

SAFETY CONTROLLER BASIC COURSE

This course is intended for beginners of safety controllers who understand safety basics. Click the Next button at the upper right of the screen to proceed to the next page.

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 that you have completed the following courses or have equivalent knowledge.

- YOUR FIRST FACTORY AUTOMATION (SAFETY OF MACHINERY)

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.

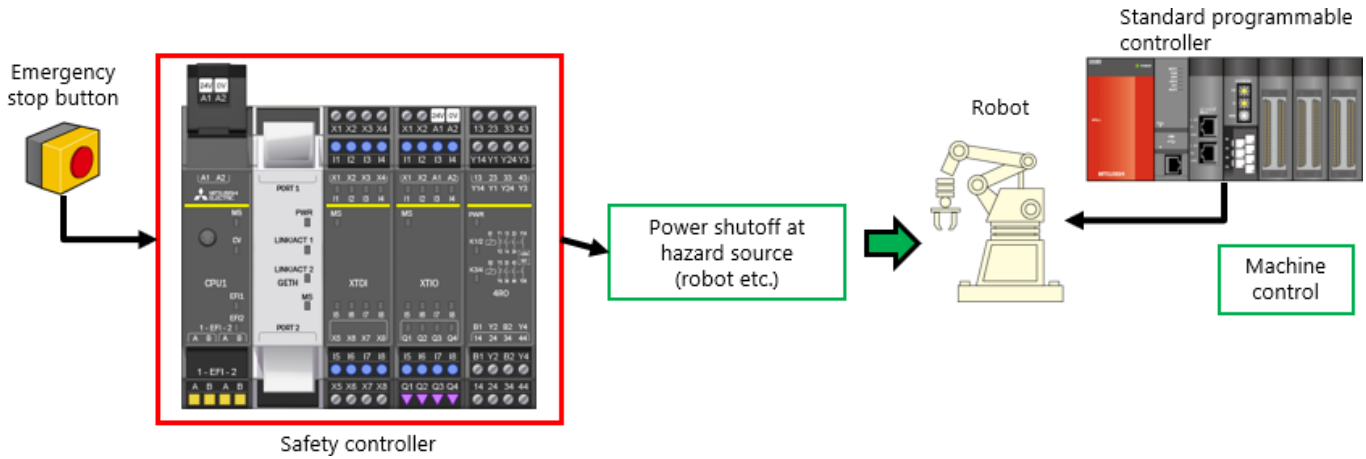
Precautions in this course

- 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

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

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.

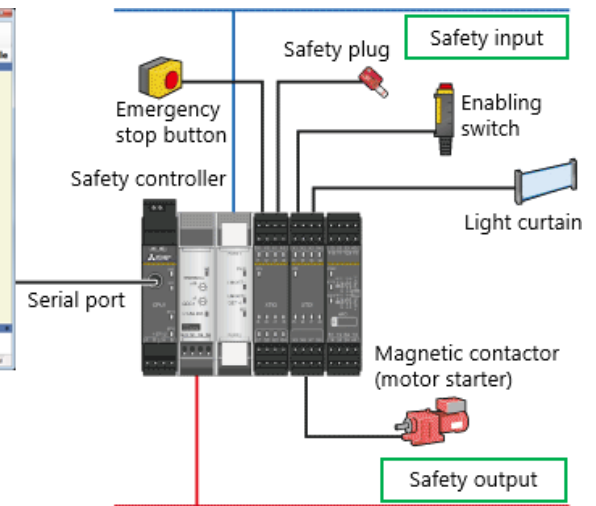
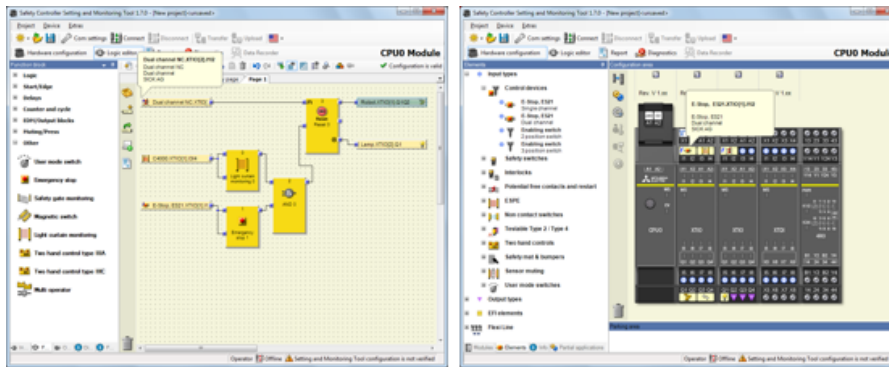
The safety I/O can be expanded to 144 points (input: 96 points, output: 48 points).

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.

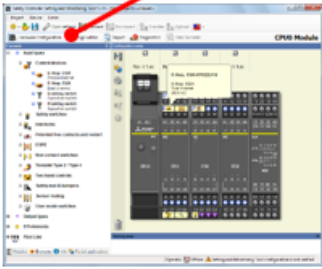
The "Setting and Monitoring Tool" can be downloaded in the [Mitsubishi Electric FA site](#).

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

■ Dedicated "Setting and Monitoring Tool"



Setting and Monitoring Tool
SW1DNN-WS0ADR-B



CPU module memory plug
WS0-MPLO

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

Serial port cable for CPU connection
WS0-C20R2
USB/serial port conversion cable
WS0-UC-232A



Serial port cable for CPU
connection WS0-C20R2

Safety I/O module
WS0-XTIO

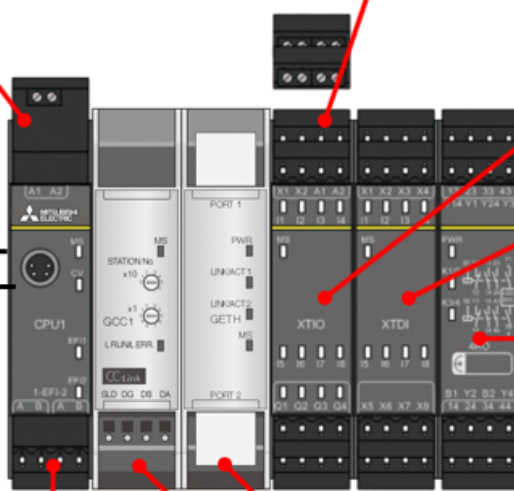
Safety input module
WS0-XTDI

Safety relay output module
WS0-4RO

Ethernet interface module WS0-GETH

CPU module WS0-CPU0
CPU module (with EFI) WS0-CPU1 (compatible with Flexi Link)

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)

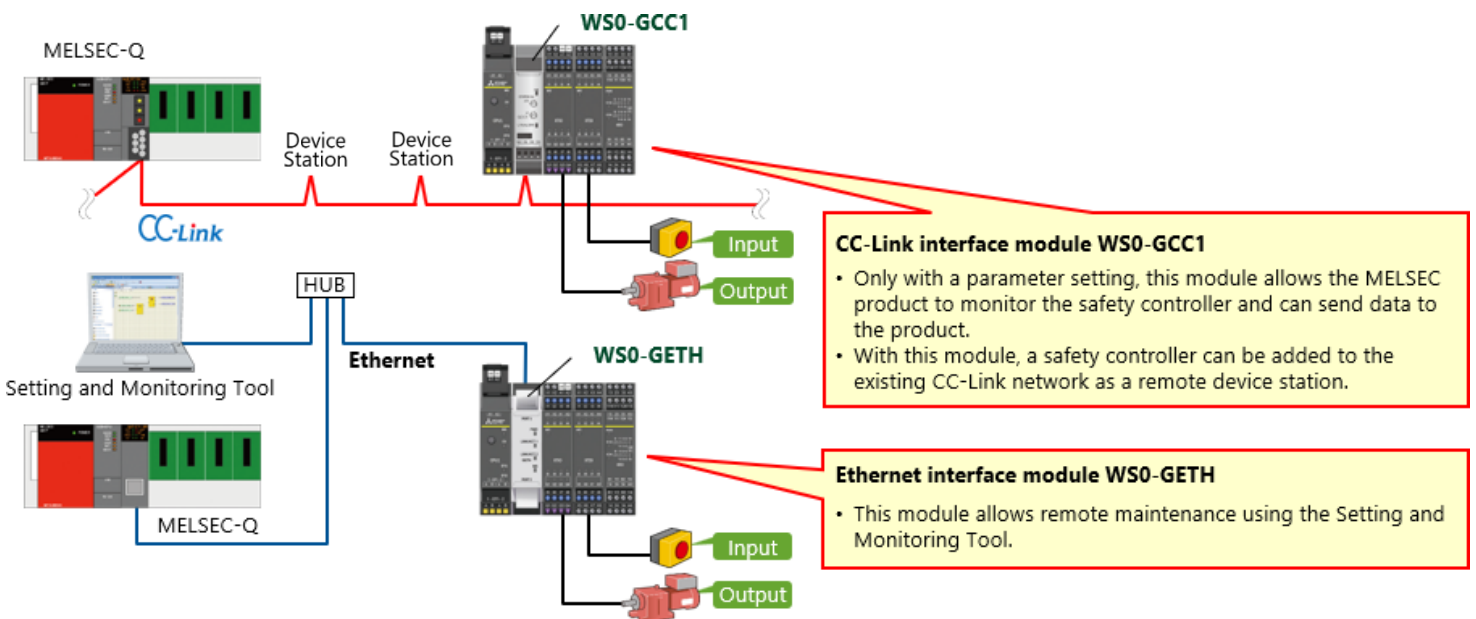


With a safety controller connected to CC-Link, the existing MELSEC-Q/L programmable controller can execute safety control. Furthermore, operation status and error status of the safety controller can be monitored with the existing MELSEC-Q/L programmable controller.

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	-	○



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)

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

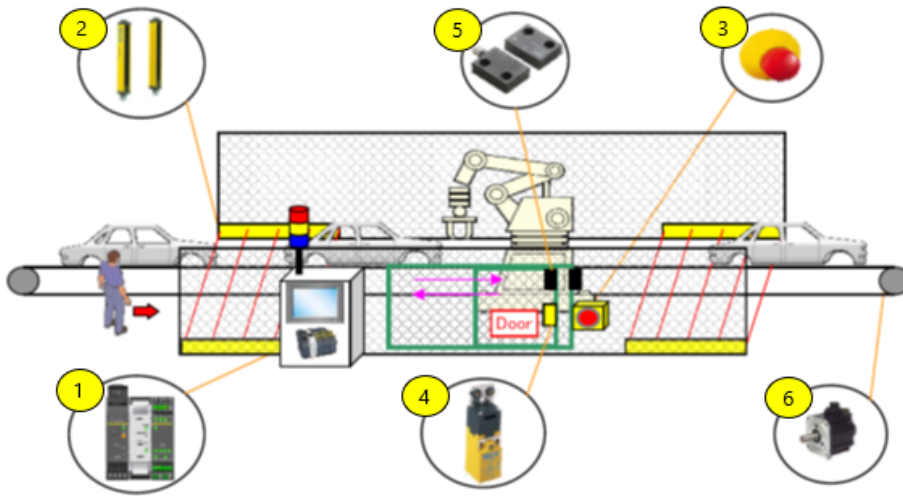


Figure. Application image

Set the following conditions to stop the production line safely.

- The light curtain is obstructed.
- The door opens.
- The emergency stop switch is pressed.

This section shows a device wiring diagram.

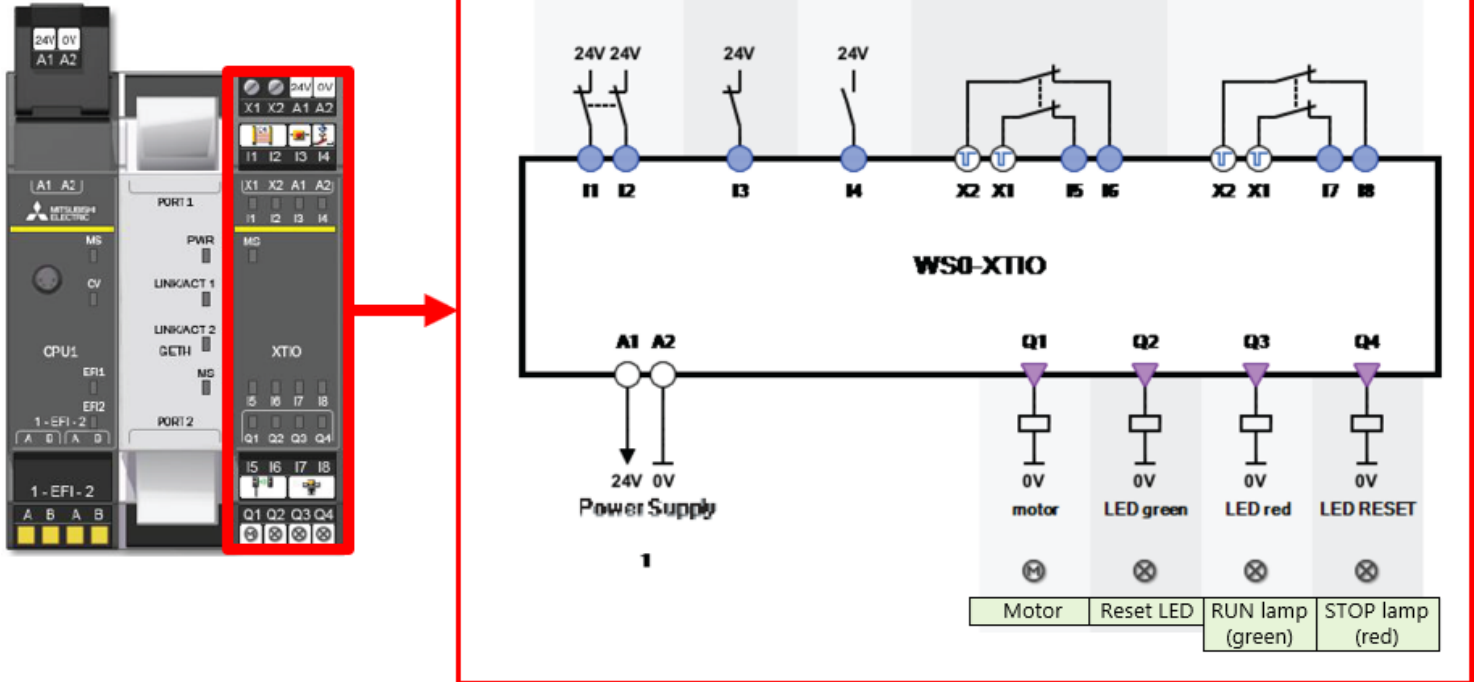


Figure. Device wiring

In this chapter, you have learned:

- System Image
- Wiring

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

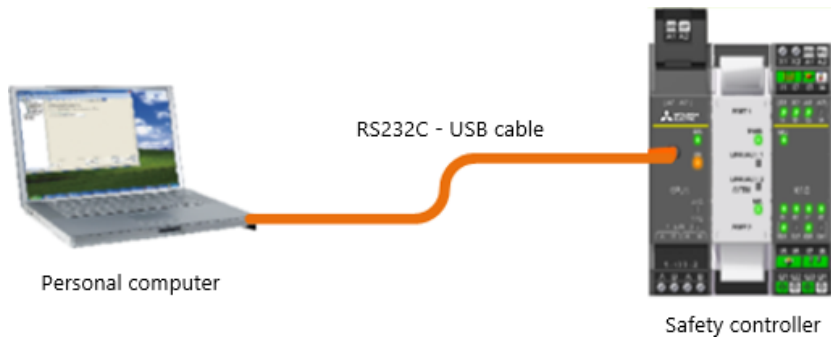
3.3 Summary of This Chapter

3.1

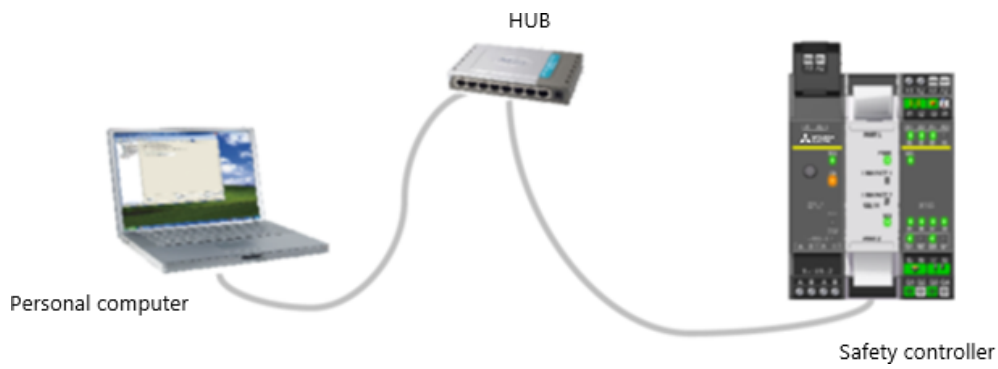
Connecting Safety Controller and Personal Computer

