

- 24-hour Telephone Number: (937) 847-3200
Use for urgent or emergency needs for technical support, service and/or replacement parts
- Routine Technical Inquiries: techsupport@motoman.com
Allow up to 36 hours for response

YRC1000 OPTIONS INSTRUCTIONS

FOR DeviceNet Safety FUNCTION

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS

YRC1000 INSTRUCTIONS

YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)

YRC1000 MAINTENANCE MANUAL

YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

The YRC1000 operator's manual above corresponds to specific usage. Be sure to use the appropriate manual.
The YRC1000 operator's manual above consists of "GENERAL" and "SUBJECT SPECIFIC".
The YRC1000 alarm codes above consists of "MAJOR ALARMS" and "MINOR ALARMS".

Please have the following information available when contacting Yaskawa Customer Support:

- System
- Primary Application
- Software Version (*Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version}*)
Robot Serial Number (*Located on robot data plate*)
Robot Sales Order Number (*Located on controller data plate*)

Part Number: 179320-1CD
Revision: 0

MANUAL NO.

HW1483416 ①

1/64



DANGER

- This manual explains the DeviceNet Safety function of the YRC1000 system. Read this manual carefully and be sure to understand its contents before handling the YRC1000. Any matter, including operation, usage, measures, and an item to use, not described in this manual must be regarded as “prohibited” or “improper”.
- General information related to safety are described in “Chapter 1. Safety” of the YRC1000 INSTRUCTIONS. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of the YRC1000 INSTRUCTIONS.



CAUTION

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place before operating this product.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the YRC1000.

In this manual, the Notes for Safe Operation are classified as “DANGER”, “WARNING”, “CAUTION”, or “NOTICE”.

**DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

**WARNING**

Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

**CAUTION**

Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

NOTICE

NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as “CAUTION” may result in a serious accident in some situations.

At any rate, be sure to follow these important items.



To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” and “CAUTION”.



DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
 - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
 - Disconnect the safety plug of the safety fence. (when in the play mode or in the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button



- Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop



- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
 - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
 - View the manipulator from the front whenever possible.
 - Always follow the predetermined operating procedure.
 - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
 - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
 - Turning ON the YRC1000 power
 - Moving the manipulator by using the programming pendant
 - Running the system in the check mode
 - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.



WARNING

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
 - Check for a problem in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows.

Equipment	Manual Designation
YRC1000 Controller	YRC1000
YRC1000 Programming Pendant	Programming Pendant
Cable between the manipulator and the controller	Manipulator cable

Descriptions of the programming pendant keys, buttons, and displays are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys /Symbol Keys	The keys which have characters or symbols printed on them are denoted with []. ex. [ENTER]
	Axis Keys /Numeric Keys	[Axis Key] and [Numeric Key] are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a "+" sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • •" means that the cursor is moved to the object item and [SELECT] is pressed, or that the item is directly selected by touching the screen.

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

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1 Outline

This manual explains settings and other information required for DeviceNet Safety communication.

Use a DeviceNet board SST-DN4-PCle (manufactured by Molex, Inc.) for DeviceNet Safety communication.

By using the SST-DN4-PCle board, safety signals can be transferred to and from the safety PLC via DeviceNet Safety communication.

DeviceNet Safety communication can be performed only by the SST-DN4-PCle attached to the PCle slot 2 (optional).

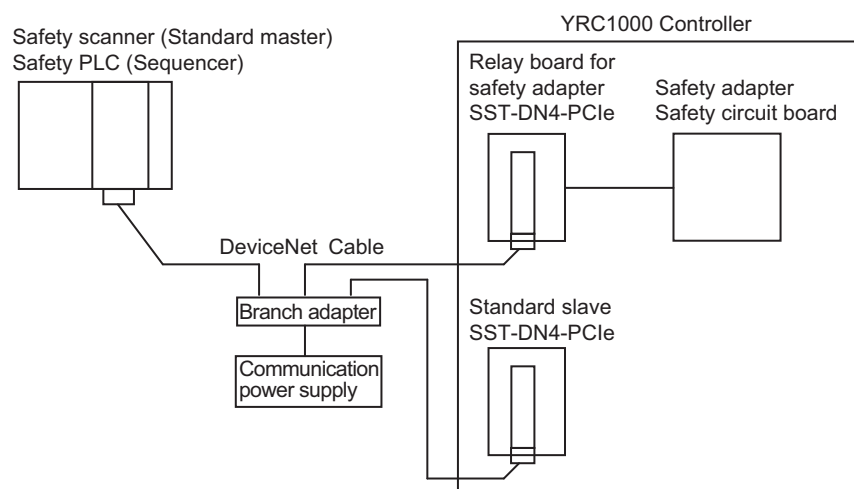


This manual explains the setting procedures when communicating the DeviceNet (Safety) to the safety PLC manufactured by Rockwell Automation, Inc.
For settings in this manual, “RSLogix 5000” manufactured by Rockwell Automation, Inc. is used.

1.1 System Configuration

The safety PLC will be the safety scanner for DeviceNet Safety communication. The safety circuit board of the YRC1000 will be the safety adapter. The SST-DN4-PCle board relays data between the safety scanner and the safety adapter as the relay board for DeviceNet Safety communication. In addition, the standard master for DeviceNet communication usually works within the safety PLC which is the safety scanner.

The YRC1000 can activate a standard master and a standard slave for DeviceNet communication at the same time as the safety adapter for DeviceNet Safety communication. In this case, another SST-DN4-PCle board is required. For the details of the standard master and the standard slave for DeviceNet communication, refer to “YRC1000 OPTIONS DeviceNet COMMUNICATIONS FUNCTION INSTRUCTIONS (HW1483856)”.



While performing DeviceNet Safety communication, supply communication power (24 V) constantly to the SST-DN4-PCle used as the relay board for the safety adapter. If the supply of communication power is cut off, DeviceNet Safety communication may not be performed again. In this case, turn the YRC1000 control power supply OFF, and then ON.



With the same channel for the SST-DN4-PCle, the standard master and the standard slave cannot be activated at the same time as the safety adapter.

2 Hardware Specifications

For the information on the SST-DN4-PCIe board hardware specifications, refer to “YRC1000 OPTIONS DeviceNet COMMUNICATIONS FUNCTION INSTRUCTIONS (HW1483856)”.

3 Mounting the SST-DN4-PCle Board

For how to mount the SST-DN4-PCle board, refer to “YRC1000 OPTIONS DeviceNet COMMUNICATIONS FUNCTION INSTRUCTIONS (HW1483856)”.

- 4 Setting for DeviceNet Safety
- 4.1 YRC1000 Side Settings

4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

4.1.1 Displaying the SST-DN4-PCle Setting Window

To use the SST-DN4-PCle board in the YRC1000, perform the settings of the optional board and the I/O module in the following manner.

Only the SST-DN4-PCle attached to the PCIe slot 2 (optional) can be set for DeviceNet Safety communication.



Make sure to perform the following settings in the management mode.

In the operation mode or the edit mode, only reference to the settings is available.

4.1.2 Setting of the SST-DN4-PCle Board to Slave

1. Turn ON the power supply while pressing [MAIN MENU].
 - The maintenance mode starts.



2. Set the security mode to the management mode.

4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

3. Select {SYSTEM} under the Main Menu.
- The sub menu appears.



4. Select {SETUP}.
- The SETUP display appears.

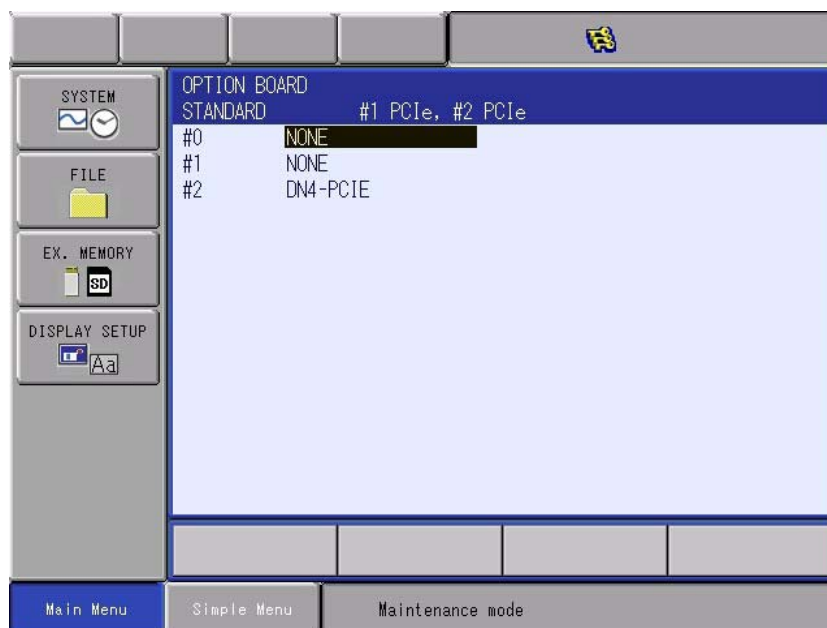


4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

5. Select "OPTION BOARD".

- The OPTION BOARD display appears.



6. Select "DN4-PCIE".

- The DN4-PCIE setup display appears.



4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

– (Explanation of Setup Items)

- (1) DN4-PCIE
Sets whether to use DeviceNet or not.
- (2) SLAVE OR MASTER
Sets the operation mode for DeviceNet. When using DeviceNet Safety, set the item to SLAVE.
- (3) IO SIZE
Sets the IO size used for the standard IO. When using DeviceNet Safety, set the item to '0'.
- (4) MAC ID
Sets the MAC ID.
- (5) BAUD RATE
Sets the baud rate.
- (6) SCAN LIST
"SCAN LIST" is not used for setting the SST-DN4-PCle board to slave.
- (7) DeviceNet Safety
Indicates whether to use safety communication using DeviceNet Safety or not.
The setting of this item cannot be changed. (Fixed to "USED")
- (8) SAFETY IO SIZE
Displays the IO size for the YRC1000 (safety adapter) used for DeviceNet Safety communication.
When setting this item, change the security mode to the safety mode.
- (9) VIRTUAL COMM
This item is the mode which is used when the robot performs a test operation. When starting the YRC1000 without connecting the SST-DN4-PCle board to the safety PLC, set this item to "VIRTUAL".
When setting this item, change the security mode to the safety mode.



When performing the normal operation, make sure to set this item to "SAFETY".

When the connection with the safety PLC is established with the setting remaining as "VIRTUAL", the setting is automatically changed to "SAFETY".

