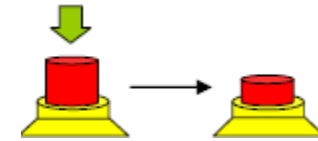
If no safety input device is operated and have malfunction after power-on of the safety controller, the components enter the following status.

RUN lamp (= green lamp)	OFF
STOP lamp (= red lamp)	ON
Motor	Stop
Reset lamp	ON flashing



■ Operating the emergency stop switch

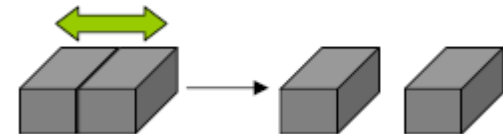
- Holding the emergency stop switch activates a trouble signal. → Press the emergency stop switch.
- After the emergency stop switch is restored, pressing the reset lamp or switch clears the trouble signal.
→ Restore the emergency stop switch.



Application: To stop the operation of the hazard source when the emergency stop switch is pressed because danger is found

■ Operating the contactless safety switch

- Separating the pieces of the contactless safety switch activates a trouble signal.
- After the pieces of the contactless safety switch are brought closer, pressing the reset lamp or switch clears the trouble signal.

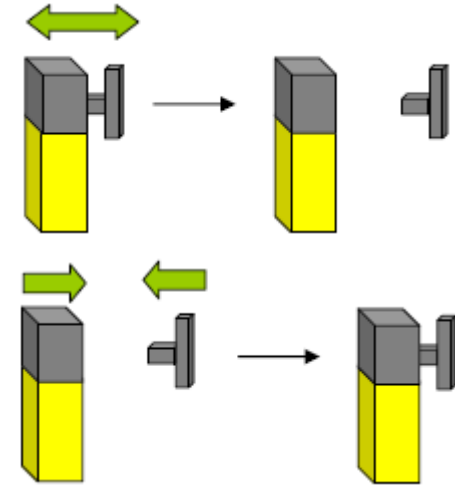


Application: To stop the operation of the hazard source when the door installed to the safety fence is opened

■ Operating the safety switch

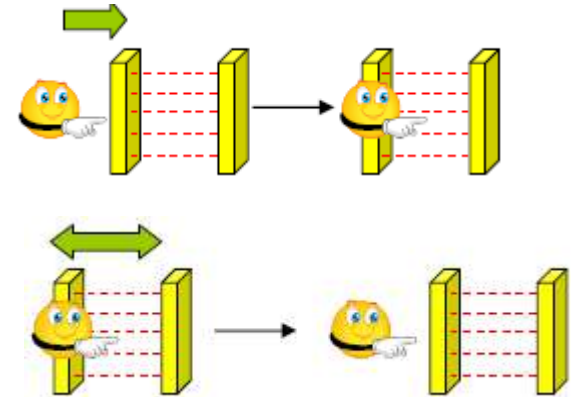
- Pulling out the safety switch activates a trouble signal.
→ Pull out the actuator from the safety door switch.
- After the safety switch is inserted back, pressing the reset lamp or switch clears the trouble signal.
→ Return the pulled-out actuator.

Application: To stop the operation of the hazard source when the door installed to the safety fence is opened