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

■ RS232C connection

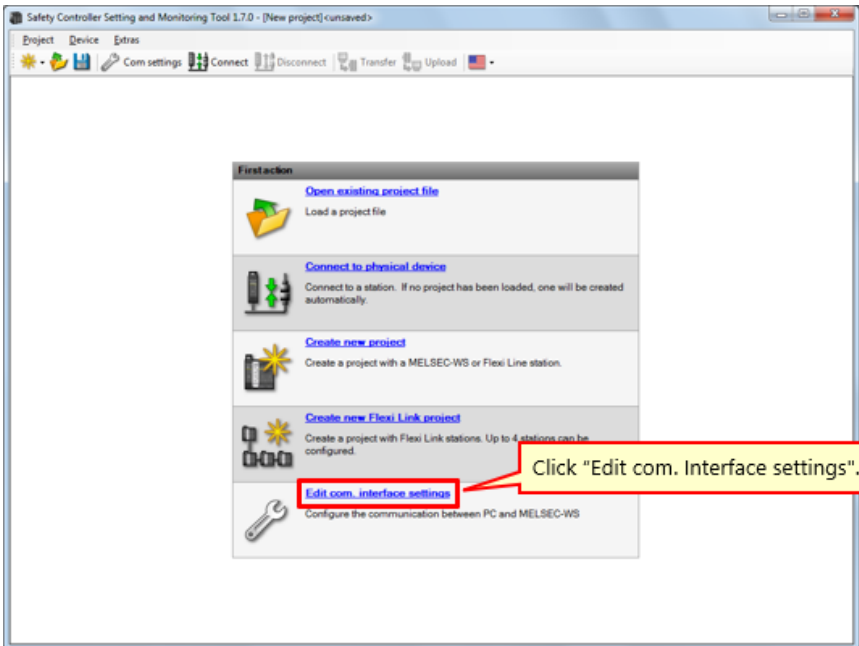


■ Ethernet connection



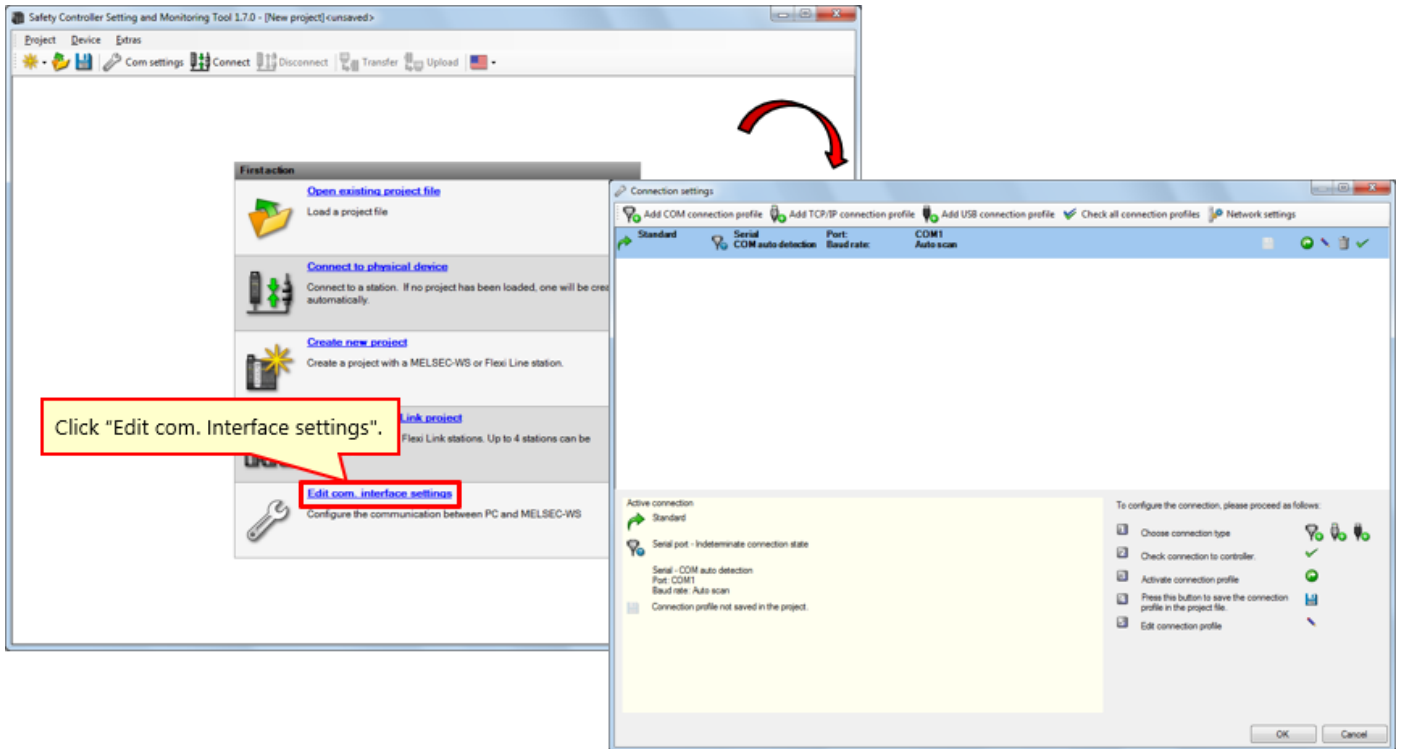
(1) Start the Setting and Monitoring tool for the safety controller.

* The following is for the RS232C connection.

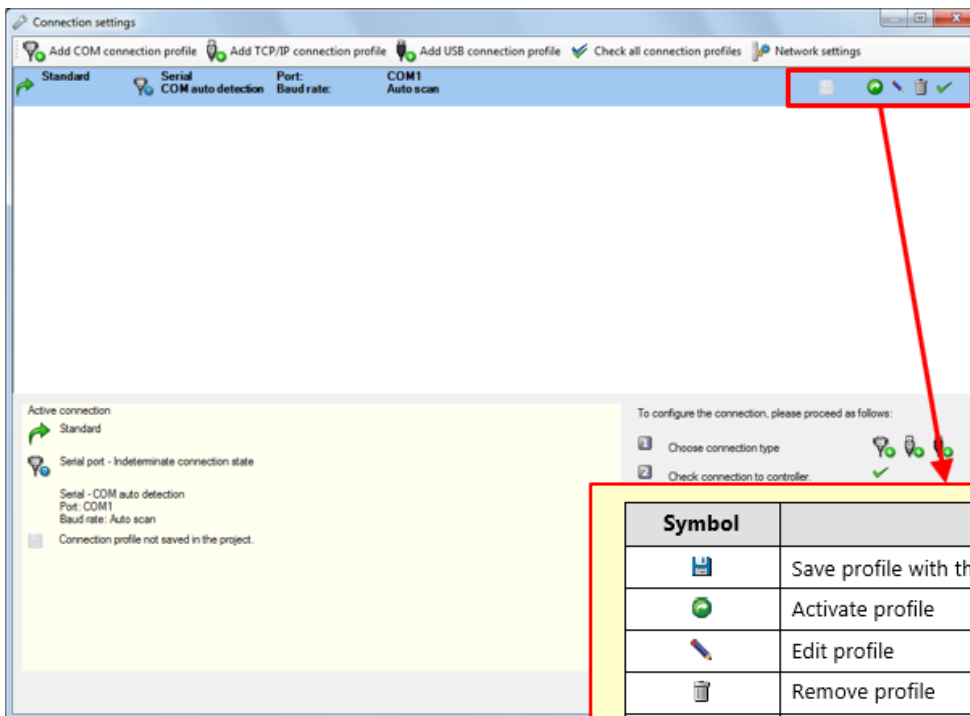







(2) Set a connection profile.

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



(3) Check the connection profile.

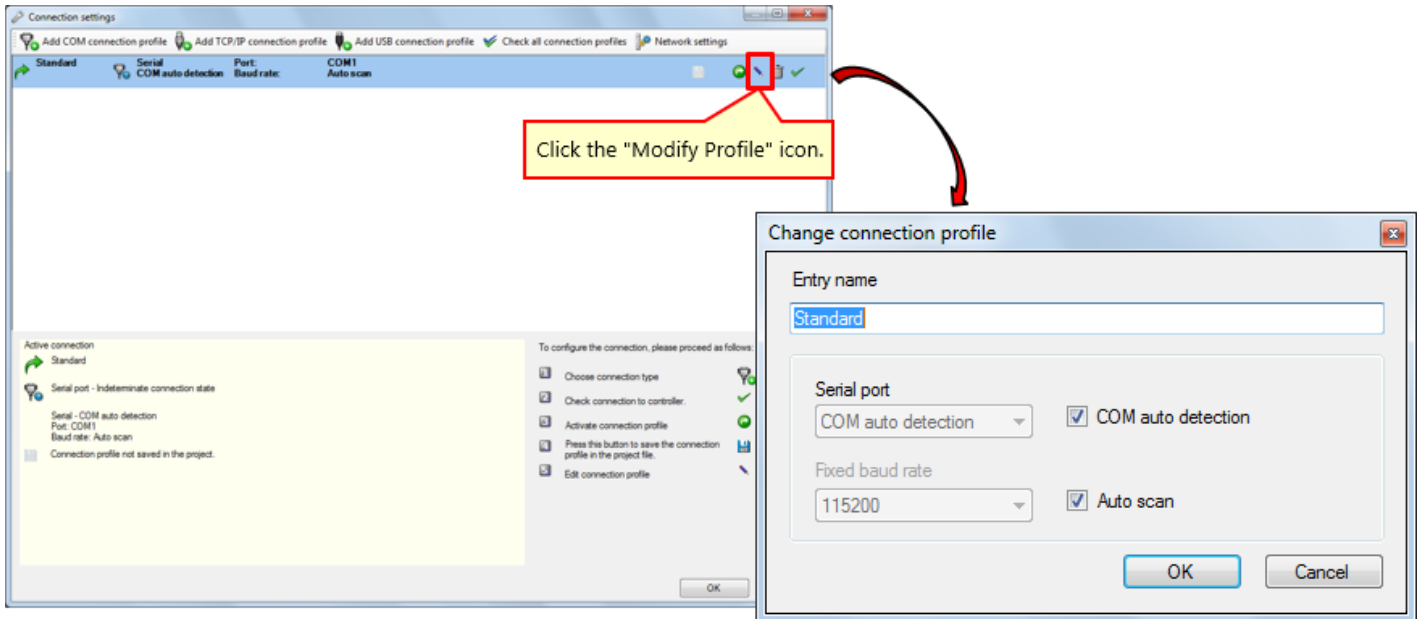


Symbol	Meaning
	Save profile with the current project
	Activate profile
	Edit profile
	Remove profile
	Check connection

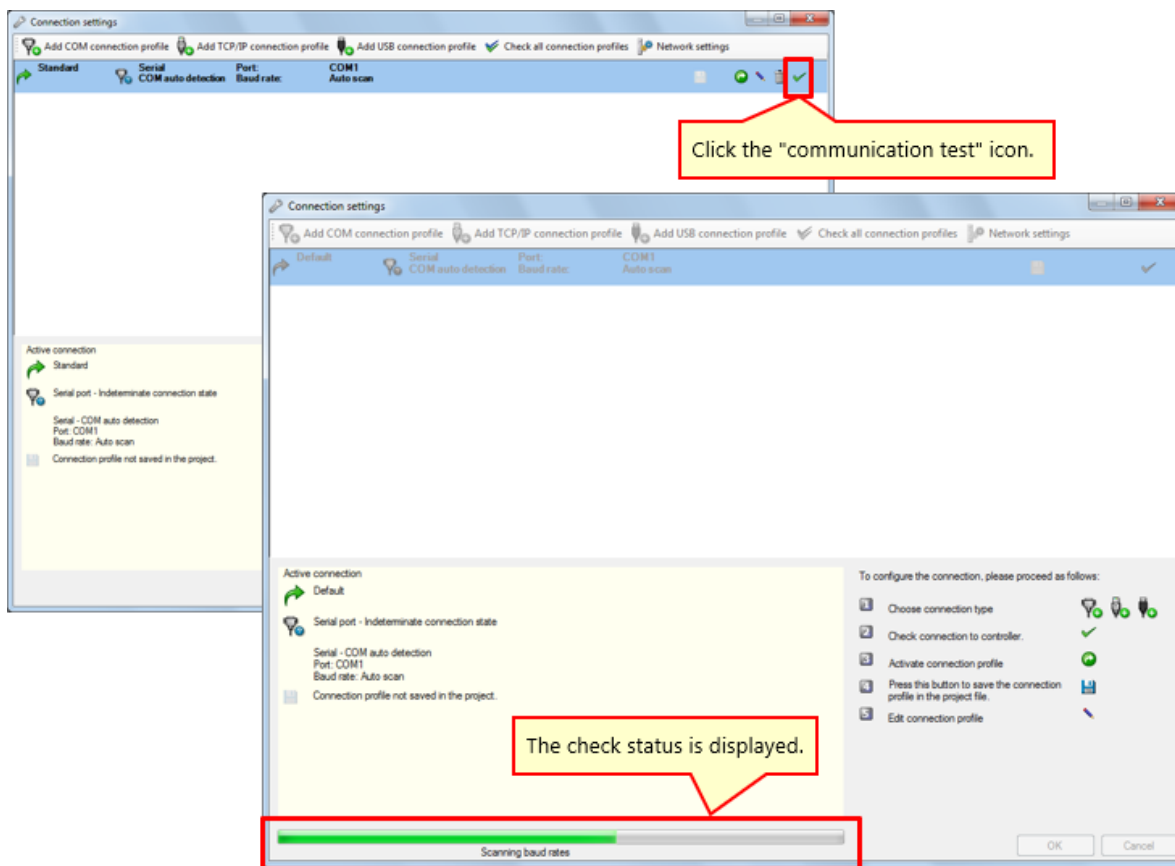
Symbols for editing the connection profiles in the Connection settings dialog box

(4) Edit the connection profile.

Select the "Modify Profile" icon.



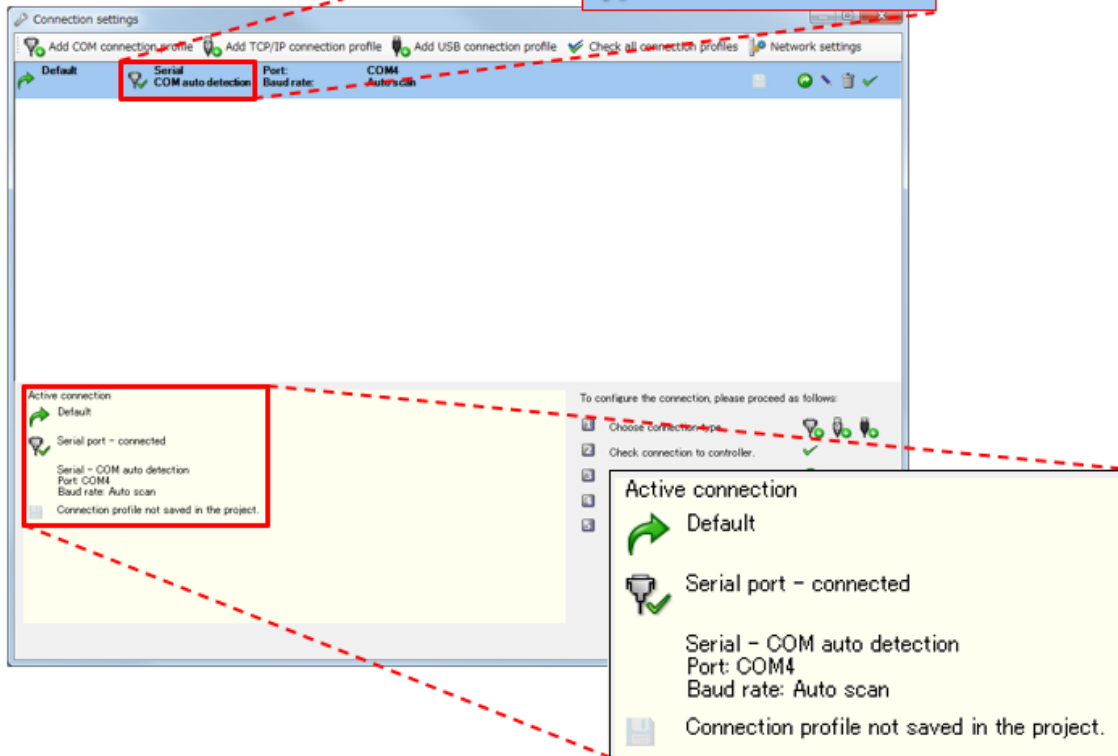
(5) Conduct a communication test.