4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

4.1.3 General Settings for DN4-PCIE

1. Confirm that DN4-PCIE is set to "USED".



2. Confirm that DeviceNet Safety is set to "USED".



4 Setting for DeviceNet Safety

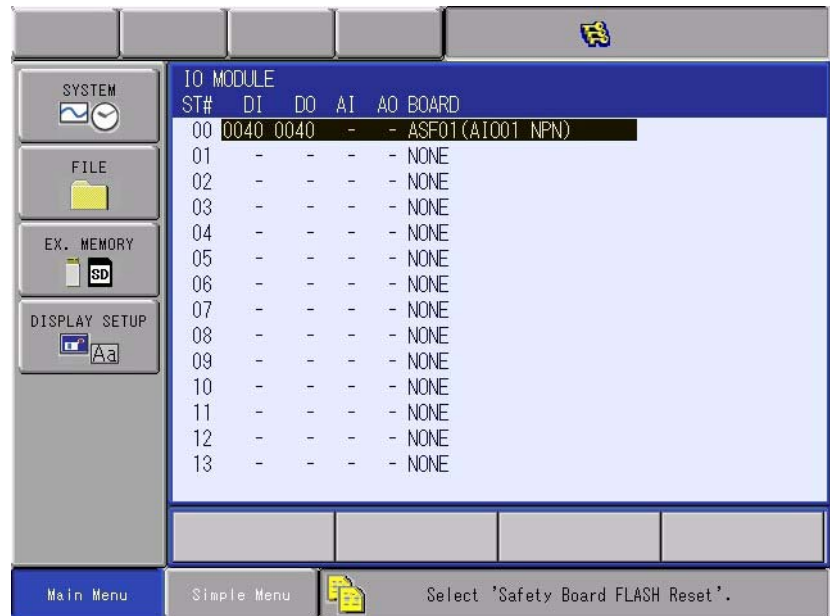
4.1 YRC1000 Side Settings

4.1.4 IO Module Settings

If the DN4-PCIE settings are changed, the IO module needs to be set as well. Perform the IO module settings by following the procedures below. (The message "Select 'Safety Board Flash Reset.'" appears, but ignore the message here.)

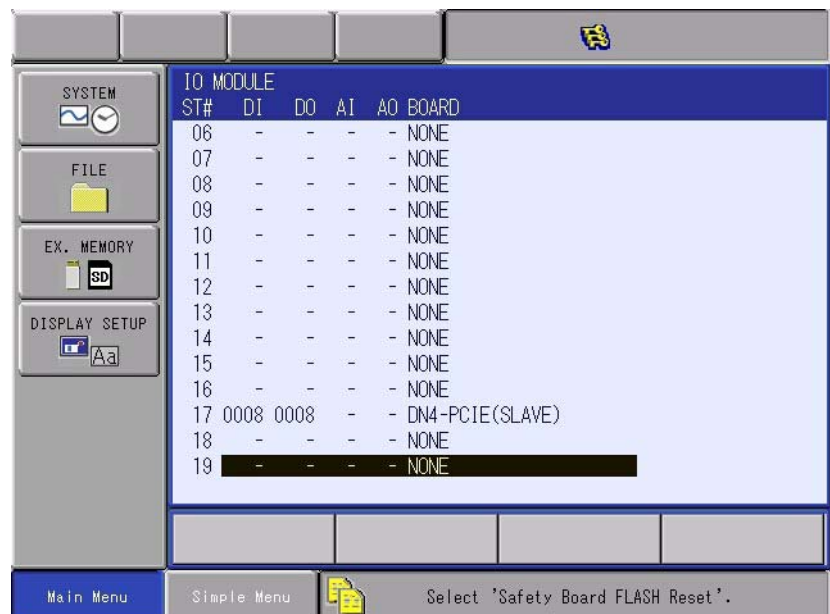
1. (DN4-PCIE settings continued)

- The IO module window (the first half) appears.



2. Press [ENTER].

- The IO module window (the latter half) appears.



- Confirm that the values, which are calculated by adding 8 to the IO size already set, are set to DI and DO of ST#17. However, the data size for the safety signals is not included.

4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

3. Press [ENTER].

- The confirmation dialog box appears.



4. Select {YES}.

- If the IO module is properly installed, select {YES}. The IO module settings will be updated, and the external IO setup window appears.

4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

4.1.5 External IO Settings

1. The EXTERNAL IO SETUP window appears.



2. Select “AUTO” or “MANUAL” for the allocation mode.
 - After “AUTO/MANUAL” is selected, the selection menu appears.



If the allocation mode is changed from “MANUAL” to “AUTO”, the allocation data that has been set will be lost, and re-allocating will be executed in the auto mode. If the set allocation data needs to be kept, save the data in the external memory menu in advance.

4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

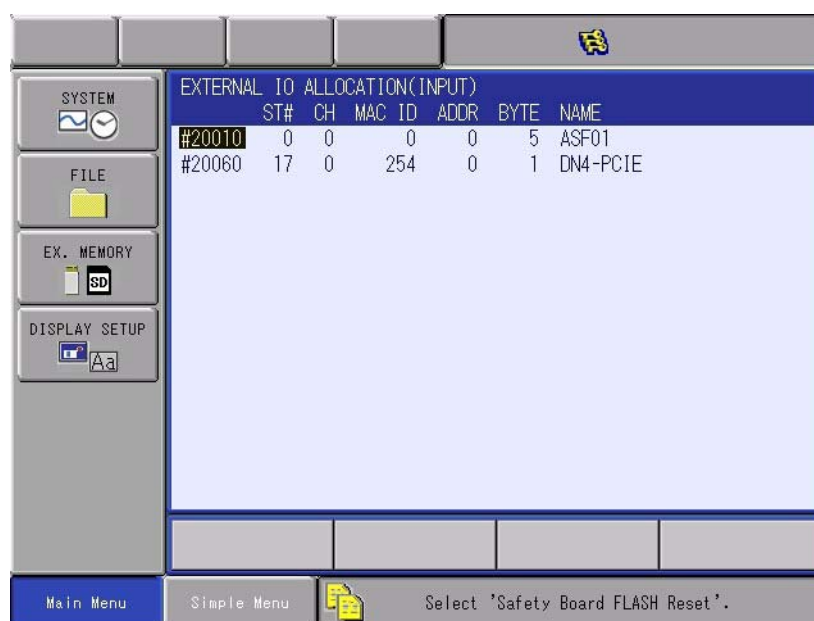
3. Select an allocation mode to be set.

- When allocating the I/O signal automatically, select “AUTO”.
When allocating the I/O signal manually, select “MANUAL”.
- The selected allocation mode will be set.



4. Select “DETAIL” of {EXTERNAL IO ALLOCATION}.

- When selecting “AUTO” for the allocation mode, the following steps 5 to 7 are not necessary.
Perform the operation from step 8.
- When selecting “MANUAL” for the allocation mode, perform the following steps 5 to 7 for the items necessary for manual settings.



4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

5. Select an external I/O signal number to be changed from the original. ({#20070} is selected in the setting example.)
 - The select menu appears.



6. Select “MODIFY” and enter an desired external input signal number to replace with the original. (“20200” is entered in the setting example.)
 - The external input signal number will be changed.



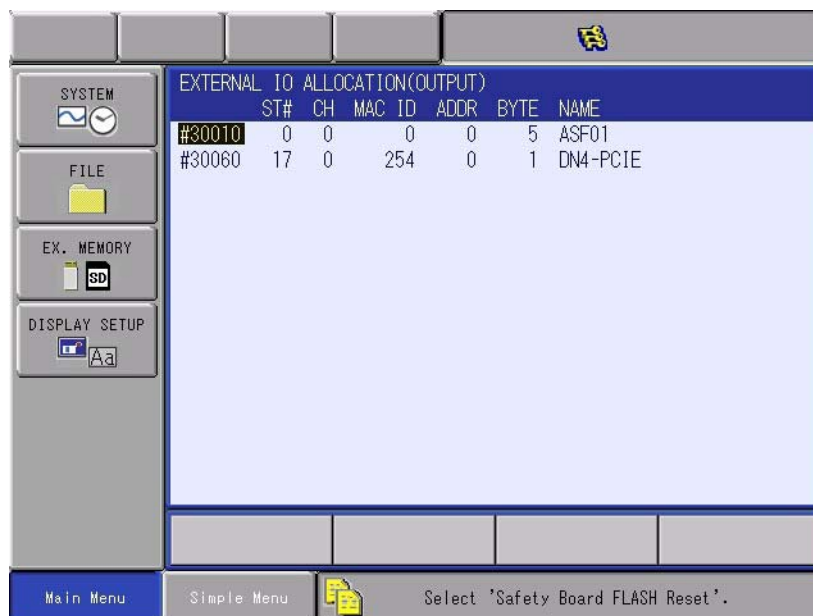
7. Select and change the external input signal number with the same steps.
 - Repeat the selecting and changing operation for the desired allocation.

4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

8. Press [ENTER].

- The external output signal allocation window appears.



9. Select and change an external output signal number by the same procedure as the external input signal number.

- Repeat the selecting and changing operation for the desired allocation.

10. Press [ENTER].

- The confirmation dialog box appears.