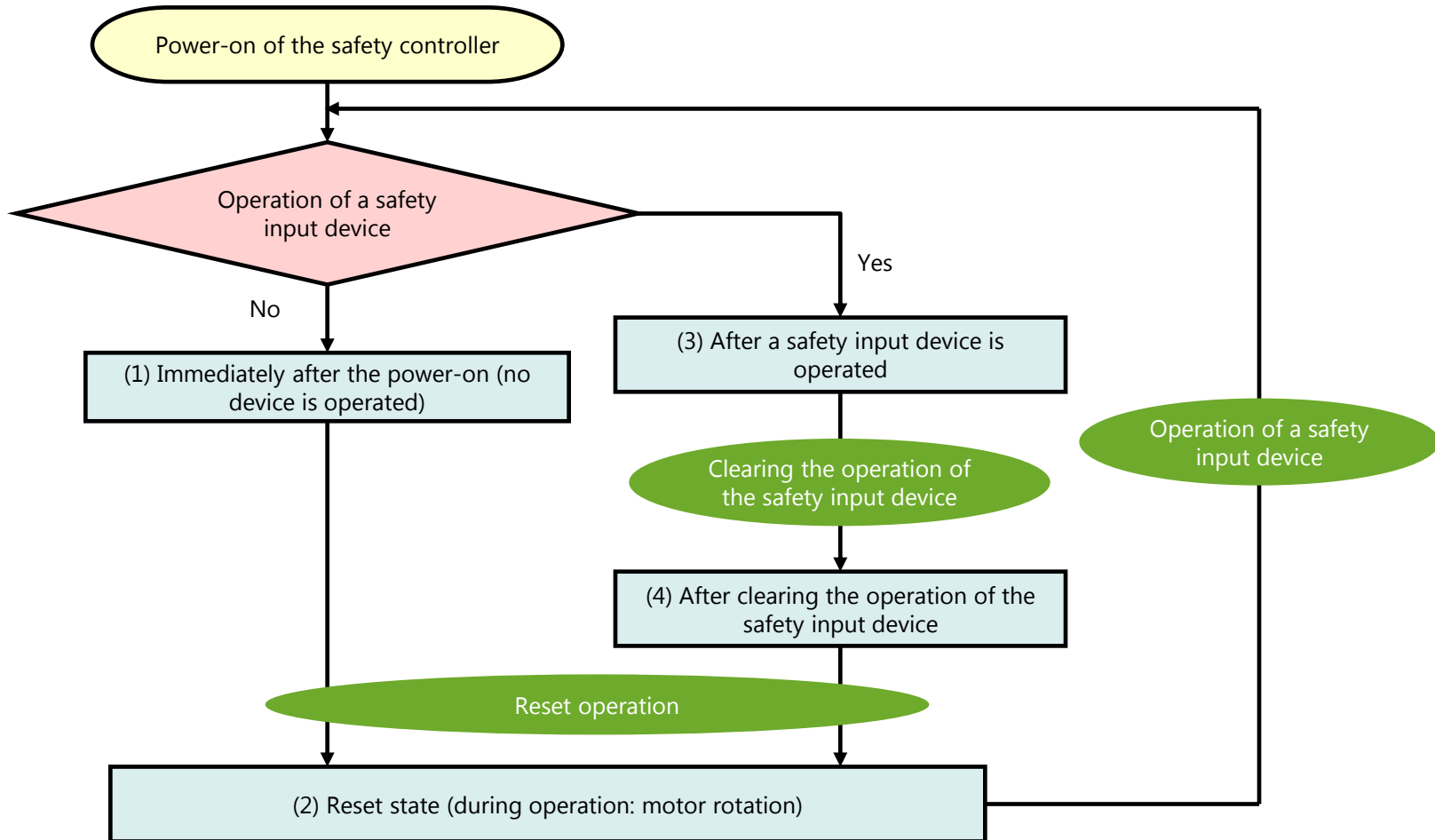


■ Operating the light curtain

- Obstructing the light beam of the light curtain by placing an object activates the trouble signal.
→ Obstruct the light beams of the light curtain.
- After the object obstructing the light beam of the light curtain is removed, pressing the reset lamp or switch clears the trouble signal.
→ Remove the object obstructing the light beam of the light curtain.



Application: To stop the operation of the hazard source when entry of an operator from an opening is detected