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

Communication test succeeded

Serial
COM auto detection



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

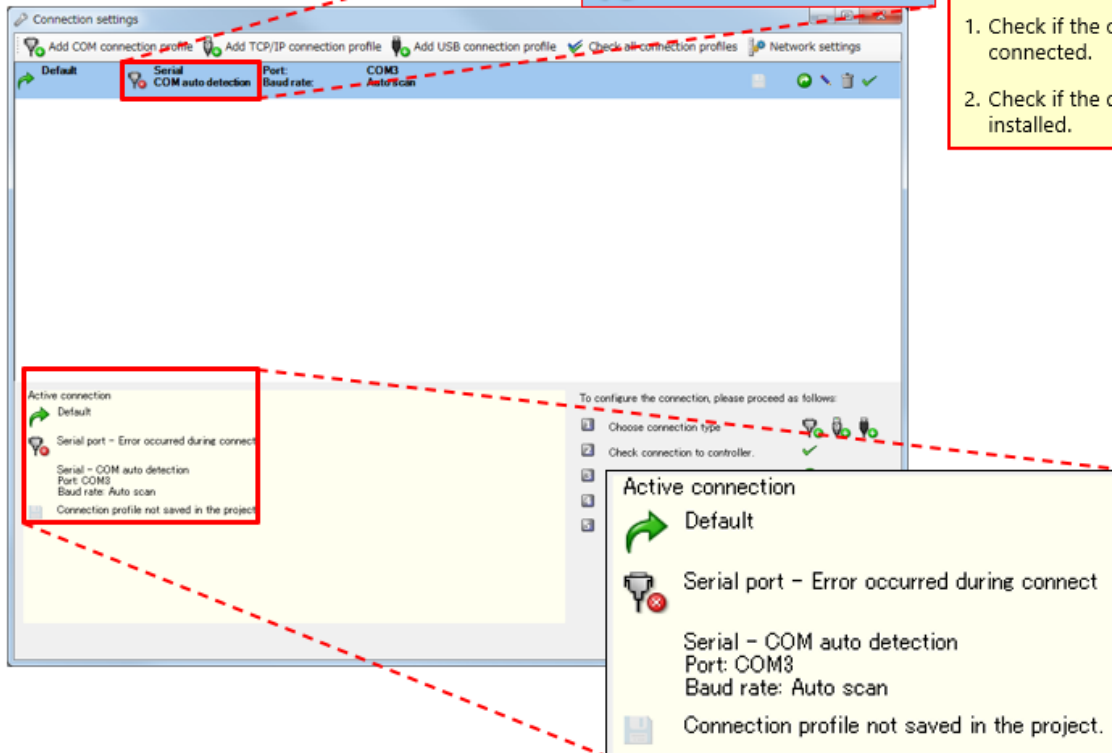
Communication test failed

**Serial
COM auto detection**

Remedy

When the connection failed

1. Check if the cable is correctly connected.
2. Check if the driver is correctly installed.



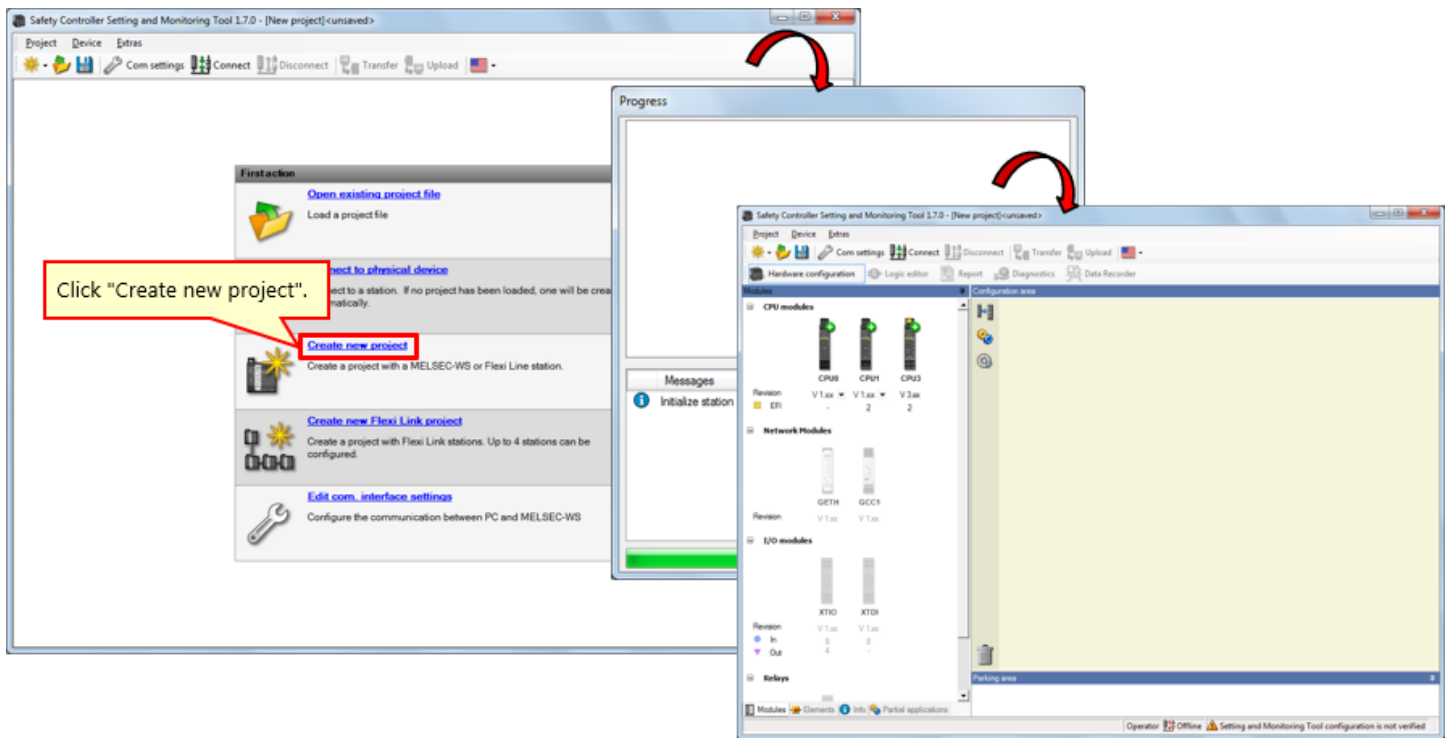
In this chapter, you have learned:

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

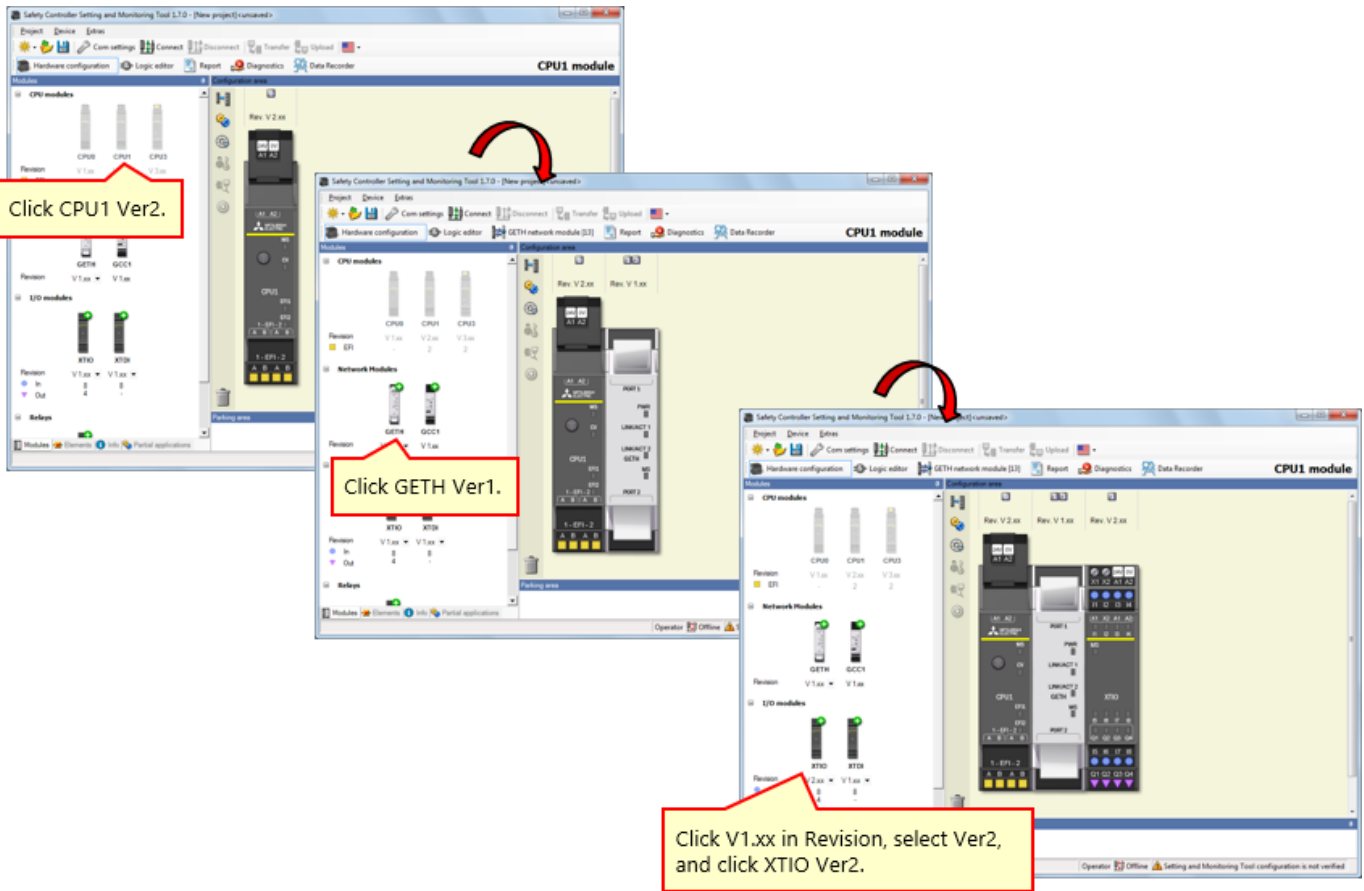
This chapter provides how to create projects for a safety controller.
Let's create a project with the system configuration described in Chapter 2.

- 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

Select "Create new project".

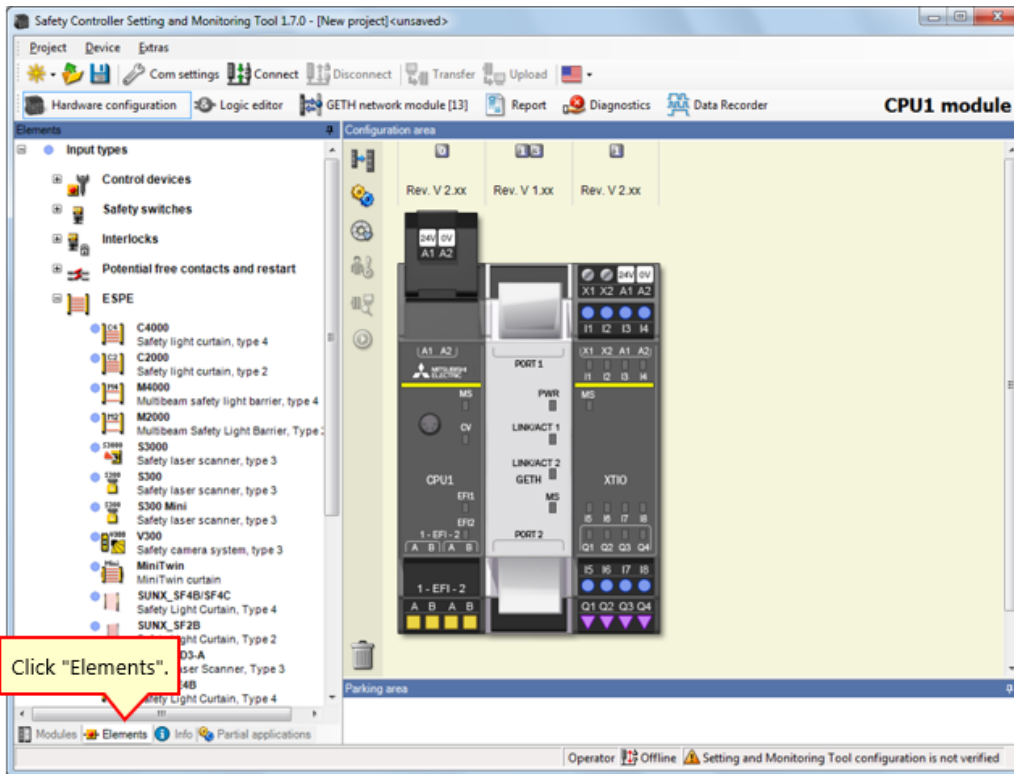


Select modules (CPU1, GETH, and XTIO) used in the hardware setting.
(Clicking the icon of a module pastes the module on the right edge.)



* In actual use, configure the settings according to the version of the device to be used.

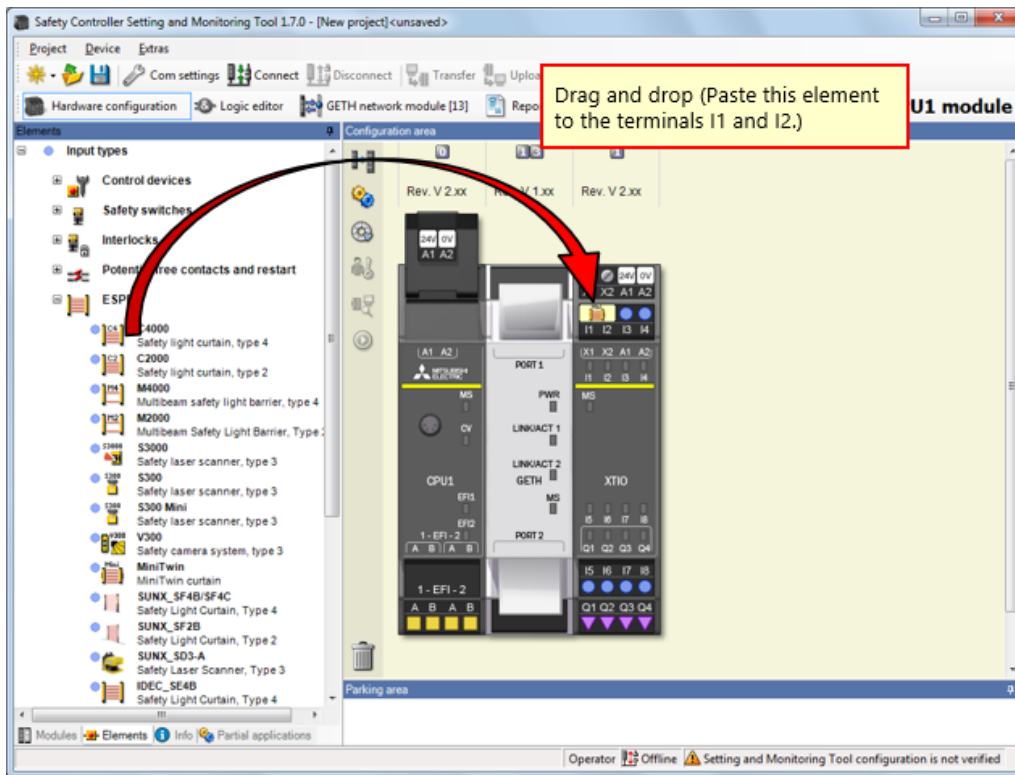
Set elements on the safety controller according to the device wiring.
→ Activate the "Elements" tag.



4.3.1

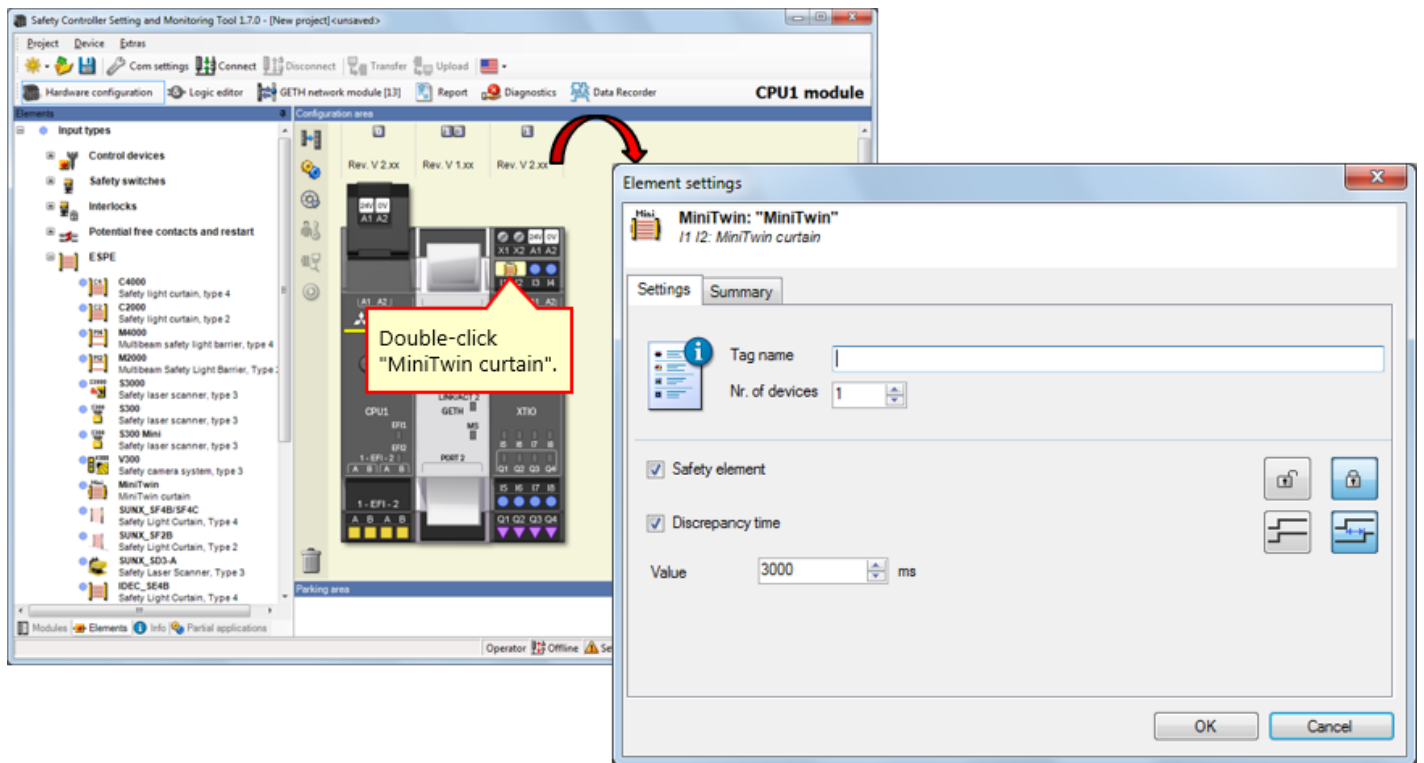
Pasting an Element of the Light Curtain

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



4.3.2 Setting the Parameter of the Light Curtain

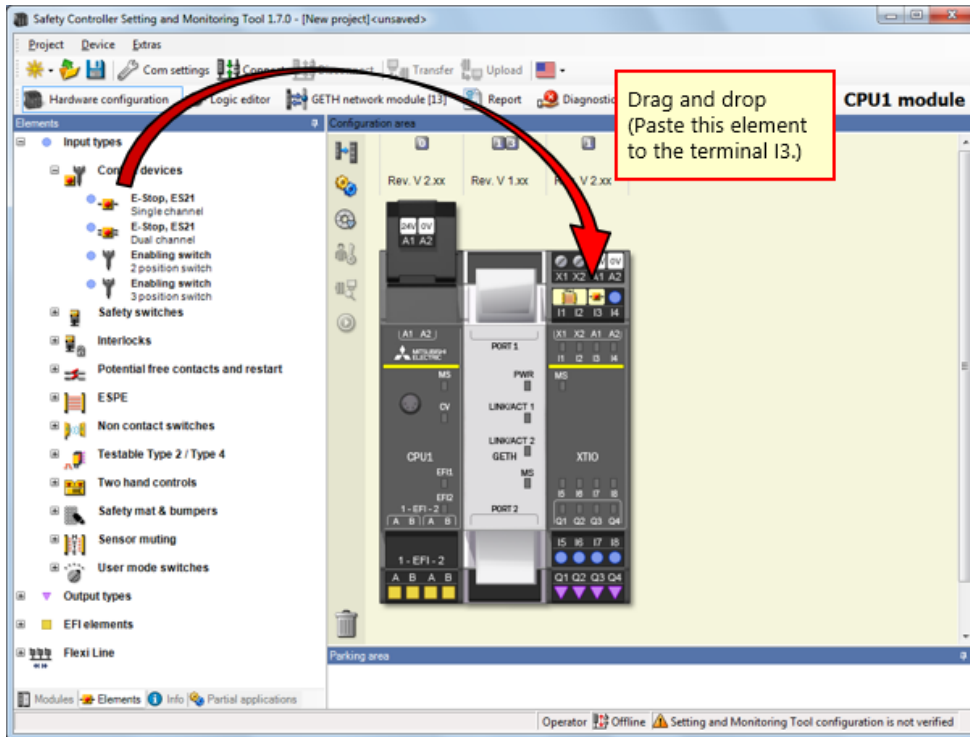
Double-click the element of the light curtain to set the parameter.