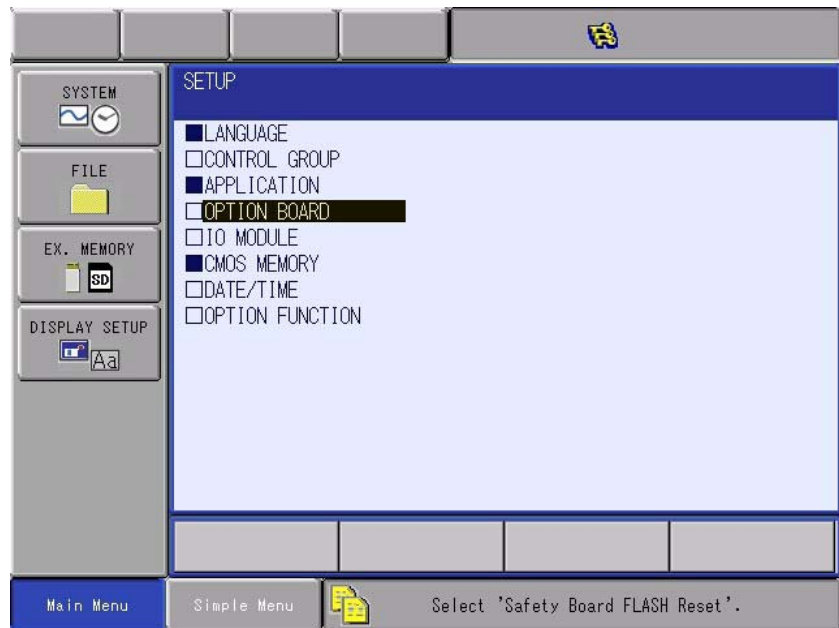


4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

11. Select {YES}.

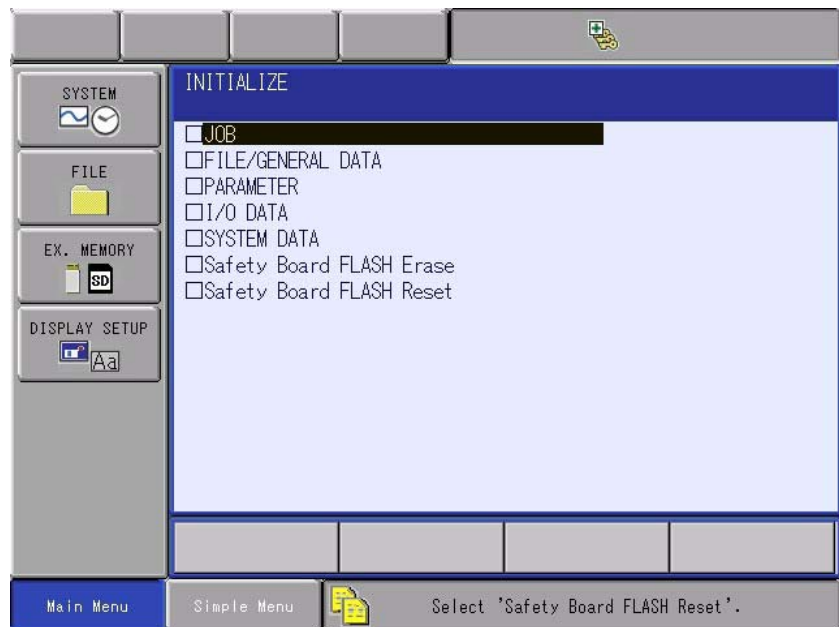
- Return to the setting window after the setting contents are confirmed.



12. Set the security mode to the "SAFETY MODE".

13. Select {FILE} - {INITIALIZE} under the Main Menu.

- The INITIALIZE window appears.

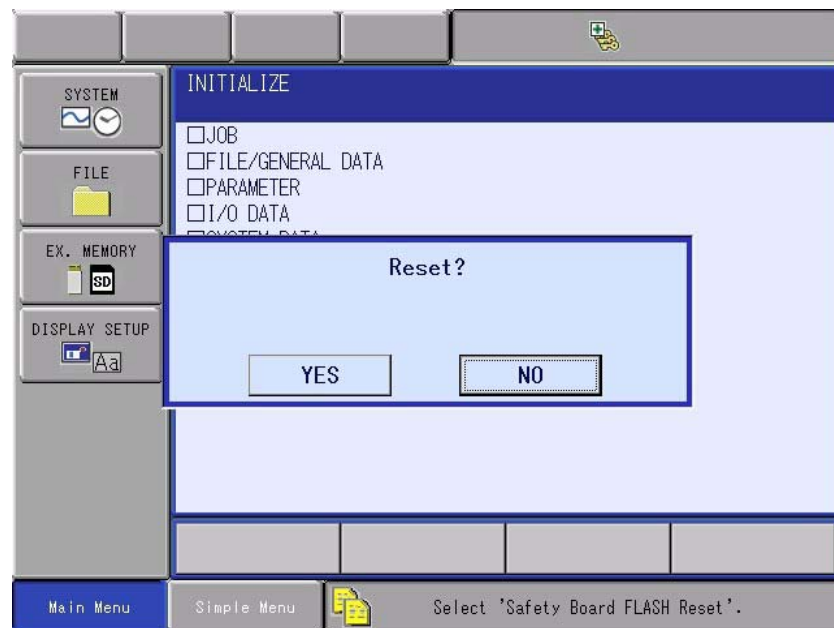


4 Setting for DeviceNet Safety

4.1 YRC1000 Side Settings

14. Select "Safety Board FLASH Reset".

- The confirmation dialog box appears.



15. Select {YES}.

- The setting is completed when the system beeps.

4 Setting for DeviceNet Safety

4.2 Creating an EDS File

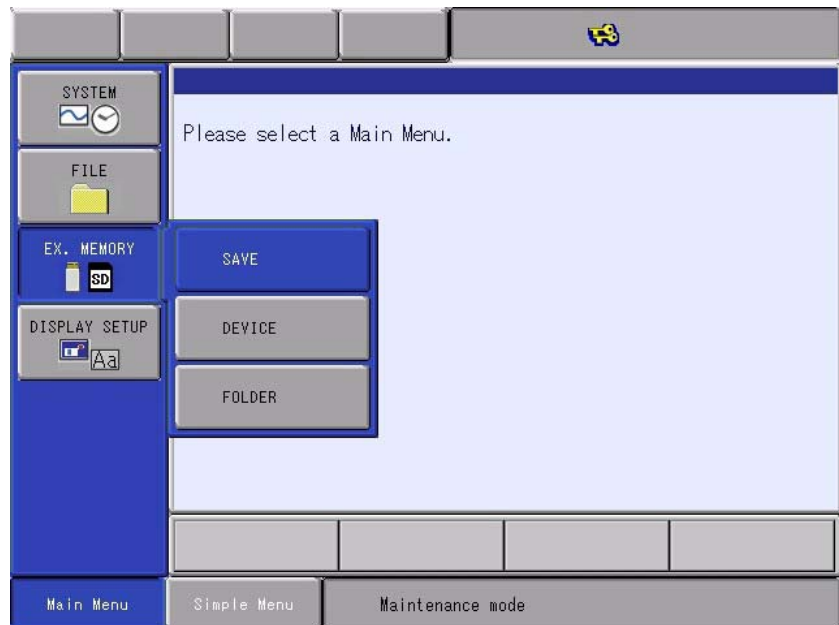
4.2 Creating an EDS File

When setting the communication of DeviceNet Safety, the EDS file (Electronic Data Sheet) may be required. (It depends on the safety scanner to be used.) Use the EDS file created in the following procedures.

For the details of the EDS file, refer to the specifications of DeviceNet and CIP. For how to use the communication master, the communication setting tool (network configurator), and the created EDS file, refer to the instruction manual of each equipment.

4.2.1 Creating Procedures of EDS File

1. Turn ON the power supply while pressing [MAIN MENU] simultaneously.
 - The maintenance mode starts-up.
2. Select {EX. MEMORY} under the Main Menu.
 - The sub menu appears.

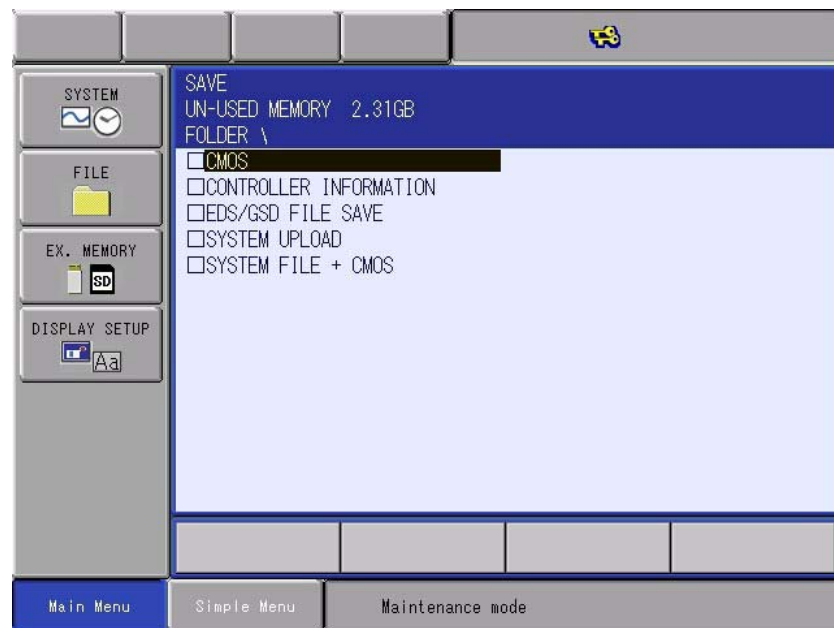


4 Setting for DeviceNet Safety

4.2 Creating an EDS File

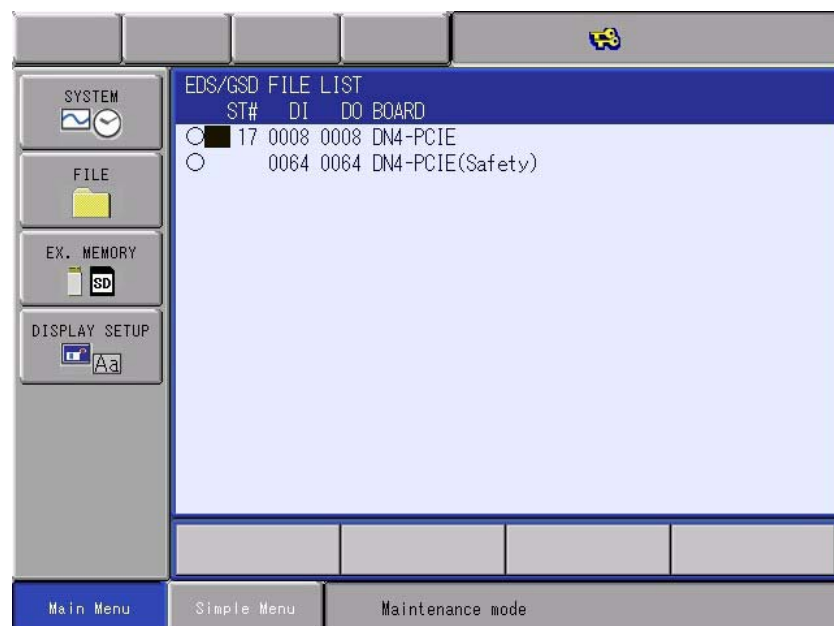
3. Select {SAVE}.

– The SAVE window appears.



4. Select "EDS/GSD FILE SAVE".

– The EDS/GSD FILE LIST window appears.