7.5

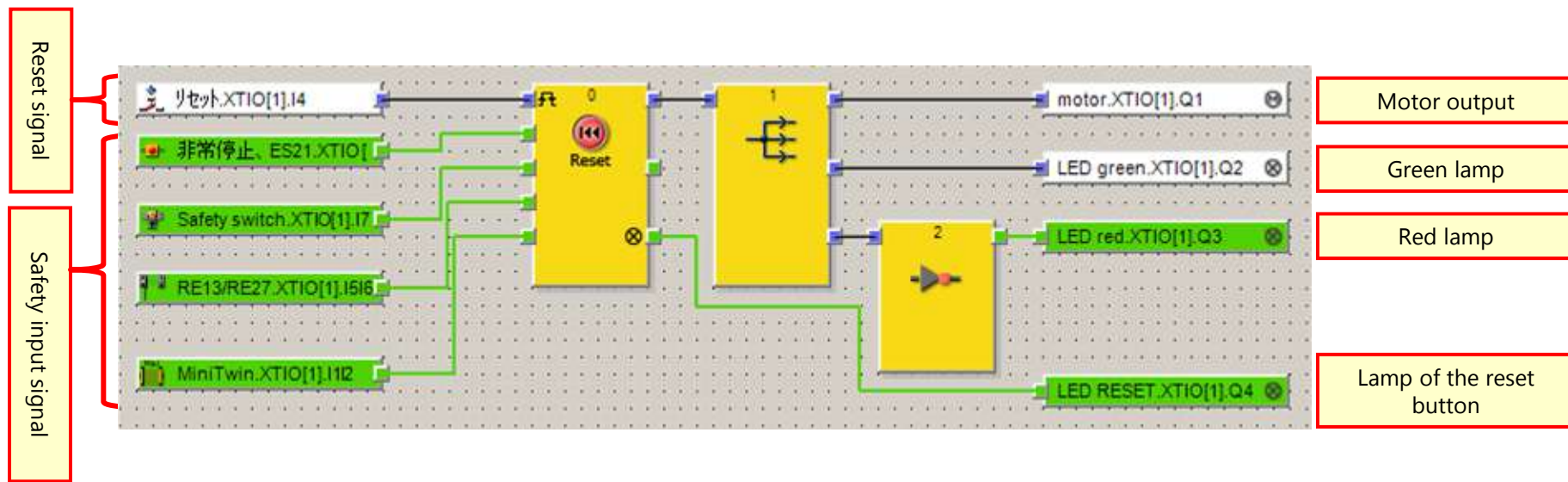
Program Description

7.5.1

Immediately after the power-on (no device is operated)

If no safety input device is operated and have malfunction after power-on of the safety controller, the components enter the following status.

RUN lamp (= green lamp)	OFF
STOP lamp (= red lamp)	ON
Motor	Stop
Reset lamp	ON flashing

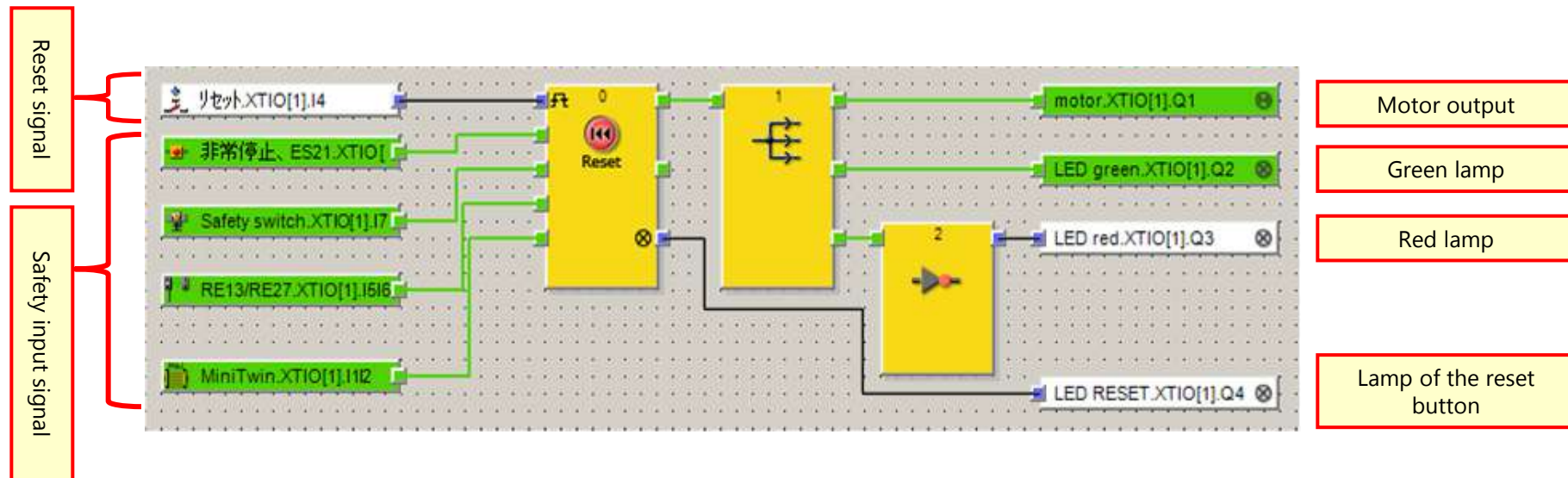


7.5.2

Reset state (during operation: motor rotation)

If no safety input device is operated and have malfunction, the following the components enter the following status when the reset switch is operated.