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.

The screenshot displays the 'Safety Controller Setting and Monitoring Tool 1.7.0' interface. The main window shows a 'CPU1 module' configuration area with a rack of modules including CPU1, LINKACT 2, GETH, XTIO, and PORT2. A red arrow points from an 'E-Stop' element in the rack to an 'Element settings' dialog box. A red callout box with the text 'Double-click "E-Stop"' is positioned over the element in the rack.

The 'Element settings' dialog box is titled 'E-Stop, ES21: "E-Stop, ES21"' and 'I3: Single channel'. It has two tabs: 'Settings' and 'Summary'. The 'Settings' tab is active and contains the following options:

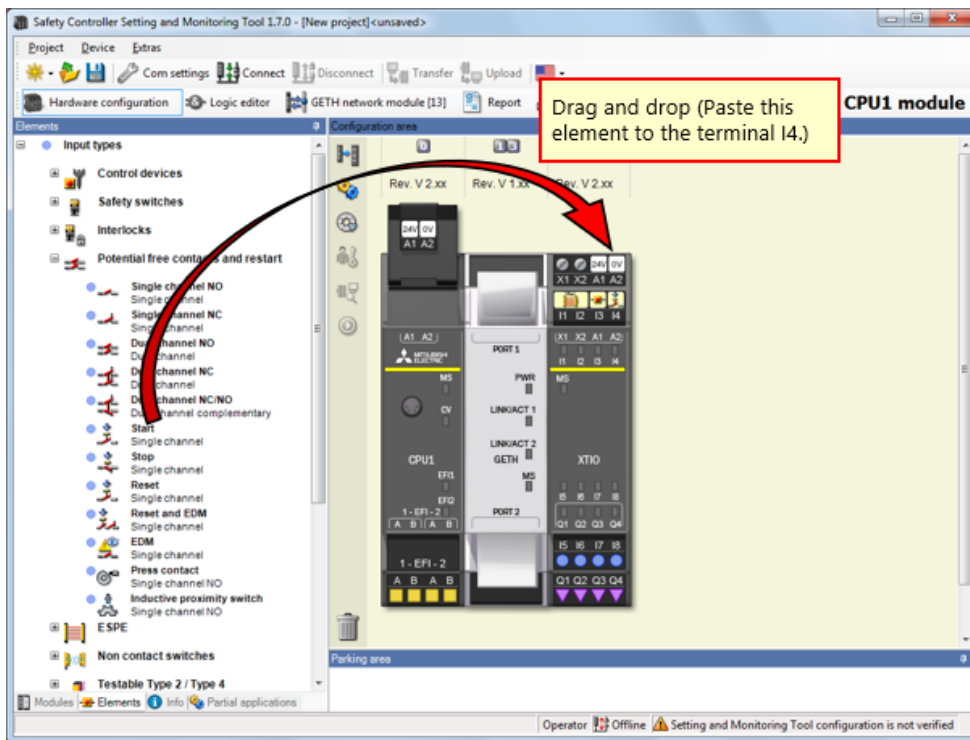
- Tag name: []
- Nr. of devices: 1
- Safety element
- ON-OFF filter (reaction time extended by filter time minimum, ≥ 8 ms)
- OFF-ON filter (reaction time extended by filter time minimum, ≥ 8 ms)
- Element is connected to test output

There are also several icons for waveform selection and lock/unlock controls. At the bottom of the dialog are 'OK' and 'Cancel' buttons.

4.3.5

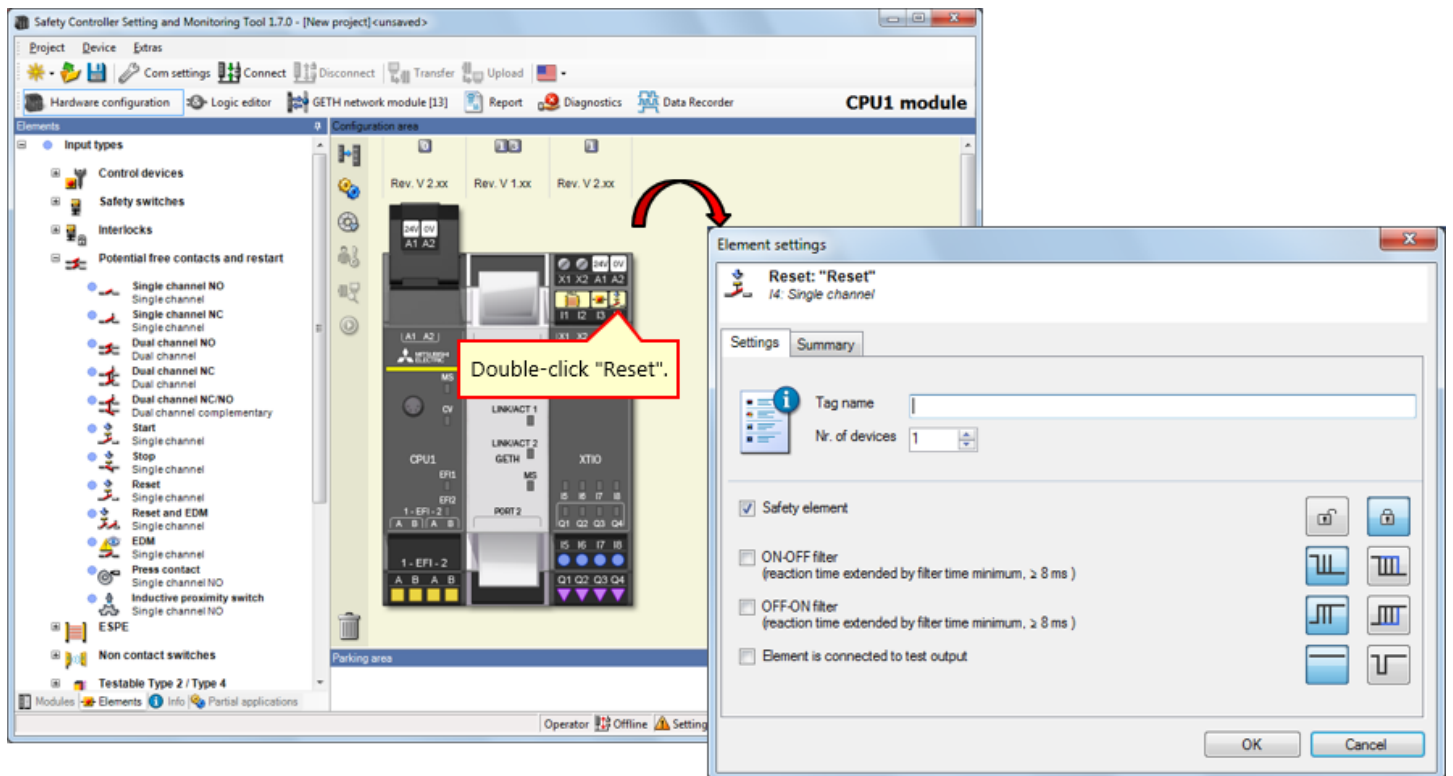
Pasting an Element of the Reset Switch

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

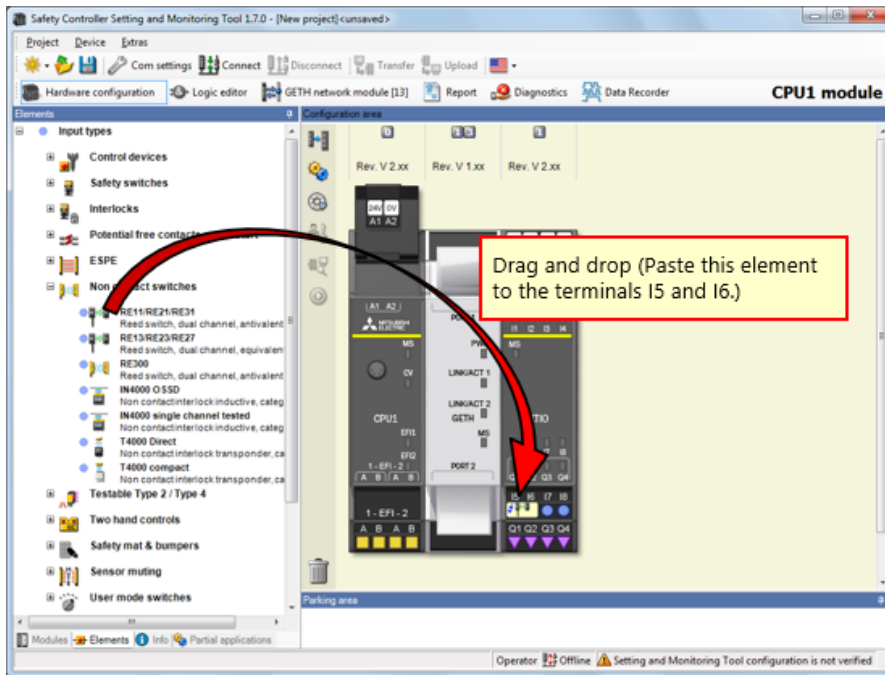
Double-click the element of the reset switch to set the parameter.



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**.



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' element in the rack to the 'Element settings' dialog box. The dialog box has three tabs: 'Settings', 'Test outputs', and 'Summary'. The 'Settings' tab is active, showing the following configuration:

- Tag name: [Empty text box]
- 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

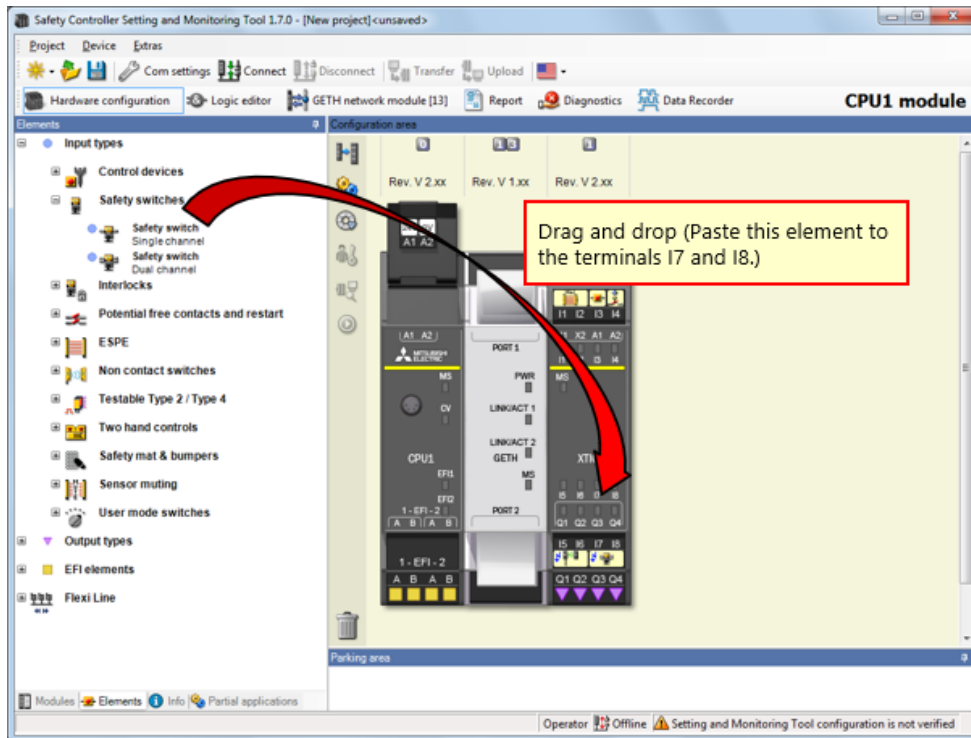
At the bottom of the dialog box are 'OK' and 'Cancel' buttons. A red callout box with the text 'Double-click "RE13/RE23/RE27"' points to the element in the rack.

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 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 'Safety switch' element in the 'Configuration area' to an 'Element settings' dialog box. A red box highlights the text 'Double-click "Safety switches"' with an arrow pointing to the 'Safety switch' element in the configuration area.

The 'Element settings' dialog box for 'Safety switch: "Safety switch"' (ID: 17 18, Dual channel) is open. It has three tabs: 'Settings', 'Test outputs', and 'Summary'. The 'Settings' tab is active, showing the following configuration:

- Tag name: [Empty text field]
- 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)
- Discrepancy time
- Value: 3000 ms

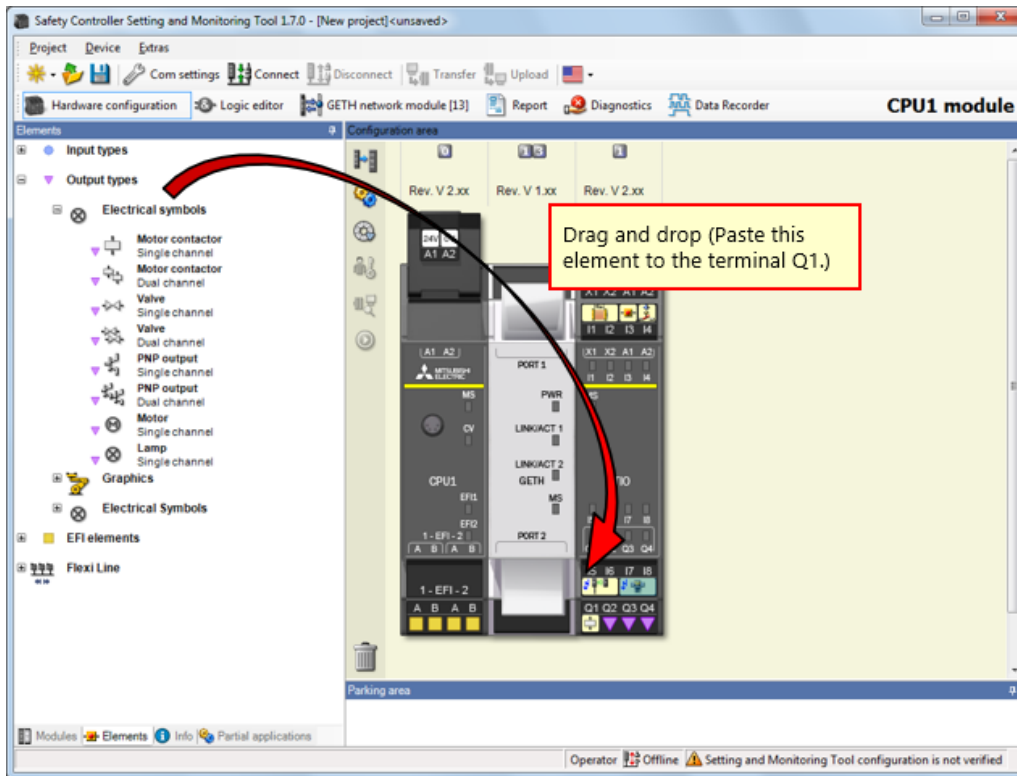
Buttons for 'OK' and 'Cancel' are at the bottom right of the dialog box.

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**.



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 hardware configuration area with various modules like CPU1, PORT 1, and PORT 2. A red arrow points from a 'Motor' element in the 'Electrical symbols' list to the 'Element settings' dialog box. The dialog box is titled 'Motor contactor: "Motor contactor"' and has a 'Tag name' field containing 'motorj'. A red box highlights the 'Tag name' field and the 'motorj' text. Another red box highlights the 'Motor' element in the list. The 'Element settings' dialog also shows 'Nr. of devices' set to 1 and several checked options: 'Safety element' and 'Enabling Test pulses of this output'. The 'Enabling Test pulses' option has a warning note: '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 'OK' and 'Cancel' buttons are at the bottom right of the dialog.

(1) Double-click "Motor".

(2) Input a tag name.

Tag name motorj

Motor contactor: "Motor contactor"
Q1: Single channel

Settings Summary

Tag name motorj

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).