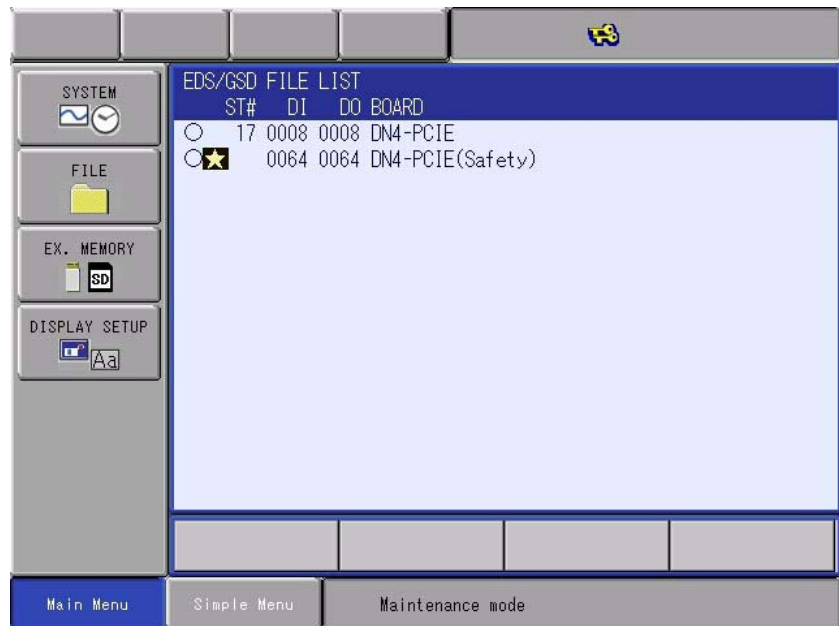


4 Setting for DeviceNet Safety

4.2 Creating an EDS File

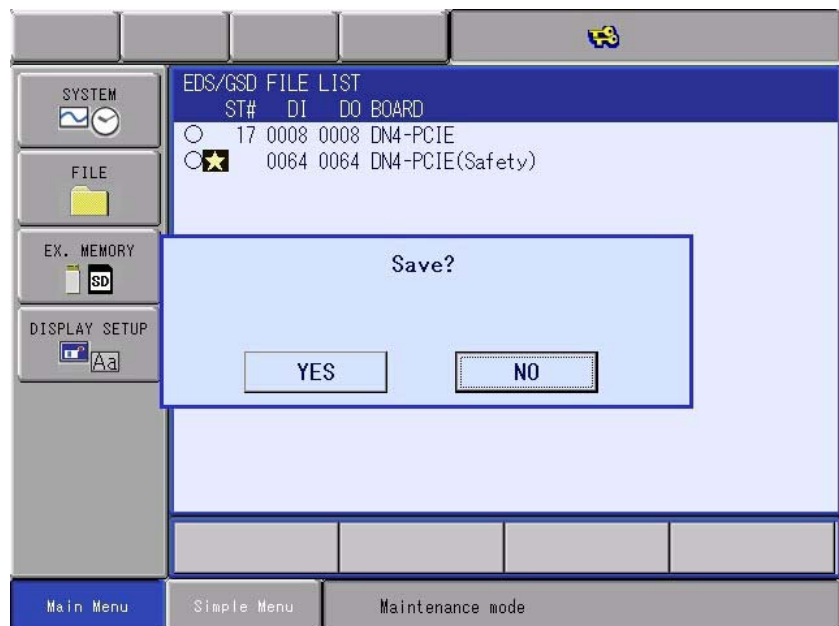
5. Select "DN4-PCIE(Safety)".

- "★" appears to the selected board.



6. Press [ENTER].

- The confirmation dialog box appears.

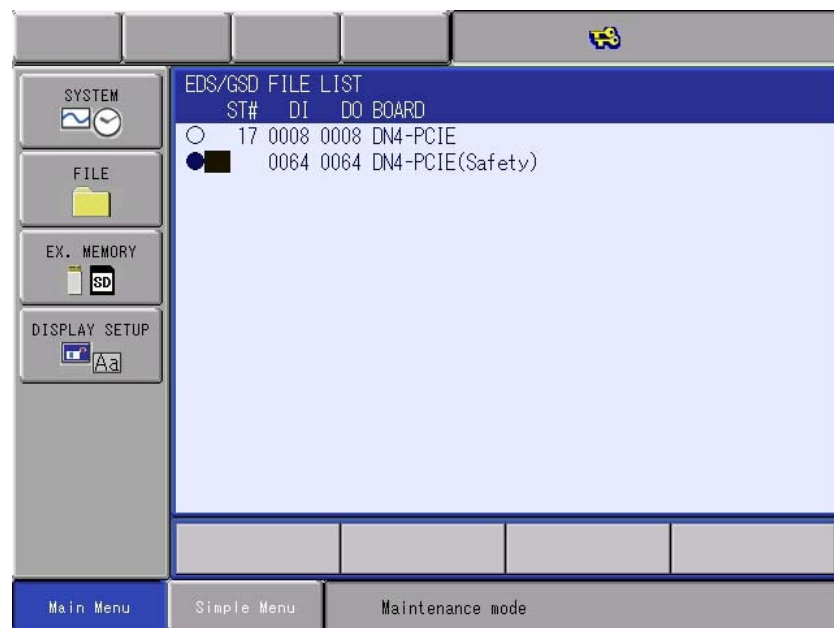


4 Setting for DeviceNet Safety

4.2 Creating an EDS File

7. Select {YES}.

- An EDS file is created in the currently valid device (SD Card or USB memory).



4.3 PLC Side Settings

For performing DeviceNet Safety communication settings, PC software such as the following is required.

- RSLogix 5000 programming software (manufactured by Rockwell Automation, Inc.)
- RSLinx software (manufactured by Rockwell Automation, Inc.)

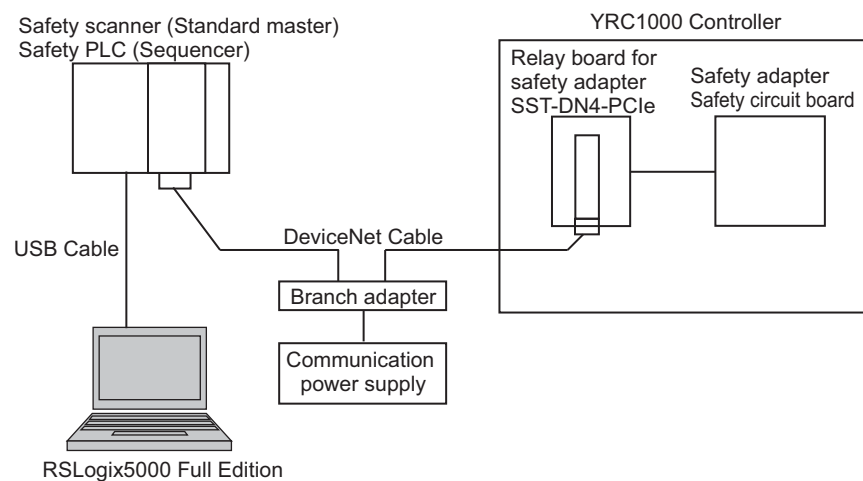
The software used in this section as an example is “RSLogix 5000 (V20.01.00 (CPR 9 SR 5))”, manufactured by Rockwell Automation, Inc. For details on setting procedures, refer to the instruction manual for software manufactured by Rockwell Automation, Inc.

4.3.1 Setting Environment

As shown in the figure below, confirm that the PC and PLC are connected using a USB cable and that PLC and the YRC1000 are connected using a DeviceNet cable. The USB cable must be supplied by the user.

When connecting the USB cable to PLC, connect it to the CPU module of PLC (“Logix 5572S Automation Controller 4M/2M 1756-L72S” in the example of this manual).

After performing the procedures described in *chapter 4.1 “YRC1000 Side Settings”*, confirm that the YRC1000 is operated in the Online mode.



4 Setting for DeviceNet Safety

4.3 PLC Side Settings

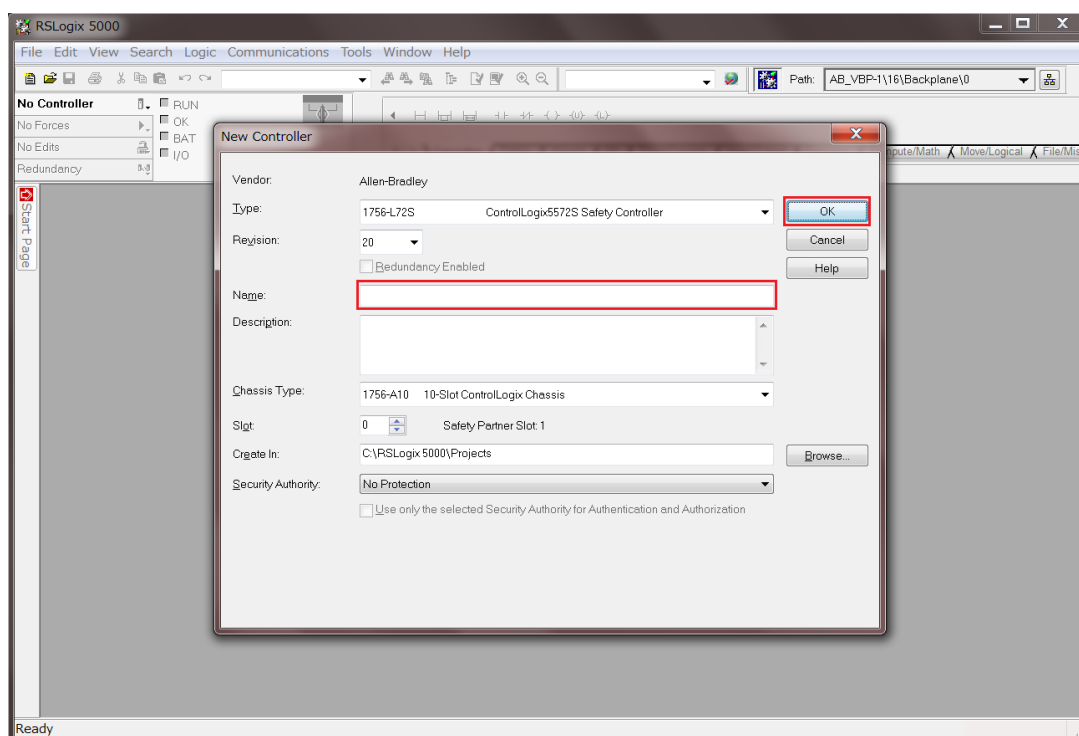
4.3.2 Safety PLC Settings

When setting the safety scanner, the EDS file for YRC1000 DeviceNet Safety may be required. (It depends on the safety scanner to be used.) Use the EDS file created in *chapter 4.2 “Creating an EDS File”*.