RUN lamp (= green lamp)	OFF → ON
STOP lamp (= red lamp)	ON → OFF
Motor	Stop → Rotation
Reset lamp	ON flashing → Off



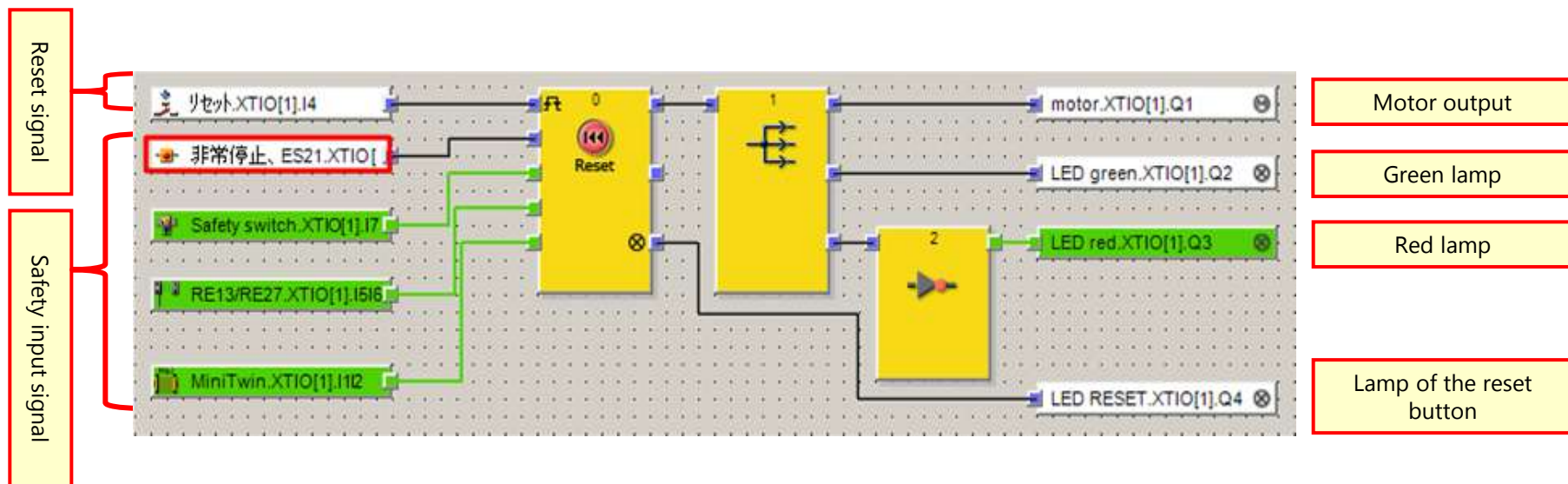
7.5.3

After a safety input device is operated

■ After operating the emergency stop switch

If the emergency stop switch is pressed during operation, the components enter the following status.

RUN lamp (= green lamp)	ON → OFF
STOP lamp (= red lamp)	OFF → ON
Motor	Rotation → Stop
Reset lamp	OFF