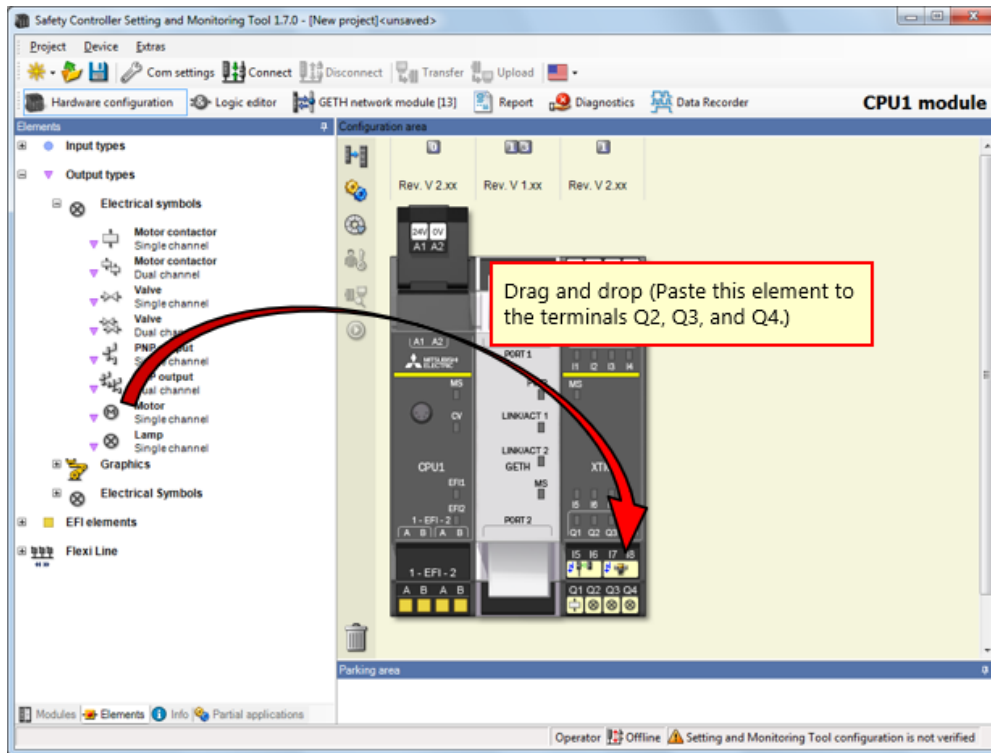
OK Cancel

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.

(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

(1) Double-click "LED".

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.

(1) Click "Edit tag names".

(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.)

(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.)

XTIO[1] 0xFF 7 6 5 4 3 2 1 0

- I7/I8 Safety switch
- I5/I6 RE13/RE23/RE27
- I4 Reset
- I3 E-Stop, ES21
- I1/I2 MiniTwin
- ▼ Q4 Lamp
- ▼ Q3 Lamp
- ▼ Q2 Lamp
- ▼ Q1 Motor contactor

Safety switch
RE13/RE23/RE27

LED RESET
LED red
LED green
motor

CPU1 module

XTIO[1] 0xFF 00000000

- I7/I8 Safety switch
- I5/I6 RE13/RE23/RE27
- I4 Reset
- I3 E-Stop, ES21
- I1/I2 MiniTwin
- ▼ Q4 Lamp
- ▼ Q3 Lamp
- ▼ Q2 Lamp
- ▼ Q1 Motor contactor

Safety switch
RE13/RE23/RE27

LED RESET
LED red
LED green
motor

Operator Offline Setting and Monitoring Tool configuration is not verified

4.5

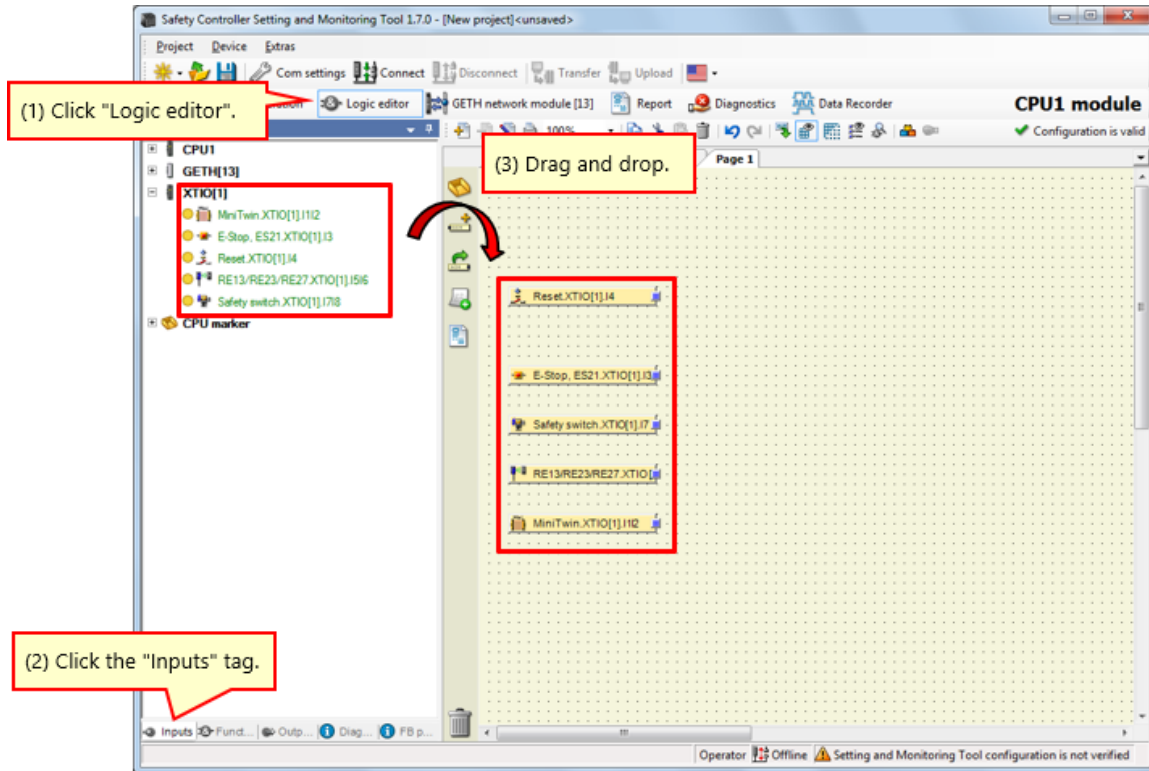
Logic Creation

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.



(1) Activate the "Function block" tag. → (2) Paste function blocks.

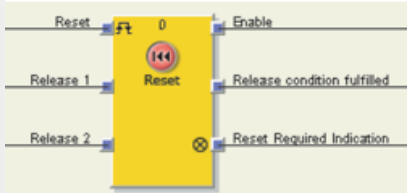
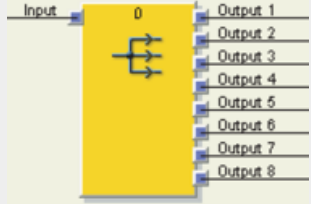
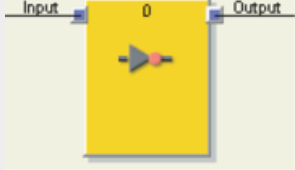
(1) Click the "Function block" tag.

(2) Drag and drop.

The next page describes the registration hierarchies and overview of the FB.

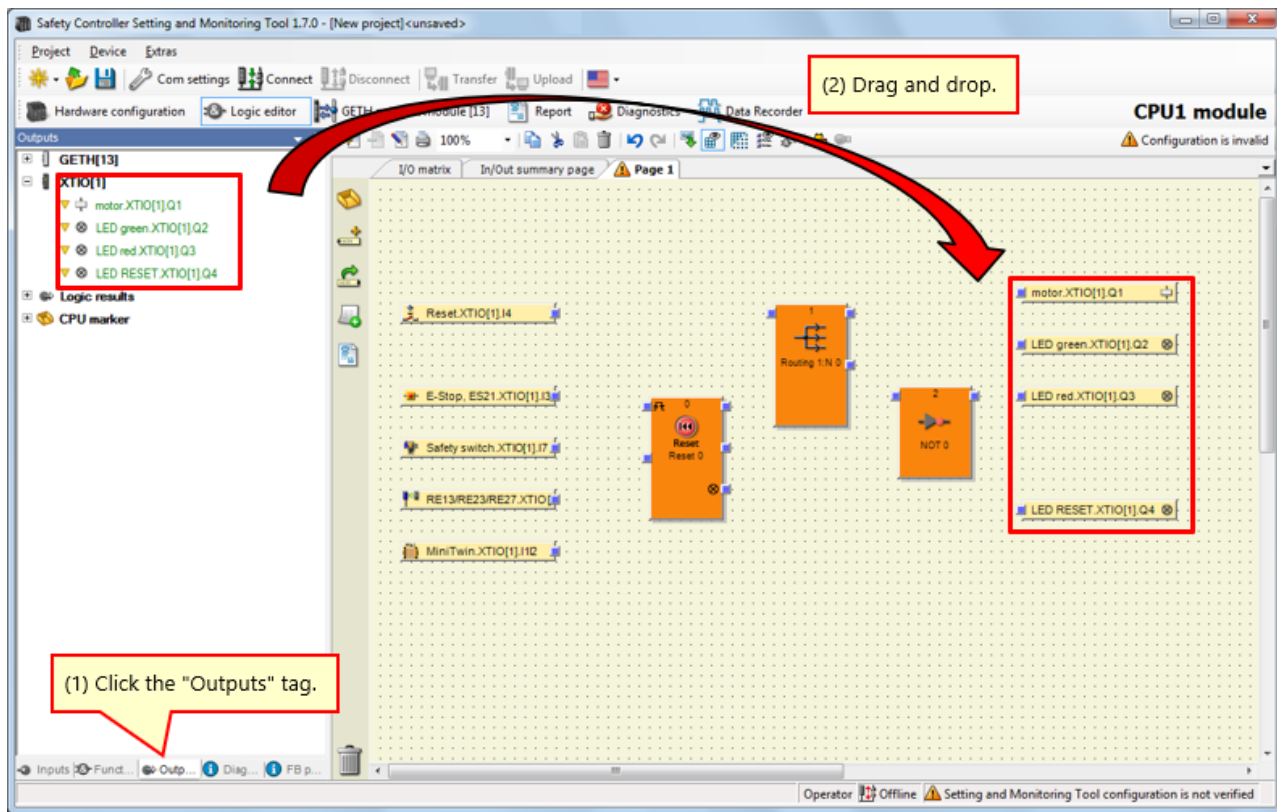
4.5.3

Description of FBs Used

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

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".

(3) The number of input fields of the Reset FB has been changed to 5.

4.5.6

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

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

(1) Double-click the Routing 1:N FB.

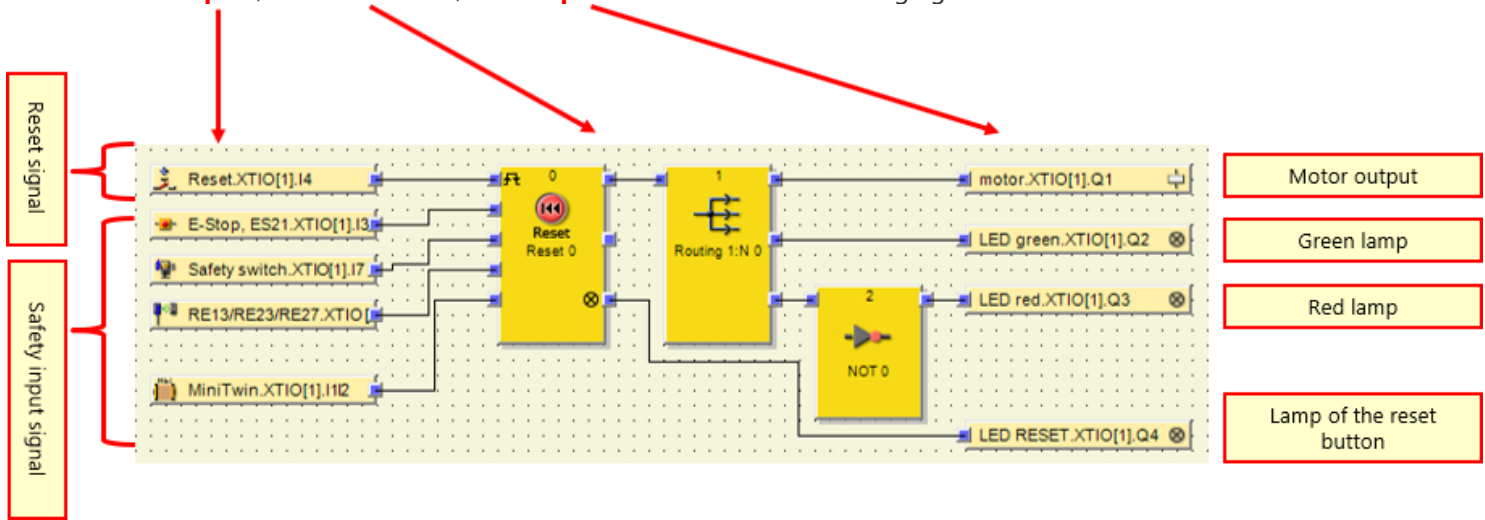
(2) Change the number of outputs to 3 in "Input/Output Settings".

(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.