This section explains the setting procedures when using the safety PLC manufactured by Rockwell Automation, Inc. “Logix 5572S Automation Controller 4M/2M 1756-L72S” + “Logix L7SP SIL3 Ple Safety Partner 1756-L7SP” + “DEVICENET BRIDGE/SCANNER MODULE 1756-DNB” as the safety scanner as an example.

When using a device which is not manufactured by Rockwell Automation, Inc., refer to the instruction manual of that device.

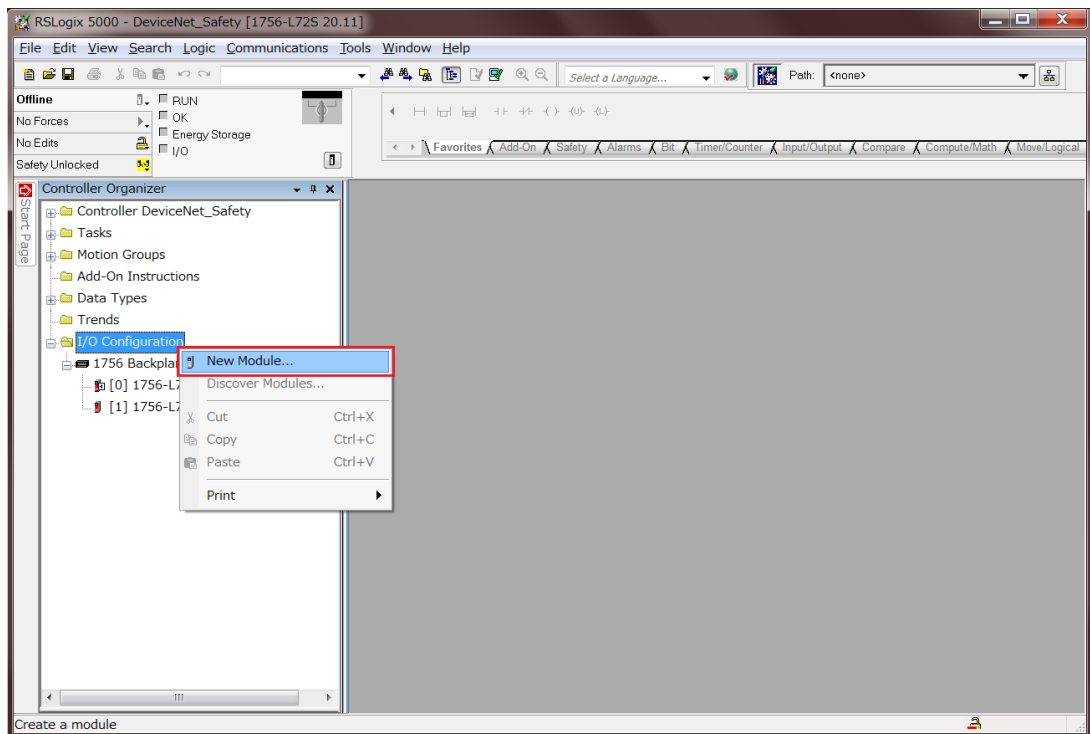
1. Start RSLogix 5000.
2. Select {File} - {New...}, and then create a new project.
3. Enter a project name in {Name}, and then select {OK}.



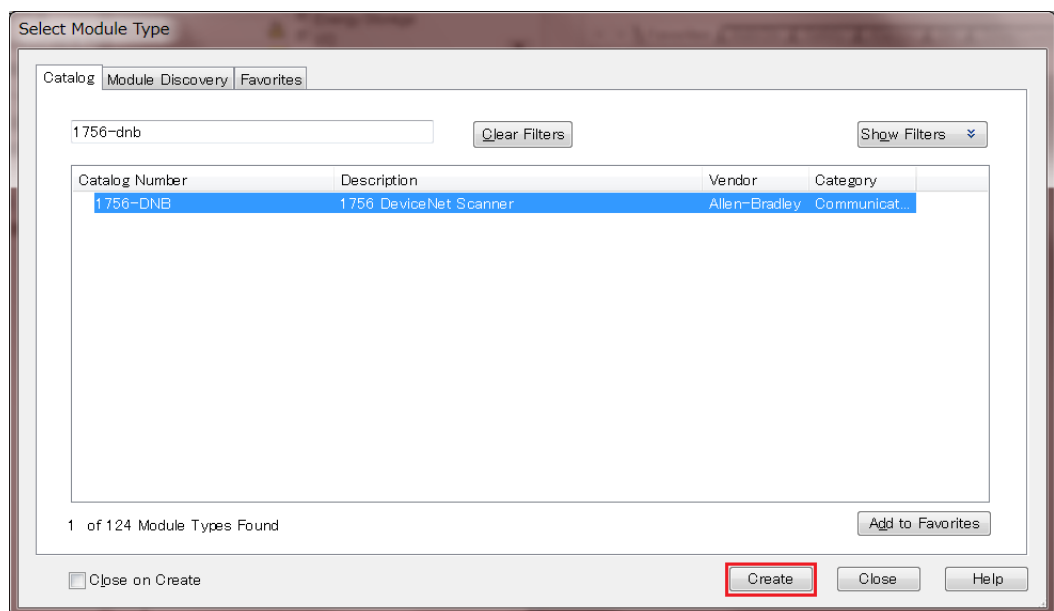
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

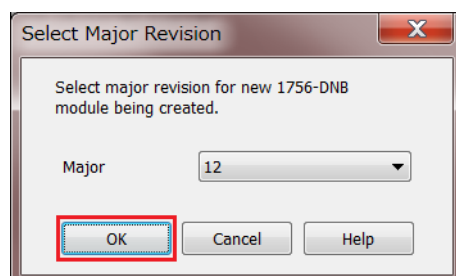
4. Right-click {I/O Configuration}, and then select {New Module...}.



5. Select 1756-DNB, and then select {Create}.



6. Select {OK}.



4 Setting for DeviceNet Safety

4.3 PLC Side Settings

7. Enter a module name in {Name}, and then select {OK}.

New Module

Type: 1756-DNB 1756 DeviceNet Scanner
 Vendor: Allen-Bradley

Name: (highlighted with a red box)

Description:

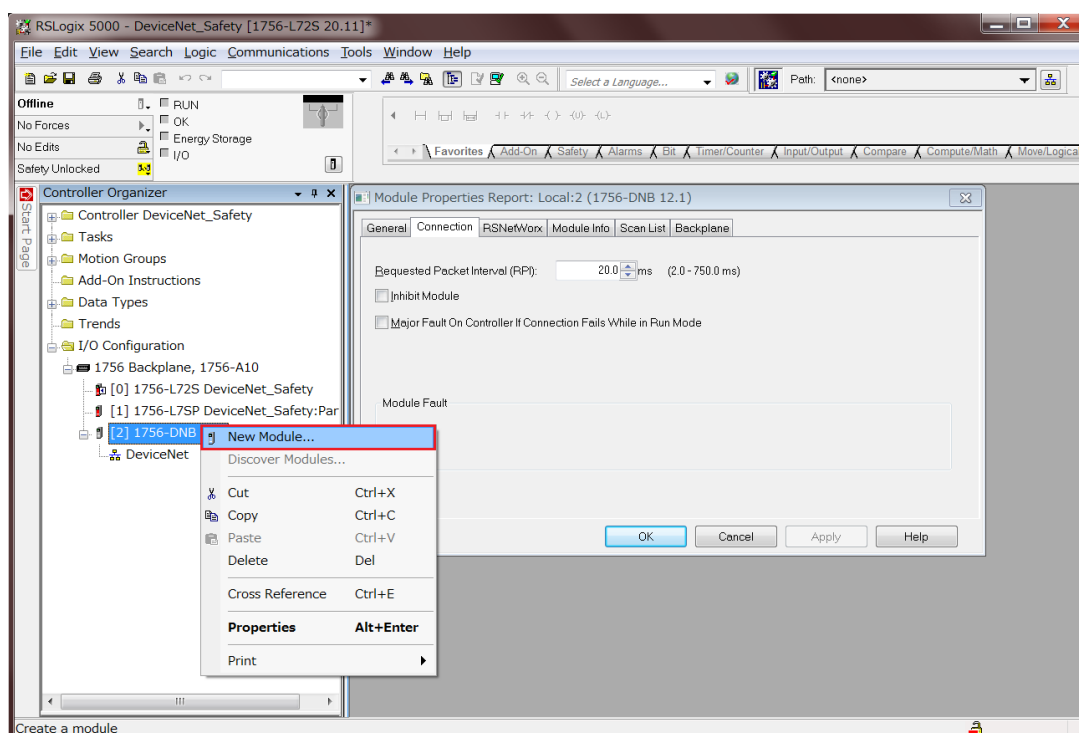
Input Size: 124 (32-bit)
 Output Size: 123 (32-bit)
 Status Size: 32 (32-bit)

Node: 0 Slot: 2
 Revision: 12 1 Electronic Keying: Compatible Keying

☒ Open Module Properties

OK (highlighted with a red box) Cancel Help

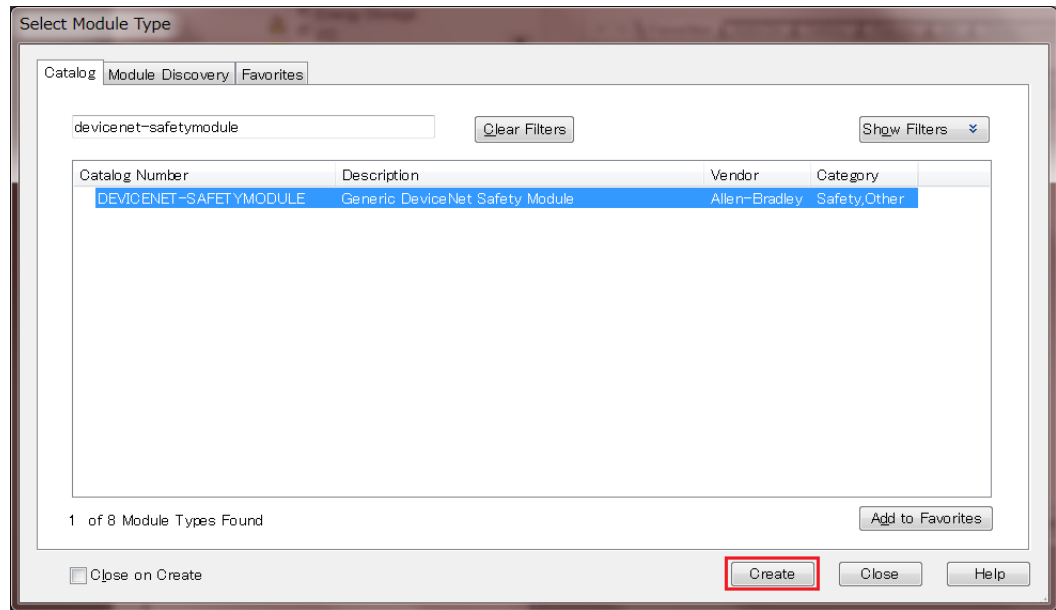
8. Right-click {DeviceNet}, and then select {New Module...}.