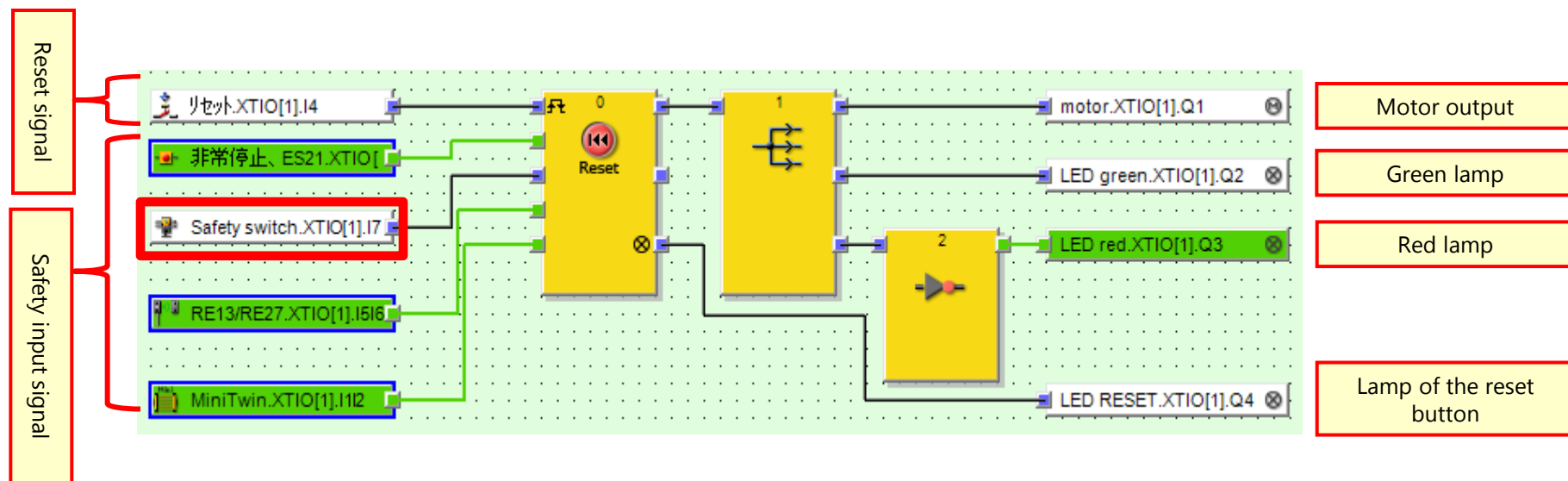
7.5.3

After a safety input device is operated

■ After operating the safety switch

If the actuator of the safety switch is pulled out during operation, the components enter the following status.

RUN lamp (= green lamp)	ON → OFF
STOP lamp (= red lamp)	OFF → ON
Motor	Rotation → Stop
Reset lamp	OFF



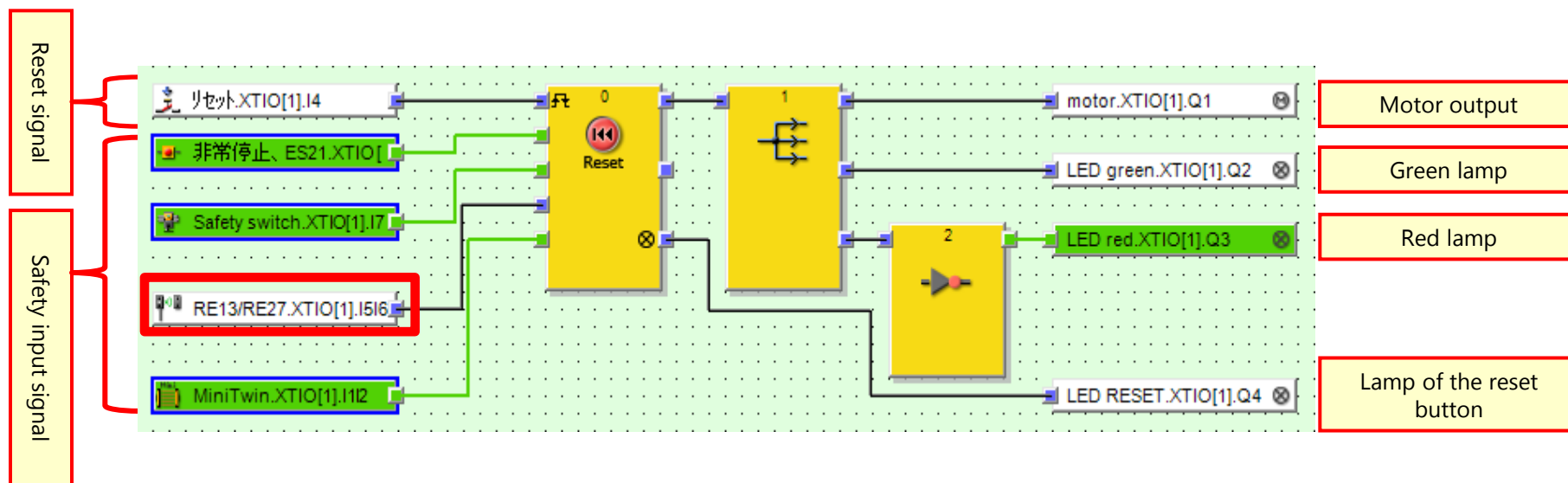
7.5.3

After a safety input device is operated

■ After operating the contactless safety switch

If the pieces of the contactless safety switch are separated during operation, the components enter the following status.