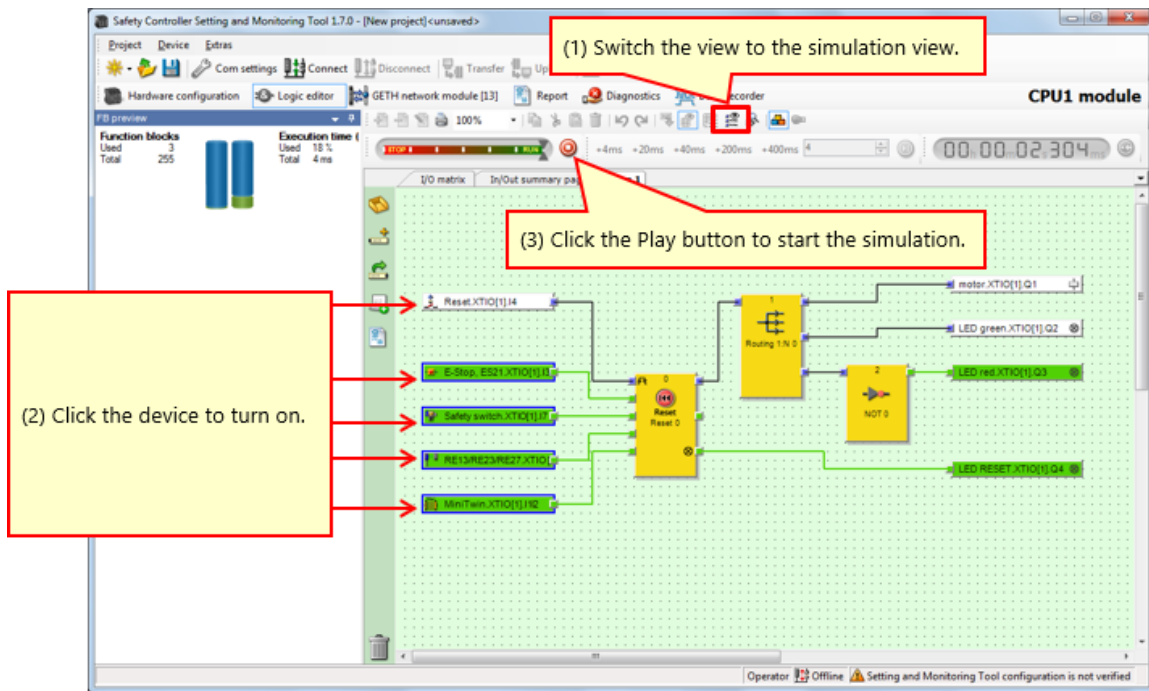


Figure. Simulation view

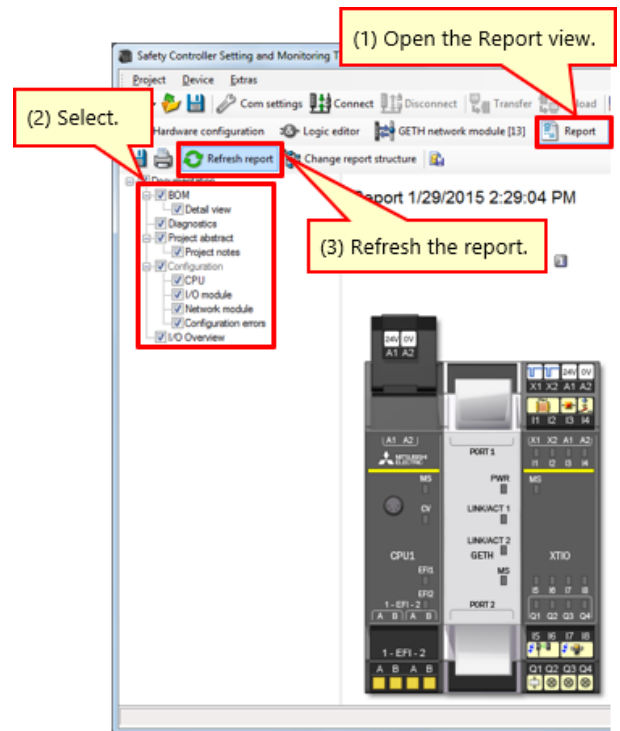
■ Report creation procedure

- (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

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

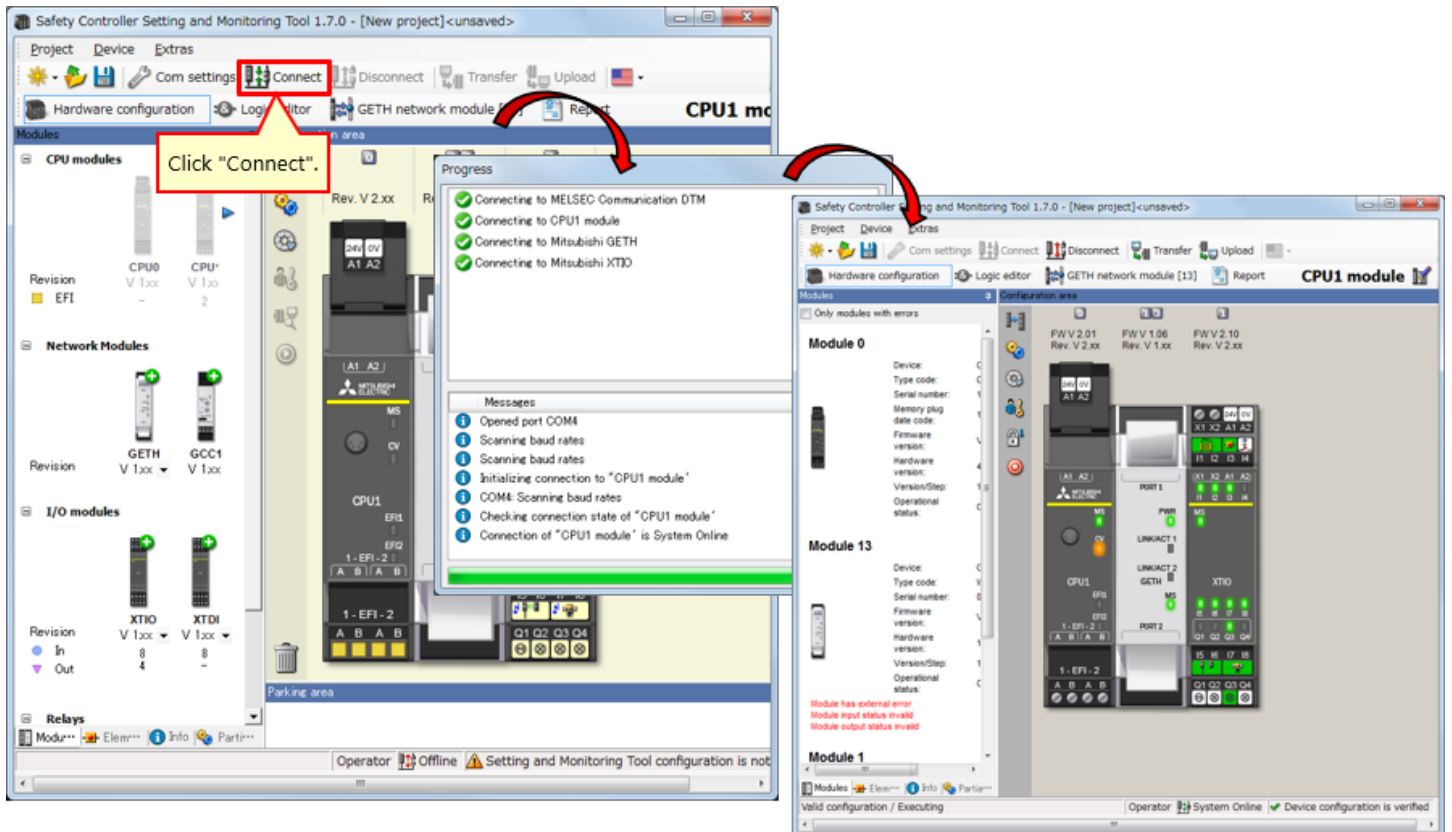
5.1 Connection with Safety Controller

5.2 Project Download

5.3 Project Verification

5.4 Project Comparison between Safety Controller and Tool

5.5 Summary of This Chapter



Safety Controller Setting and Monitoring Tool 1.7.0 - [New project]-<unsaved>

Project Device Extras

Hardware configuration Logic editor GETH network m [13] Report

Modules

Only modules with errors

Module 0

Device: CPU1
Type code: 11
Serial number: 1405 0030
Memory plug date code:
Firmware version:
Hardware version:
Version/Step:
Operational status:

Module 13

Device: CPU1
Type code: 11
Serial number: 1405 0030
Memory plug date code:
Firmware version:
Hardware version:
Version/Step:
Operational status:

Module 1

Module has external error
Module input status invalid
Module output status invalid

Valid configuration / Executing Operator System Online Device configuration is verified

Change user group

Device type MELSEC-WS
Type key CPU1
Serial number 1405 0030

User level Administrator

Password

Default: "MELSECWS"

Progress

The CPU module "CPU1 module" is currently verified. Do you really want to download the configuration?

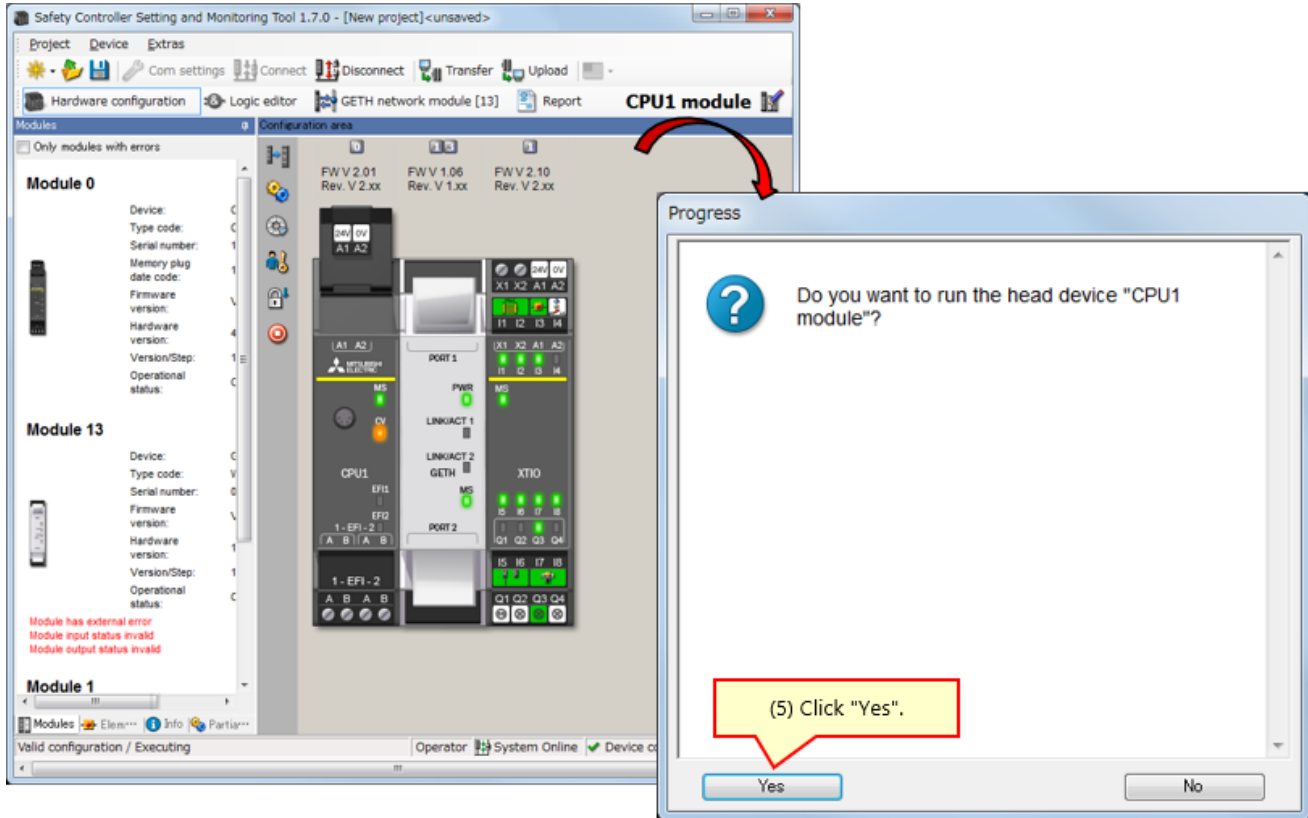
Log on Log on

(1) Click "Transfer".

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

(3) Click "Log On".

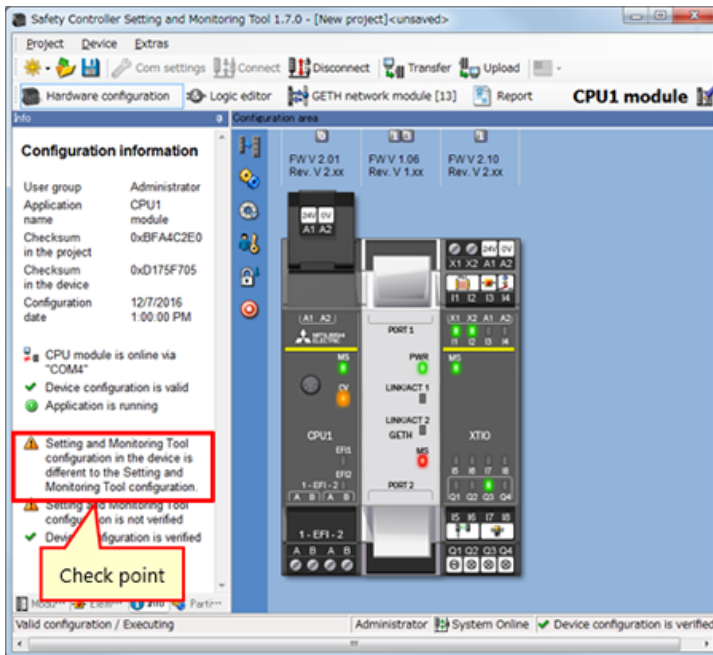
(4) Click "Yes".



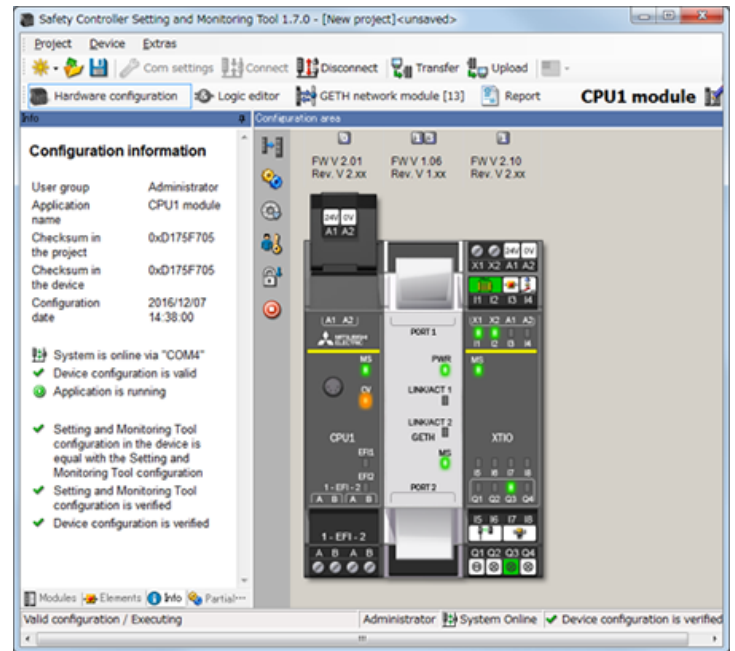
- * If verification processing has not been completed, the CPU module remains in the STOP state at the next power-on. To run the CPU module at the next power-on, verification processing is required.

The screenshot displays the 'Safety Controller Setting and Monitoring Tool 1.7.0' interface. The main window shows the 'Configuration area' for the 'CPU1 module'. A yellow callout box with a red border points to the 'Upload and verify configuration' button, with the text '(1) Click "Upload and verify configuration"'. Below this, a 'Progress' dialog box is shown with an information icon and the text 'Attention, the following report is safety-relevant. Study it carefully.' A yellow callout box with a red border points to the 'OK' button in this dialog, with the text '(2) Click "OK"'. To the right, the 'Upload and verify result' dialog box is shown, displaying a report titled 'Report 2016/12/07 13:04:44' and a 'Bill of material' section. A yellow callout box with a red border points to the 'Yes' button at the bottom right of this dialog, with the text '(3) Click "Yes"'. The background window shows configuration details for the CPU1 module, including application name, checksums, and configuration date. It also lists system status: 'System is online via "COM4"', 'Device configuration is valid', 'Application is running', and 'Setting and Monitoring Tool configuration in the device is equal with the Setting and Monitoring Tool configuration'. A warning icon indicates that 'Setting and Monitoring Tool configuration is not verified' and 'Device configuration is not verified'.

■ 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

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

6.1 Connection with Safety Controller

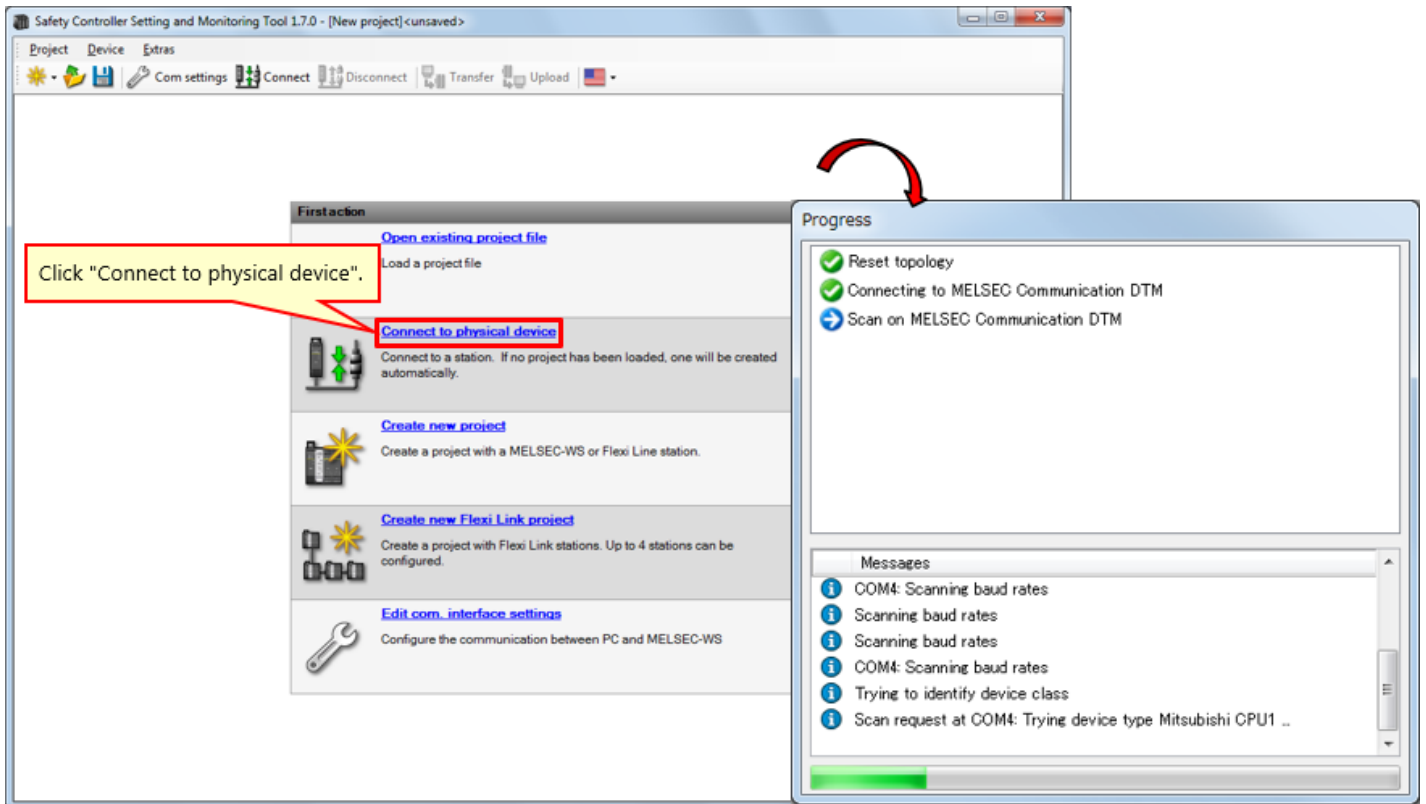
6.2 Disconnection

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 image illustrates the process of uploading configuration to a Safety Controller. It features three overlapping windows from the 'Safety Controller Setting and Monitoring Tool 1.7.0'.

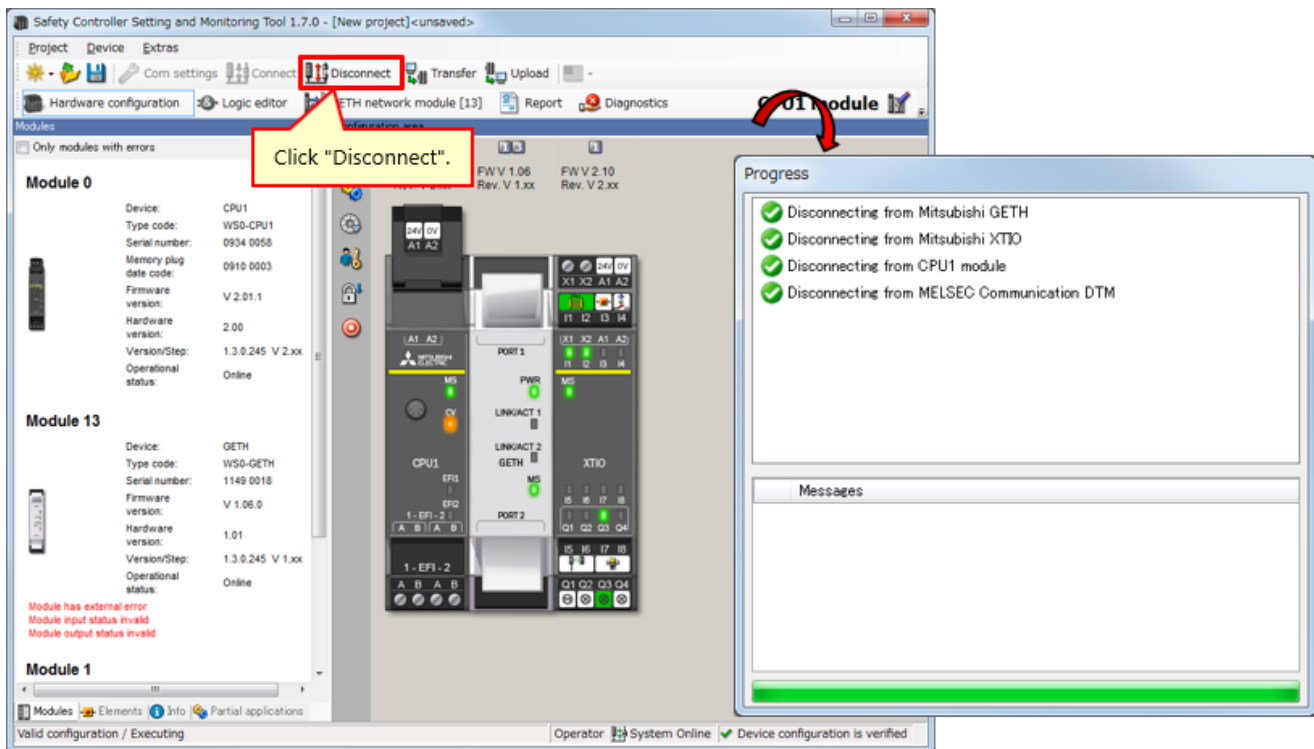
The first window, titled 'Progress', asks: "Do you want to upload the configuration on 'CPU1 module'?" A red box highlights the 'Yes' button, with a callout box stating "Click 'Yes'".