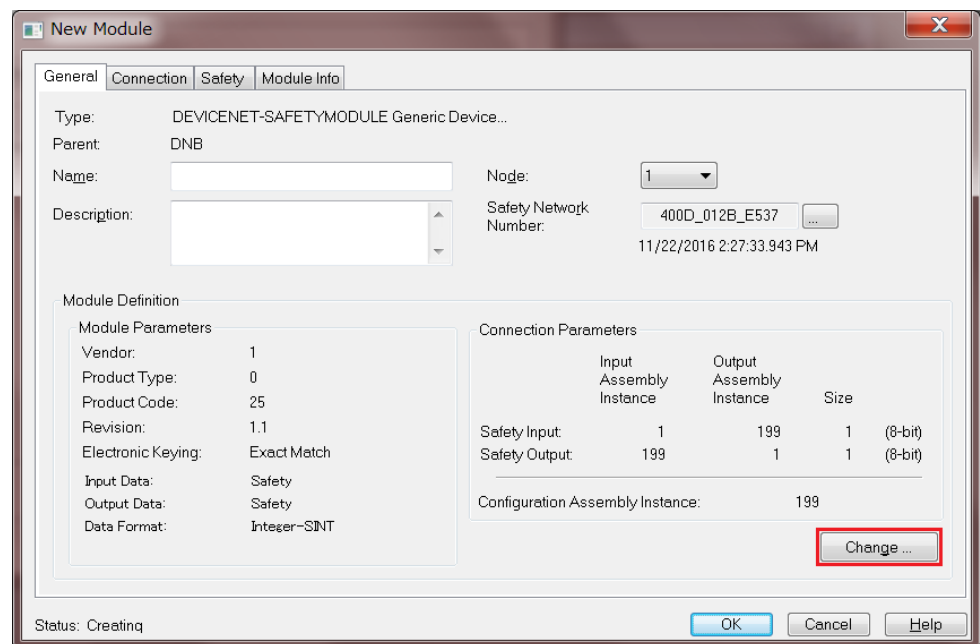
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

9. Select DEVICENET-SAFETYMODULE, and then select {Create}.



10. Select {Change...}.



4 Setting for DeviceNet Safety

4.3 PLC Side Settings

11. In the {Module} tab, perform the following settings.

- Vendor: 44
- Product Type: 140
- Product Code: 1284
- Major Revision: 1
- Minor Revision: 1
- Electric Keying: Compatible Module

12. When the above settings are completed, select {Connection}.

Module Definition

Module: **Connection**

Vendor:	44
Product Type:	140
Product Code:	1443
Major Revision:	1
Minor Revision:	1

Electronic Keying: **Compatible Module**

Input Data:	Safety
Output Data:	Safety
Data Format:	Integer-SINT

OK Cancel Help

4 Setting for DeviceNet Safety

4.3 PLC Side Settings

13. In the {Connection} tab, perform the following settings.

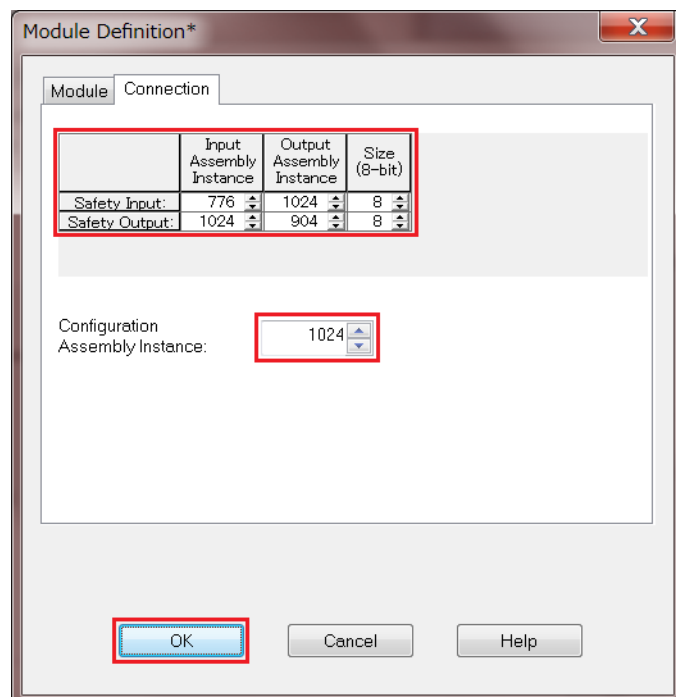
Safety Input:

- Input Assembly Instance: 776
- Output Assembly Instance: 1024
- Size(8-bit): 8

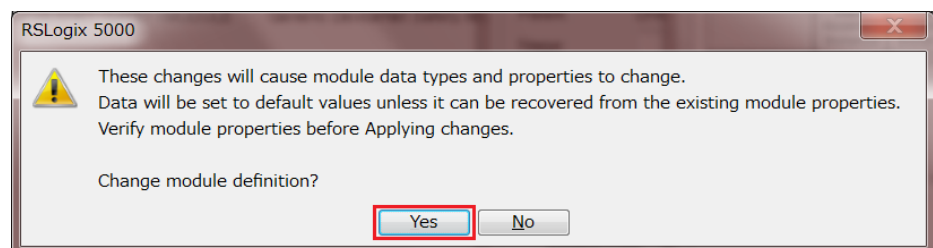
Safety Output:

- Input Assembly Instance: 1024
- Output Assembly Instance: 904
- Size(8-bit): 8
- Configuration Assembly Instance: 1024

14. After settings, select {OK}.



15. When the following dialog box appears, select {Yes}.



4 Setting for DeviceNet Safety

4.3 PLC Side Settings

16. Enter a module name in {Name}. Set the same value as MAC ID of the YRC1000 used in DeviceNet Safety in {Node}, and then select the {Safety} tab.

New Module

General* **Safety** Module Info

Type: DEVICENET-SAFETYMODULE Generic Device...

Parent: DNB

Name:

Node: 1

Description:

Safety Network Number: 400D_012B_E537
11/22/2016 2:27:33.943 PM

Module Definition

Module Parameters

Vendor:	44
Product Type:	140
Product Code:	1443
Revision:	1.1
Electronic Keying:	Compatible Module
Input Data:	Safety
Output Data:	Safety
Data Format:	Integer-SINT

Connection Parameters

	Input Assembly Instance	Output Assembly Instance	Size
Safety Input:	776	1024	8 (8-bit)
Safety Output:	1024	904	8 (8-bit)
Configuration Assembly Instance:	1024		

Change ...

Status: Creating

OK Cancel Help

17. Uncheck {Configuration Signature} in the {Safety} tab, set the value of {Requested Packet Interval(RPI)(ms)} in {Safety Input} to 16 or more and a multiple of 4, and then select {OK}.

New Module

General* Connection **Safety** Module Info

Connection Type	Requested Packet Interval (RPI) (ms)	Connection Reaction Time Limit (ms)	Max Observed Network Delay (ms)
Safety Input	16	64.0	Reset
Safety Output	20	60.0	Reset

Advanced...

Configuration Ownership:

Reset Ownership

☐ **Configuration Signature:**

ID: (Hex) Copy

Date: Paste

Time: ms

Disabling the Configuration Signature disables the configuration validation check performed when connections are established.