RUN lamp (= green lamp)	ON → OFF
STOP lamp (= red lamp)	OFF → ON
Motor	Rotation → Stop
Reset lamp	OFF



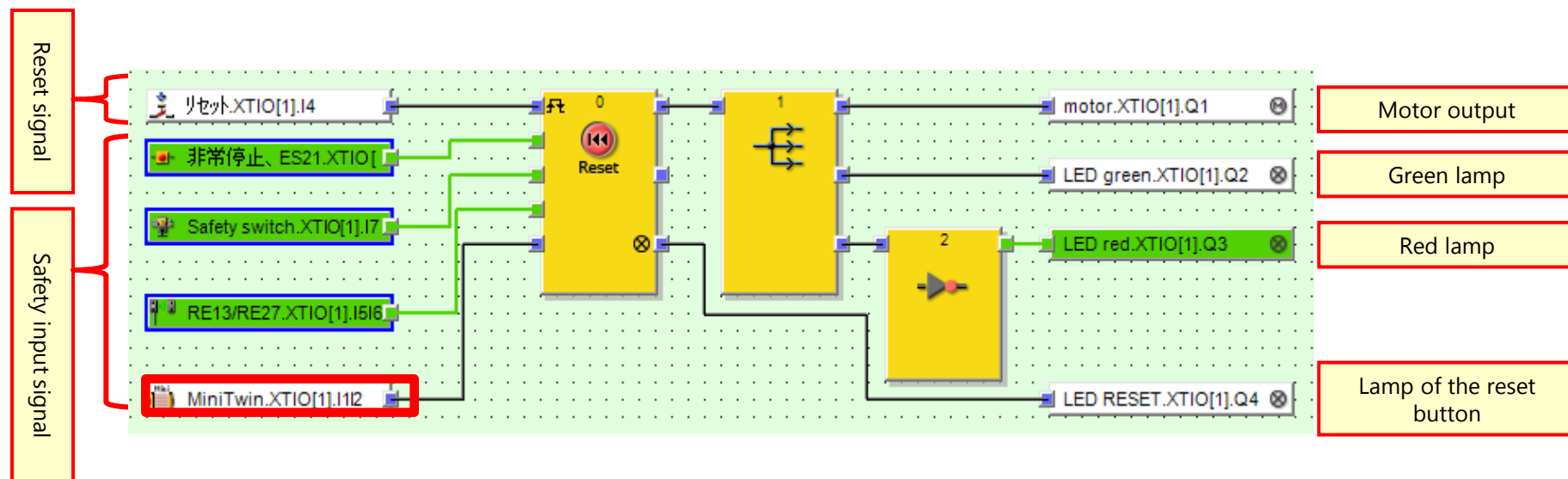
7.5.3

After a safety input device is operated

■ After operating the light curtain

If the light beam of the light curtain is obstructed during operation, the components enter the following status.

RUN lamp (= green lamp)	ON → OFF
STOP lamp (= red lamp)	OFF → ON
Motor	Rotation → Stop
Reset lamp	OFF