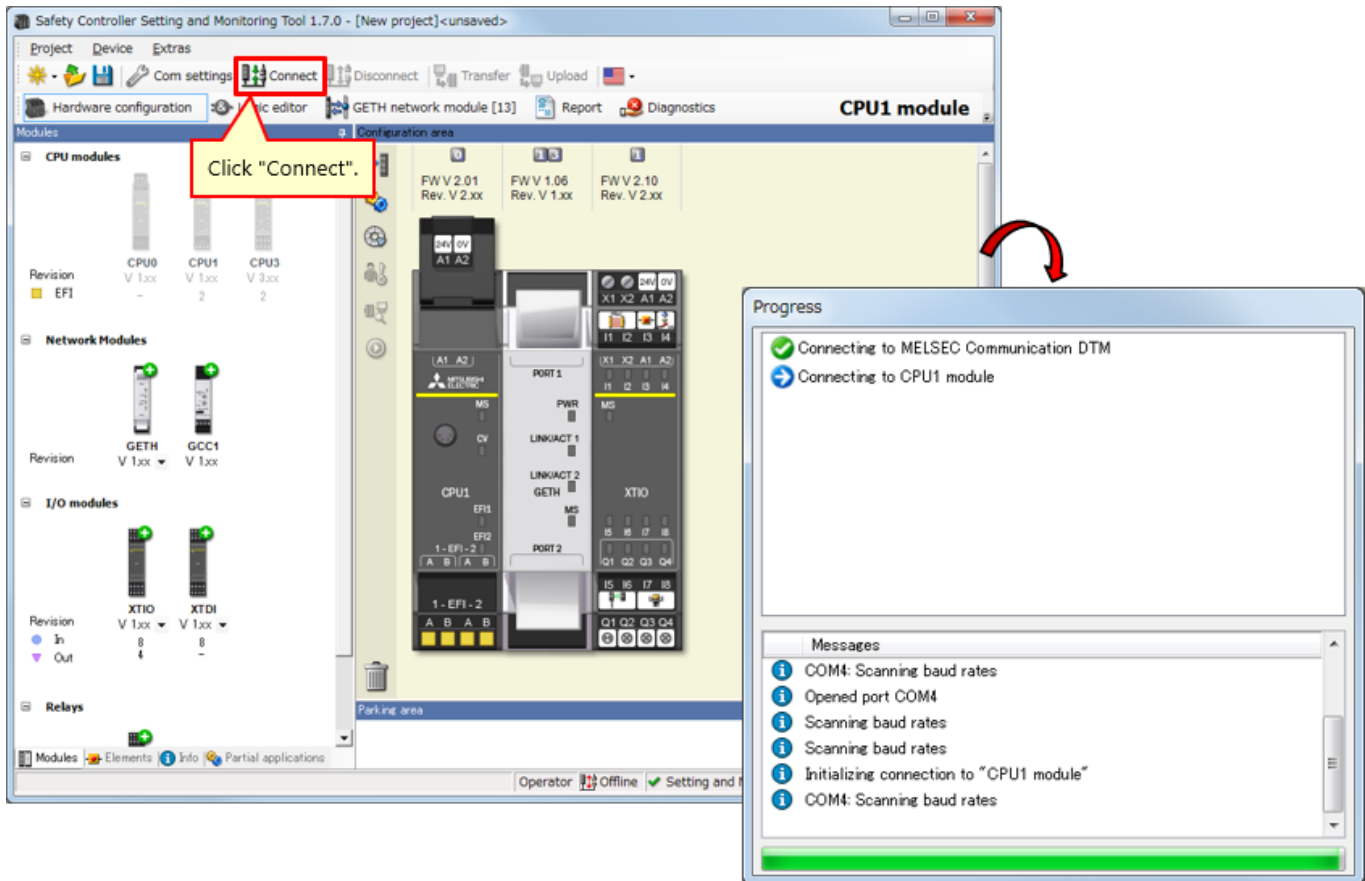
The second window, also titled 'Progress', shows the progress of the upload. It lists: "Perform scan on 'CPU1 module'" (with a green checkmark) and "Upload configuration on 'CPU1 module'" (with a blue arrow). A 'Messages' pane below lists several 'Reading Object' entries (20, 41, 46, 78, 120, 130).

The third window is the main 'Safety Controller Setting and Monitoring Tool' interface. The title bar reads "Safety Controller Setting and Monitoring Tool 1.7.0 - [New project]-unsaved-". The 'CPU1 module' is selected. The interface shows a list of modules with details for 'Module 0' and 'Module 13'. 'Module 0' is a CPU1 (W50-CPU1) with serial number 1329 0039, firmware version V 2.01.0, hardware version 2.00, and version step 1.3.0.245 V 2.xx. 'Module 13' is a GETH (W50-GETH) with serial number 1329 0000, firmware version V 1.06.0, hardware version 1.01, and version step 1.3.0.245 V 1.xx. The 'Configuration area' on the right shows a rack of modules with various status indicators.

A yellow callout box with a red border states: "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

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

The screenshot displays the Safety Controller Setting and Monitoring Tool 1.7.0 interface, showing the hardware configuration and logic editor for a CPU1 module.

Hardware Configuration:

- FW V 2.01 Rev. V 1.xx
- FW V 1.06 Rev. V 1.xx
- FW V 2.10
- Hardware configuration: CPU1 module
- Ports: PORT 1, PORT 2
- Links: LINKACT 1, LINKACT 2, GETH
- EPIS, EPQ, RE13/R, RE21/R, RE27/R

Elements List:

Title	Position	Tag name
XTIO	A1	XTIO(1)
E-Stop...	A1B	
Reset	A1B	
Motor	A1Q1	
Lamp	A1Q2	
Lamp	A1Q3	
Lamp	A1Q4	
C489	A11Q2	
RE13/R	A1B36	
Safety	A1179	

Logic Editor:

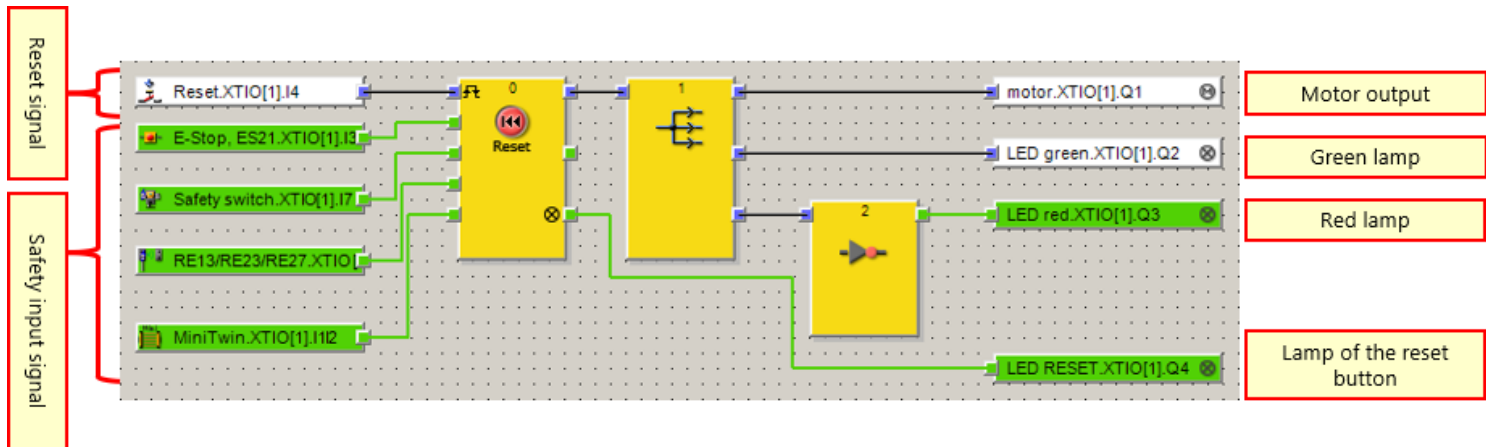
The logic editor shows a ladder logic diagram for the CPU1 module. The diagram includes the following elements:

- Reset.XTIO(1).Q1
- LED green.XTIO(1).Q2
- LED red.XTIO(1).Q3
- LED RESET.XTIO(1).Q4
- motor.XTIO(1).Q1
- E-Stop.E521.XTIO(1).Q1
- Safety switch.XTIO(1).Q1
- RE13/RE23/RE27.XTIO(1).Q1
- RE13/RE23/RE27.XTIO(1).Q1
- RE13/RE23/RE27.XTIO(1).Q1

The status bar at the bottom indicates: Valid configuration / Executing. Operator System Online Device configuration is verified.

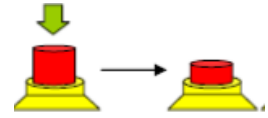
If no safety input device is operated and have malfunction after power-on of the safety controller, the components enter the following status.

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



■ Operating the emergency stop switch

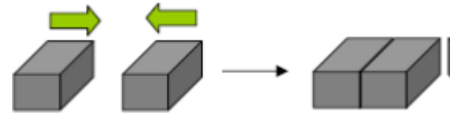
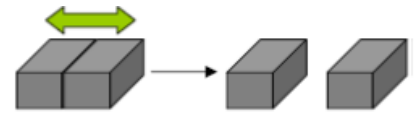
- Holding the emergency stop switch activates a trouble signal.
→ Press the emergency stop switch.
- After the emergency stop switch is restored, pressing the reset lamp or switch clears the trouble signal.
→ Restore the emergency stop switch.



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.

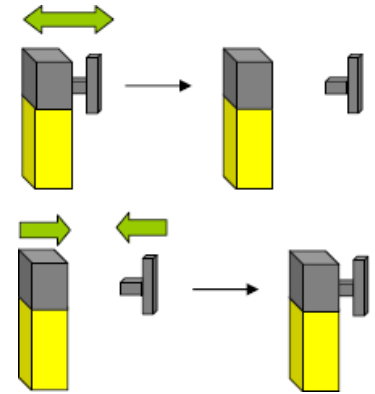


Application: To stop the operation of the hazard source when the door installed to the safety fence is opened

■ 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.

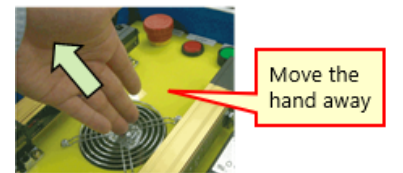
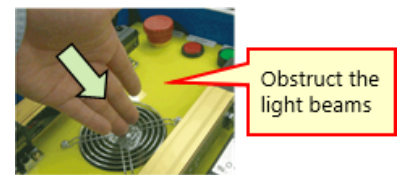
Application: To stop the operation of the hazard source when the door installed to the safety fence is opened