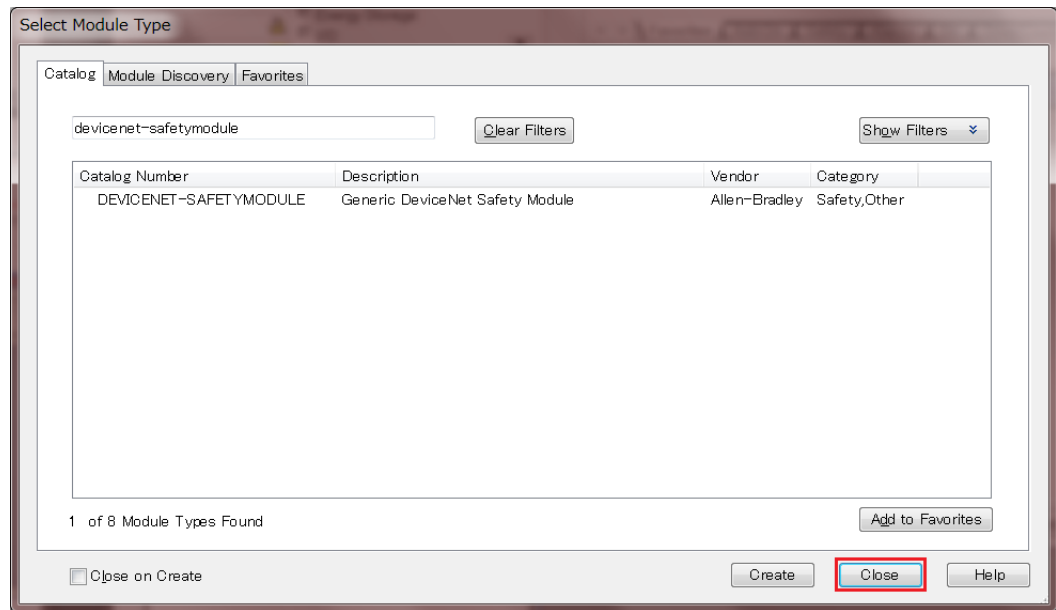
Status: Creating

OK Cancel Help

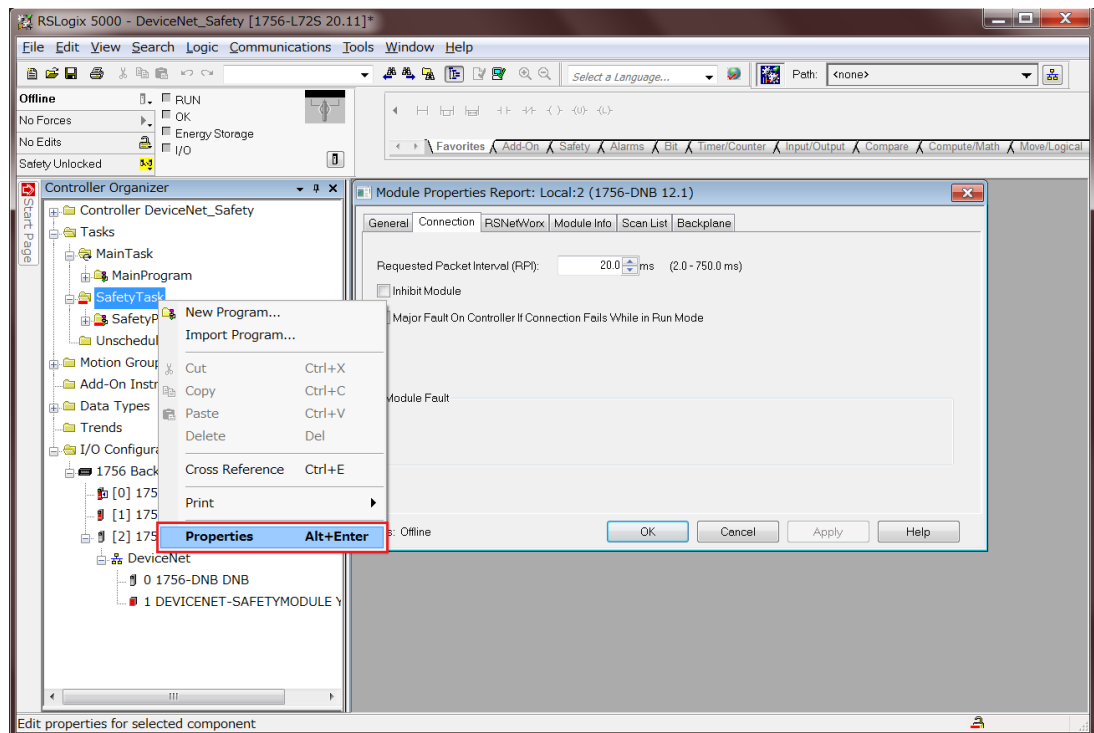
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

18. Select {Close}.



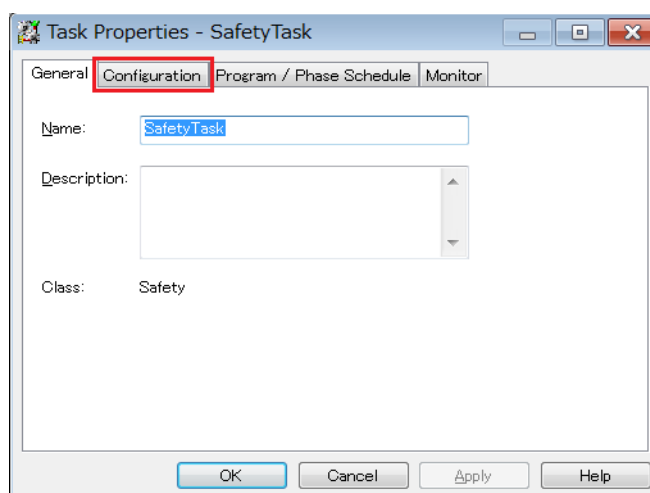
19. Set {Requested Packet Interval(RPI)(ms)} in {Safety Output} following the procedures below. Right-click {Safety Task}, and then select {Properties}.



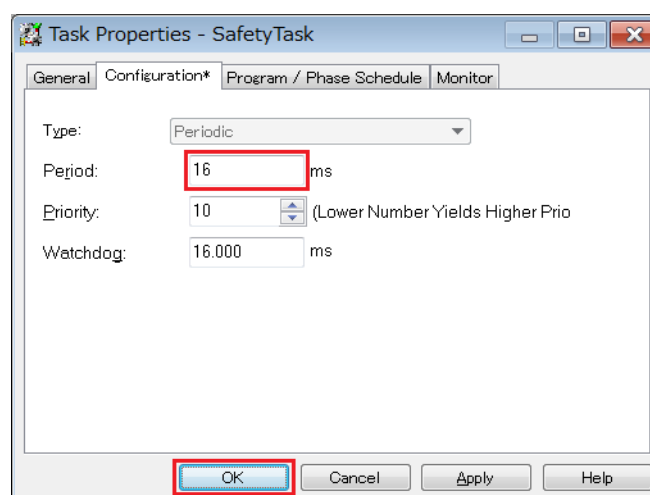
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

20. Select the {Configuration} tab.

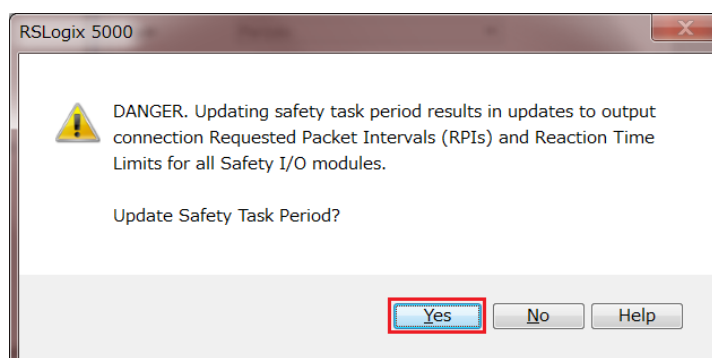


21. Set the value for {Requested Packet Interval(RPI)(ms)} of {Safety Output} in {Period}.
Set the value to 16 or more and a multiple of 4.
After setting, select {OK}.



For the values of the Requested Packet Interval (RPI) (ms) in the Safety Input/Safety Output, set the both values to 16 or more and multiples of 4.

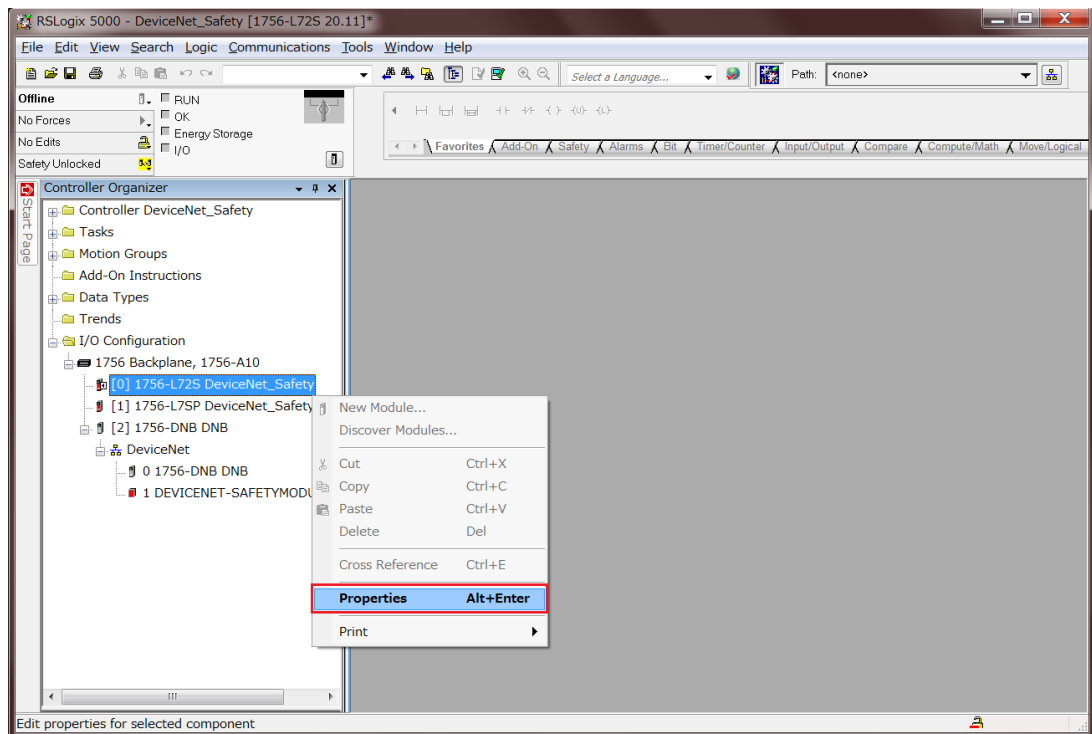
22. When the following dialog appears, select {Yes}.



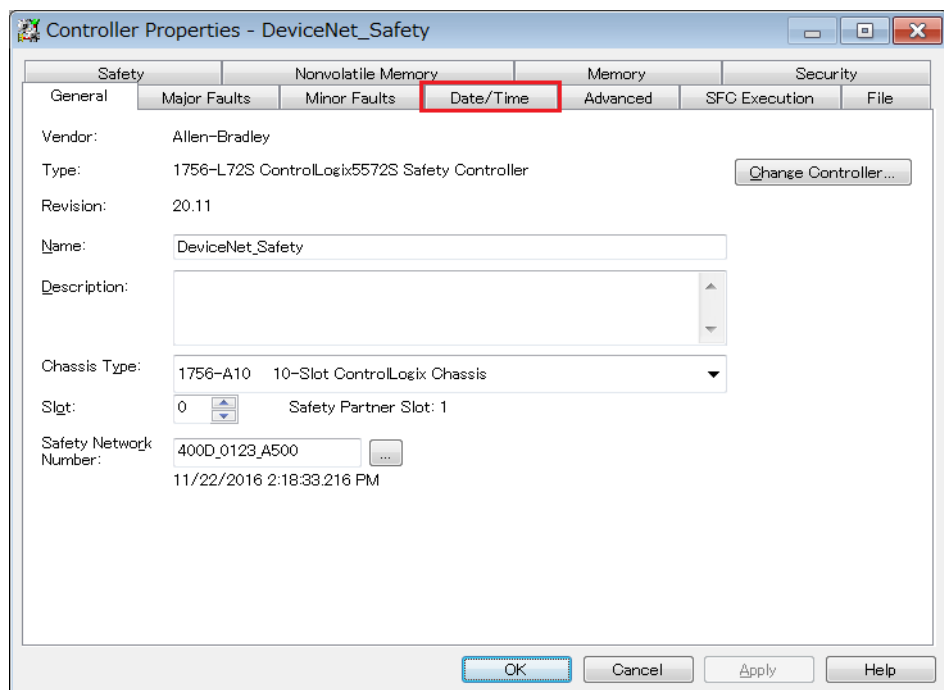
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