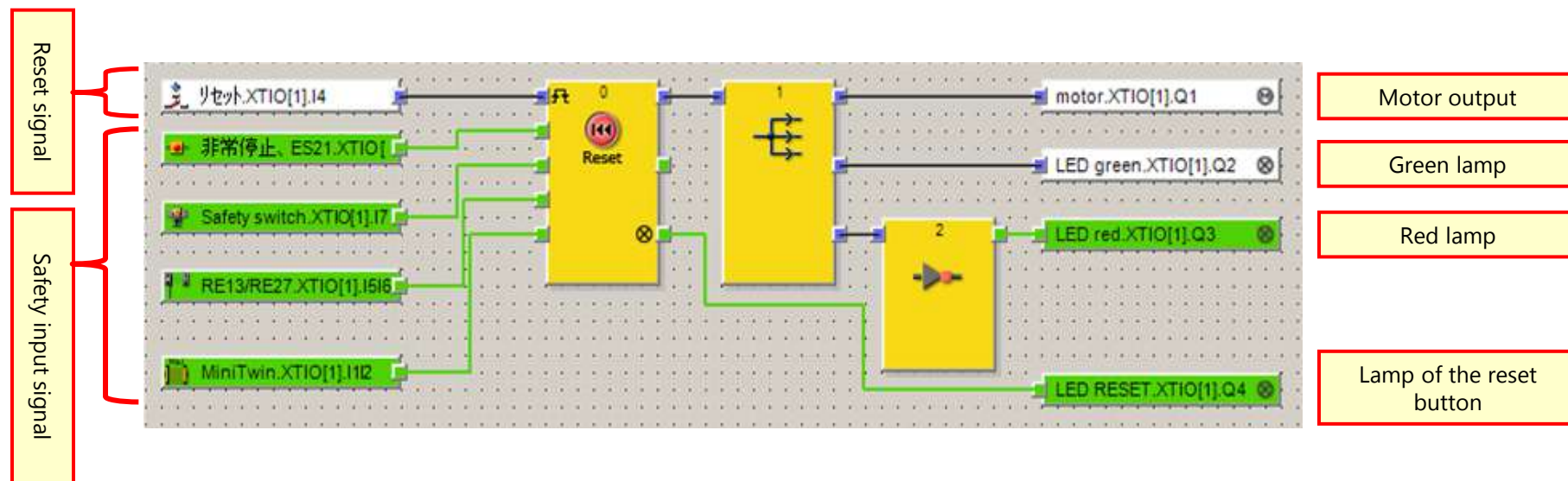


7.5.4

After clearing the operation of the safety input device

If a safety input device is operated and then the operation is cleared, the components enter the following status.

RUN lamp (= green lamp)	OFF
STOP lamp (= red lamp)	ON
Motor	Stop
Reset lamp	OFF → ON flashing



Diagnostic results and operation of the safety controller can be checked on the Setting and Monitoring Tool.

The devices can be monitored.

Errors can be diagnosed.

The log of devices connected to the safety controller is displayed.

The screenshot shows the '診断' (Diagnosis) tab in the Setting and Monitoring Tool. The top toolbar includes buttons for '接続先設定' (Connection destination setting), '接続' (Connect), '切断' (Disconnect), and 'タウソフ' (Taufu). Below the toolbar, the status bar shows '現在の操作時間: 2:16:25:38, 電力サイクル: 138' and '現在の診断結果: 6, 履歴: 0'. The main table displays a list of error logs with columns for 'タイムスタンプ' (Timestamp), '現地時間' (Local time), 'ソース' (Source), 'カテゴリ' (Category), and '説明' (Description). A red box highlights the error log entries, and a red arrow points from one entry to the 'Details' section below.