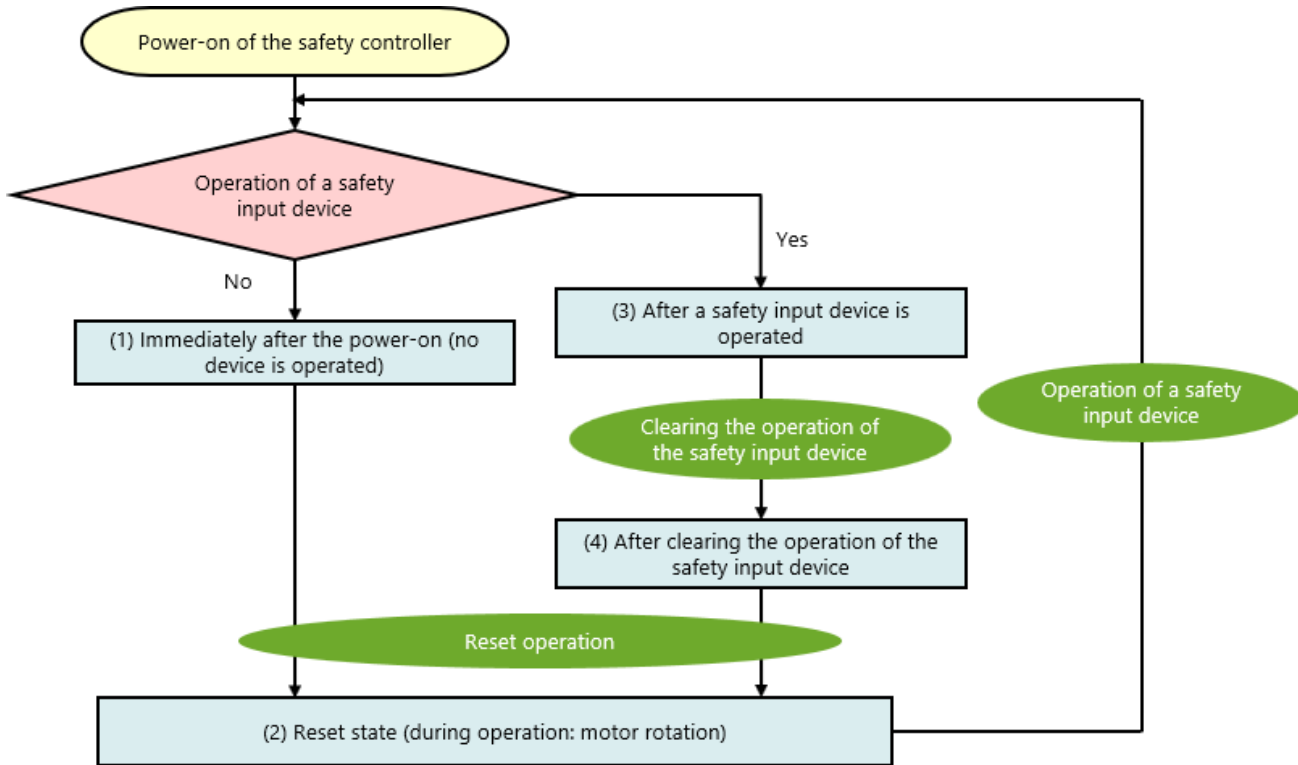


■ Operating the light curtain

- 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



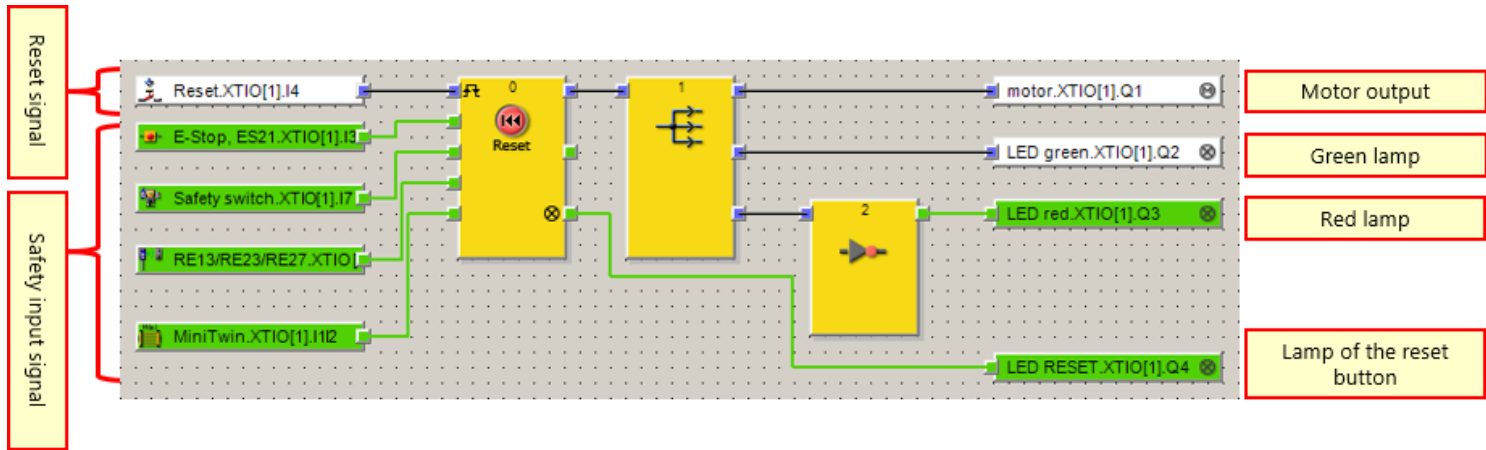


7.5 Program Description

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

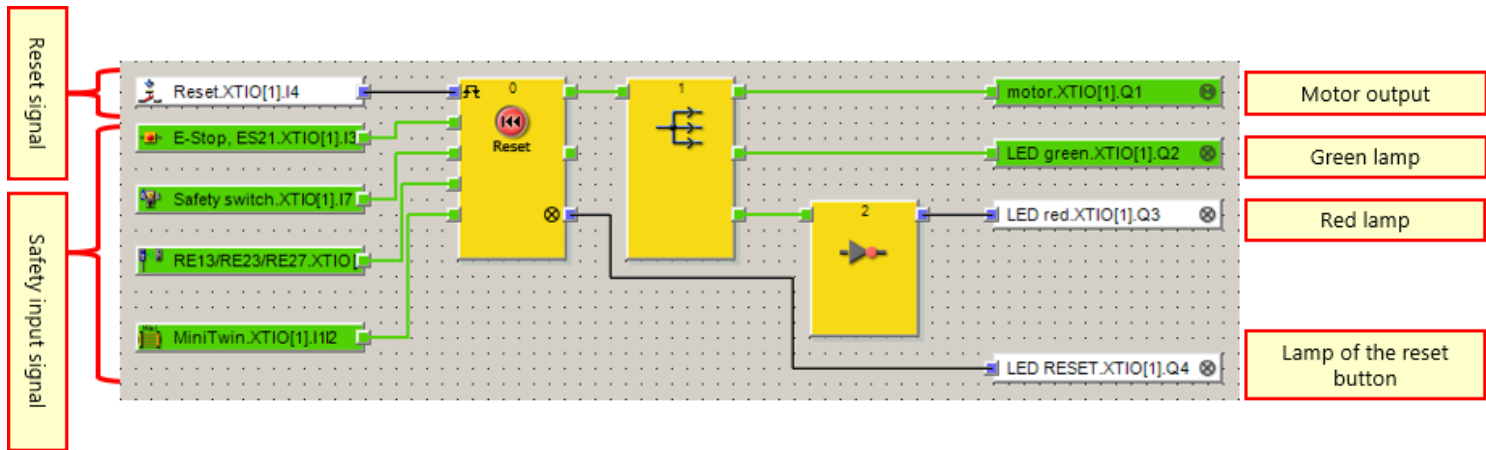


7.5.2

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



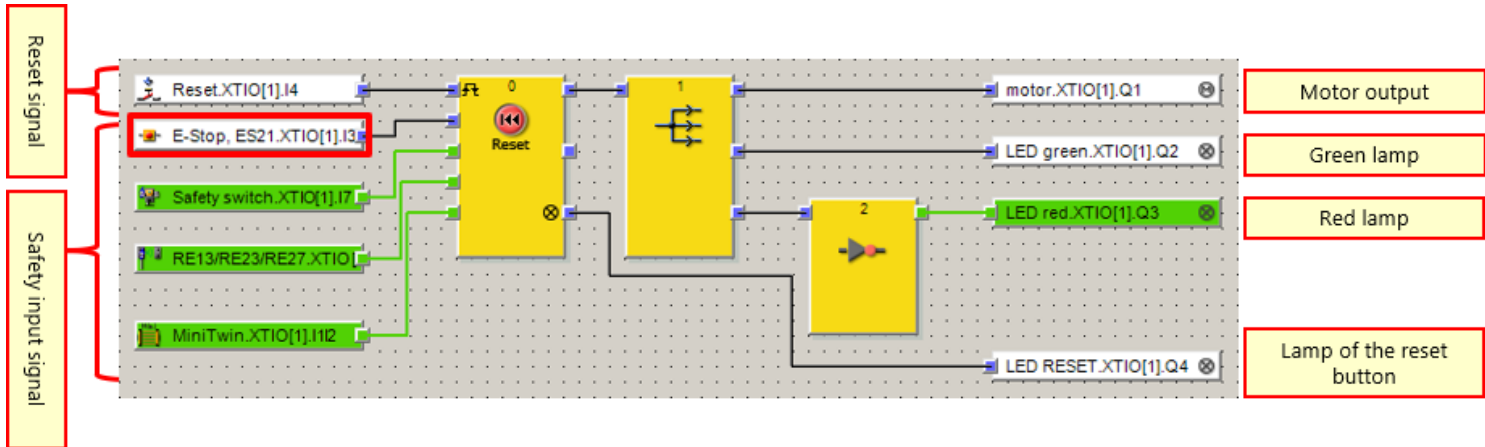
7.5.3

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



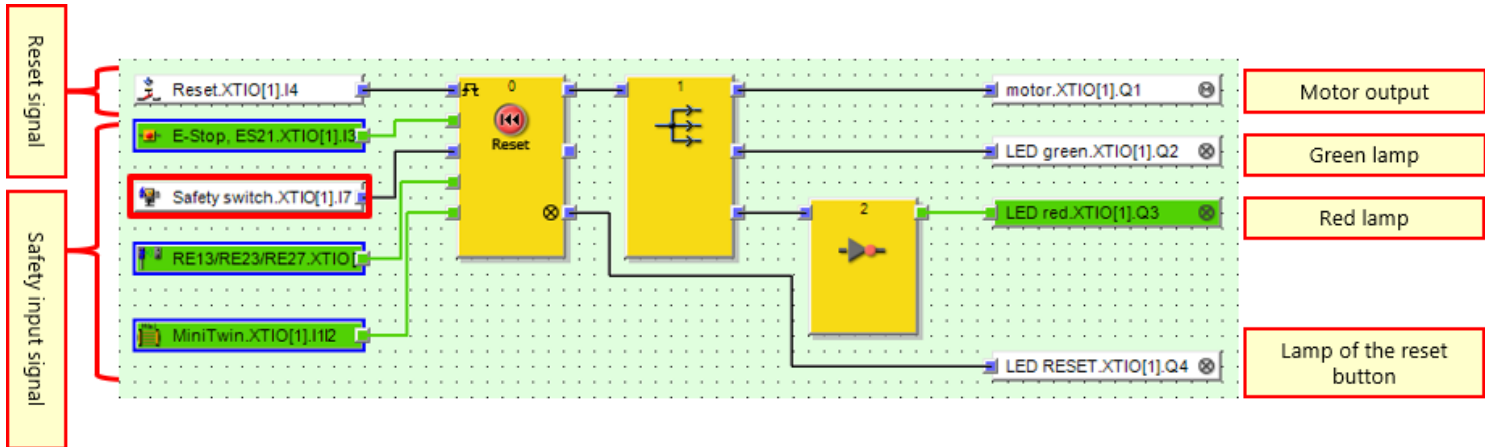
7.5.3

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



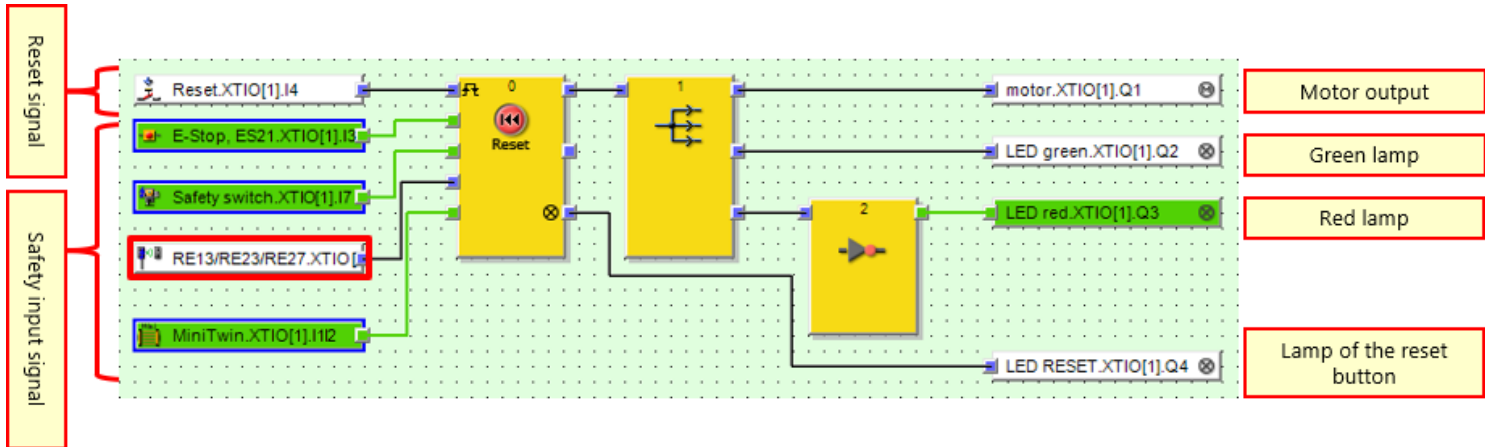
7.5.3

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

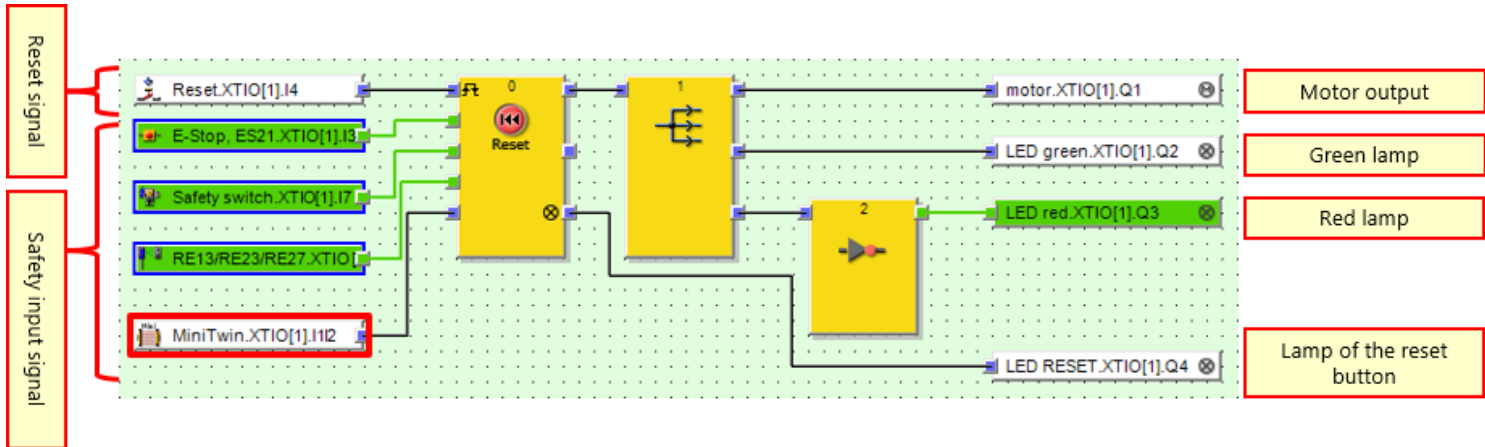


7.5.3 After a safety input device is operated

■ 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

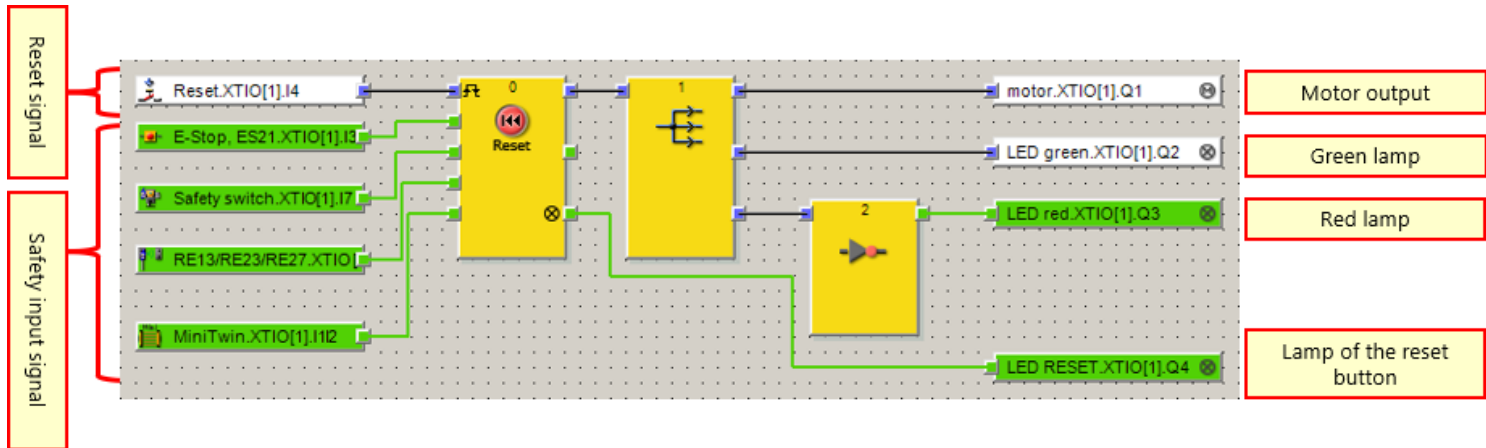


7.5.4

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 'Diagnostics' window for a 'CPU1 module'. The error log table is as follows:

Time stamp	Local time	Source	Category	Description
09:42:25	12/9/2016 8:56:21 AM	CPU module	Application	Configuration in the memory plug is incompatible for at least one safety I/O mo...
09:42:25	12/9/2016 8:56:21 AM	CPU module	FLEXBUS+	Configuration in the memory plug is incompatible for at least one safety I/O mo...
09:42:25	12/9/2016 8:56:21 AM	CPU module	Application	Configuration in the memory plug is incompatible for at least one safety I/O mo...
09:42:25	12/9/2016 8:56:21 AM	CPU module	Application	Configuration in the memory plug is incompatible for at least one safety I/O mo...
09:41:05		CPU module	Application	Configuration in the memory plug is incompatible for at least one safety I/O mo...
09:41:05		CPU module	FLEXBUS+	Configuration in the memory plug is incompatible for at least one safety I/O mo...

The detailed view for the selected error is:

Code	0x001F4006
Description	Configuration in the memory plug is incompatible for at least one safety I/O module.
Time stamp	09:42:25
Local time	12/9/2016 8:56:21 AM
Power-up cycles	47
Type	Warning (non-volatile)
Source	CPU module
Category	Application
Information	08 03 00 00
Occurrence counter	1
Power on hour	00:00:12 (12 s)
Operating hours	09:42:25 (34945 s)
Block	8
Register	0
CPU channel	A

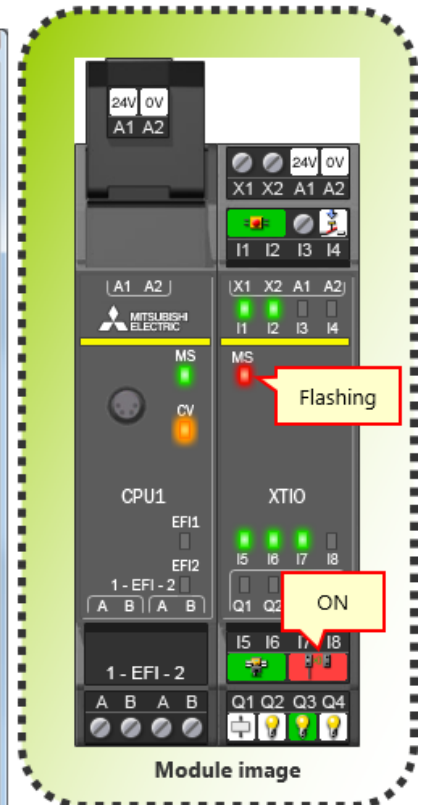
At the bottom of the window, the status bar shows: Configuration is invalid / Configuration required | Operator CPU module online | Device configuration is verified.

Details

Flashing

ON

Module image



In this chapter, you have learned:

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

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.

		1	2	3	4	5	6	7	8	9	10	
Retry	Final Test 1	✓	✓	✓	✗							Total questions: 28 Correct answers: 23 Percentage: 82 %
	Final Test 2	✓	✓	✓	✓							
	Final Test 3	✓										
	Final Test 4	✓										
	Final Test 5	✓	✓									
Retry	Final Test 6	✓	✗	✗	✗							
	Final Test 7	✓	✓	✓	✓							
	Final Test 8	✓	✓	✓	✓	✓						
	Final Test 9	✓										
Retry	Final Test 10	✗										

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

In a safety controller (MELSEC-WS), "up to 10" safety I/O modules can be connected to a CPU module.

Q1

○

×

The Setting and Monitoring Tool, a programming tool for the safety controller, is available for free.

Q1

○

×

The programming language of the Setting and Monitoring Tool for the safety controller is "FBD".

Q1

○

×

The report creation function of the Setting and Monitoring Tool for the safety controller can output hardware configurations and error histories to PDF files.

Q1

○

×

The default password for the user level "Administrator", which is required for downloading projects in safety controllers, is "MELSECWS".

Q1

○

×

The safety controller cannot be connected with a MELSEC-Q series programmable controller via a network and cannot monitor the operating status of the programmable controller.

Q1 ○ ×

In a safety controller (MELSEC-WS), "up to 10" safety I/O modules can be connected to a CPU module.

Q1

○

×

The Setting and Monitoring Tool, a programming tool for the safety controller, is available for free.

Q1

○

×

The programming language of the Setting and Monitoring Tool for the safety controller is "FBD".

Q1

○

×

The report creation function of the Setting and Monitoring Tool for the safety controller can output hardware configurations and error histories to PDF files.

Q1

○

×

The default password for the user level "Administrator", which is required for downloading projects in safety controllers, is "MELSECWS".

Q1 ○ ×

The safety controller cannot be connected with a MELSEC-Q series programmable controller via a network and cannot monitor the operating status of the programmable controller.

Q1

○

×

You have completed the Final Test. Your results area as follows.
To end the Final Test, proceed to the next page.

	1	2	3	4	5	6	7	8	9	10
Final Test 1	✓									
Final Test 2	✓									
Final Test 3	✓									
Final Test 4	✓									
Final Test 5	✓									
Final Test 6	✓									

Total questions: **6**

Correct answers: **6**

Percentage: **100 %**

Clear

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.

Review

Close