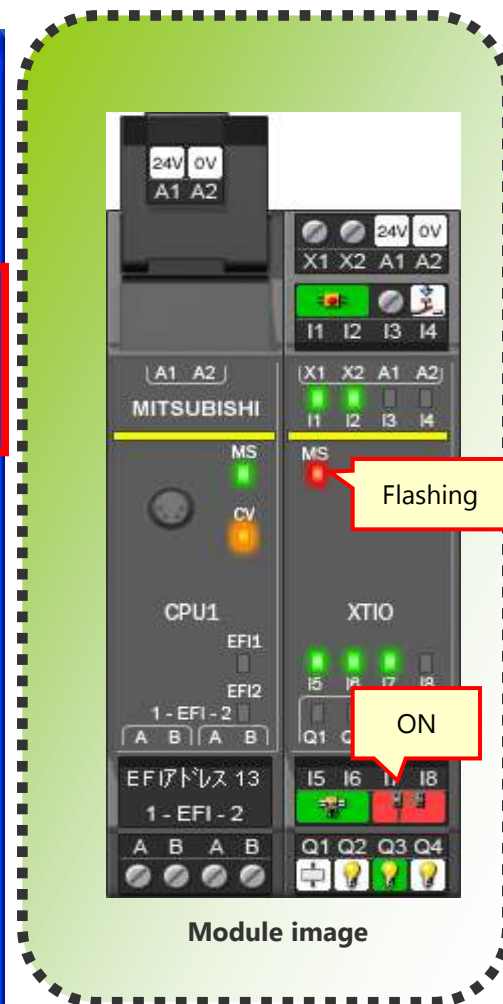
タイムスタンプ	現地時間	ソース	カテゴリ	説明
2:16:21:23	2009/11/26 11:42:56	FLEX BUS+ ユニット 1		ユニット1 :デュアルチャネル入力 I5, 6, 7, 8で二重化不一致エラー
2:16:21:17	2009/11/26 11:42:50	FLEX BUS+ ユニット 1		ユニット1 :デュアルチャネル入力 I5, 6, 7, 8で二重化不一致エラー
2:16:14:39	2009/11/26 11:36:12	FLEX BUS+ ユニット 1		ユニット1 :デュアルチャネル入力 I5, 6で二重化不一致エラー
2:16:18:08	2009/11/26 11:39:40	FLEX BUS+ ユニット 1		ユニット1 :デュアルチャネル入力 I7, 8で二重化不一致エラー
2:16:17:59	2009/11/26 11:39:31	FLEX BUS+ ユニット 1		ユニット1 :デュアルチャネル入力 I7, 8で二重化不一致エラー
2:16:09:59	2009/11/26 11:31:32	FLEX BUS+ ユニット 1		ユニット1 :デュアルチャネル入力 I7, 8で二重化不一致エラー

The 'Details' section below the table provides the following information:

- コード: 0x4429
- 説明: ユニット1 :デュアルチャネル入力 I5, 6, 7, 8で二重化不一致エラー
- タイムスタンプ: 2:16:21:23
- 現地時間: 2009/11/26 11:42:56
- 電力サイクル: 138
- タイプ: 警告(不揮発)
- ソース: FLEX BUS+ ユニット 1
- カテゴリ: 情報
- 情報: 01 00 F0 00
- 発生カウンタ: 1
- 電源ON時間: 00:18:22 (1102 s)
- 操作時間: 2:16:21:23 (231683 s)
- ブロック: 8
- レジスタ: 14
- CPU-チャネル: A&B

The status bar at the bottom shows 'Administrator' and 'オフライン' (Offline) with a green checkmark indicating 'ツールの設定は照合済みです。' (Tool settings are verified).

Details



In this chapter, you have learned:

- System Operation Check
- Program Description
- Operating Safety Input Devices
- Transition of System Operating State
- Program Description
- Error Diagnostics

Important points

The contents you learned in this chapter are listed below.

Program Description	• This section describes the program status when safety input devices are not operated.
Operating Safety Input Devices	• This section describes the operation and applications of safety input devices
Transition of System Operating State	• This section describes transition of the system operating state in the flowchart.
Program Description	• This section describes the program status when safety input devices are operated.
Error Diagnostics	• This section describes the view for error diagnostics.

Now that you have completed all of the lessons of the **SAFETY CONTROLLER BASIC** Course, you are ready to take the final test. If you are unclear on any of the topics covered, please take this opportunity to review those topics.

There are a total of 6 questions (6 items) in this Final Test.

You can take the final test as many times as you like.

How to score the test

After selecting the answer, make sure to click the **Answer** button. Failure to do so will not score the test. (Regarded as unanswered questions.)

Score results

The number of correct answers, the number of questions, the percentage of correct answers, and the pass/fail result will appear on the score page.

Correct answers : 3

Total questions : 10

Percentage : 30%

To pass the test, **60%** of correct answers is required.

Proceed

Review

Retry

- Click the **Proceed** button to exit the test.
- Click the **Review** button to review the test. (Correct answer check)
- Click the **Retry** button to retry the test multiple times.

You have completed the **SAFETY CONTROLLER BASIC** Course.

Thank you for taking this course.

We hope you enjoyed the lessons and the information you acquired in this course is useful for configuring systems in the future.

You can review the course as many times as you want.