23. Right-click {[0] 1756-L72S}, and then select {Properties}.



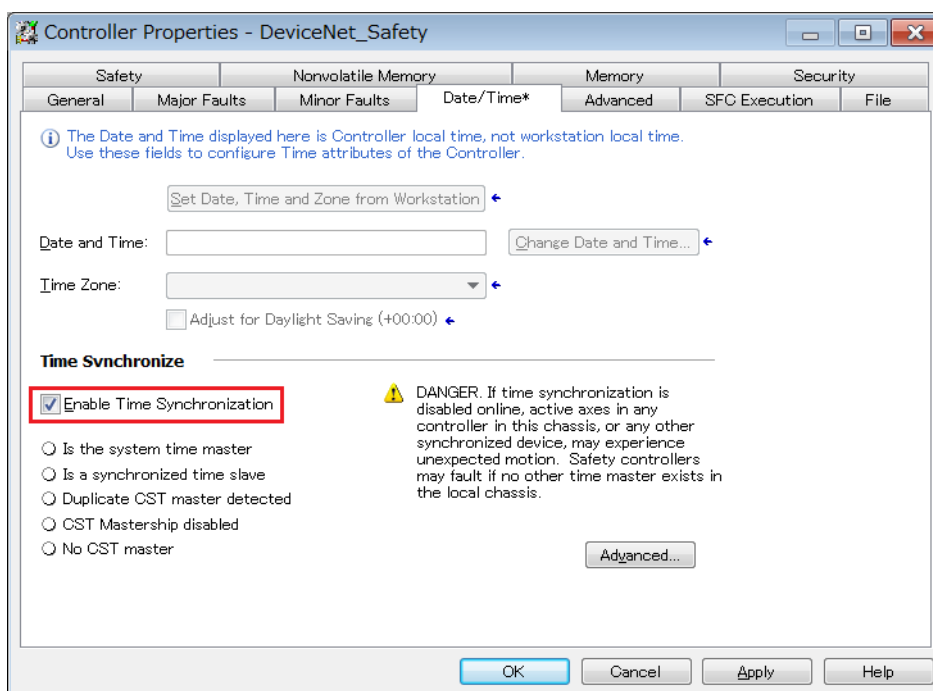
24. Select the {Date/Time} tab.



4 Setting for DeviceNet Safety

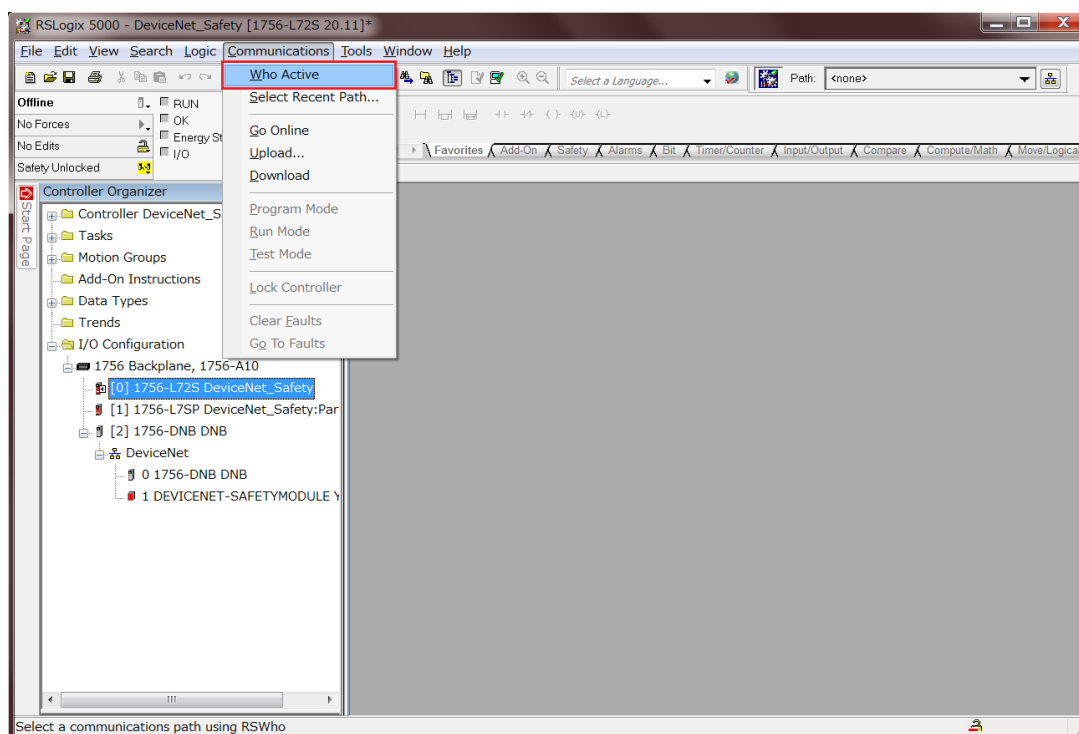
4.3 PLC Side Settings

25. Check the checkbox of {Enable Time Synchronization}, and then select {OK}.



26. Connect the PC and the PLC using a USB cable, and then turn the PLC power supply ON.
When performing the connection for the first time, install the driver for Rockwell Automation USBCIP.

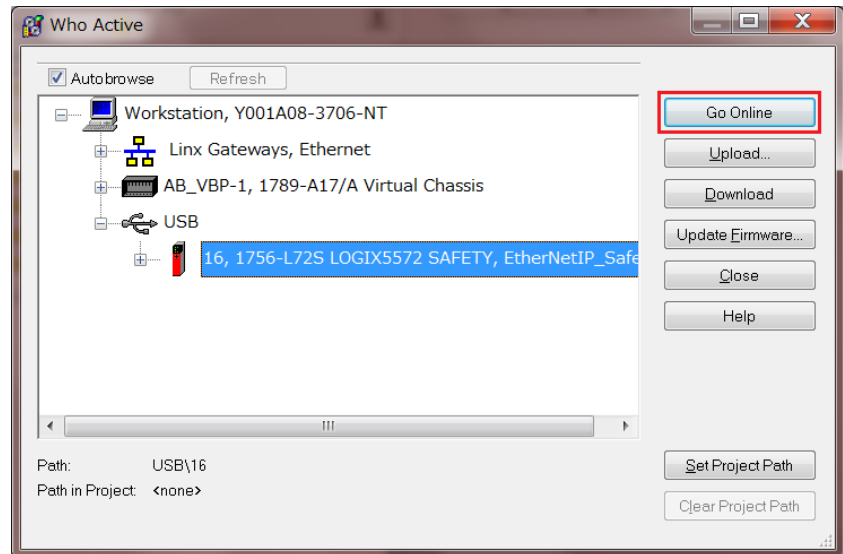
27. Select {Communications} - {Who Active}.



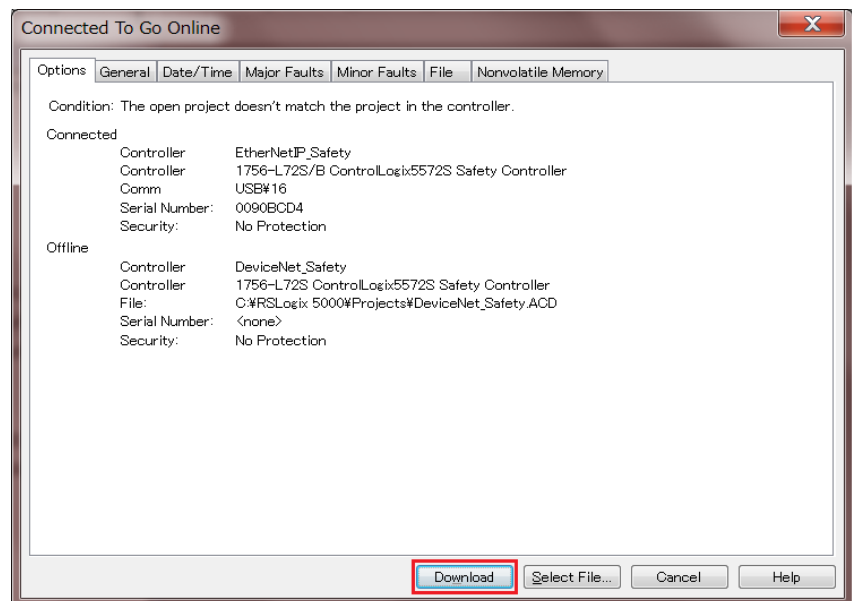
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

28. Select PLC which is to be connected to the USB connector under the USB tree, and then select {Go Online}.



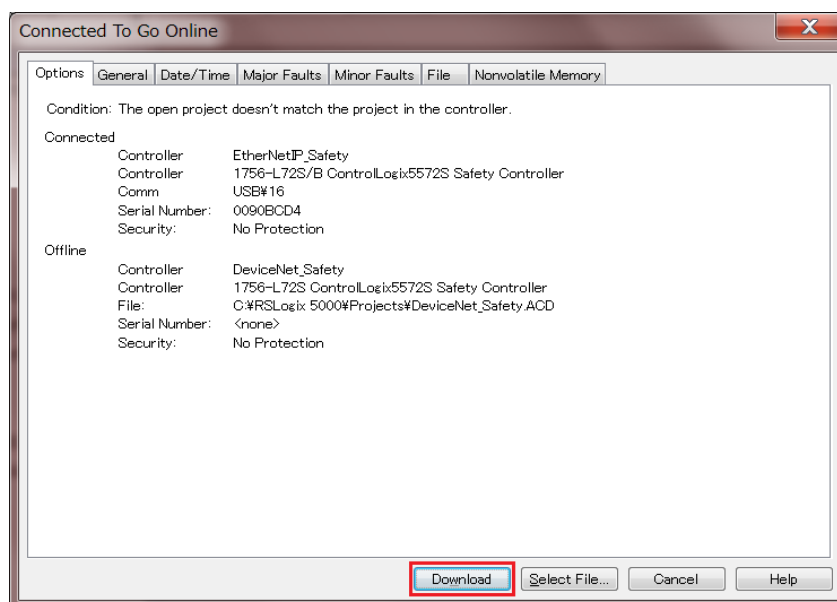
29. When the following dialog box appears, select {Download}.



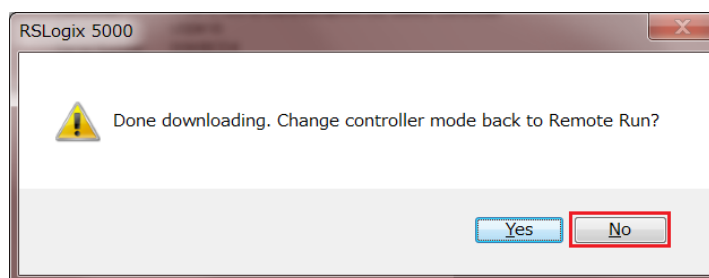
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

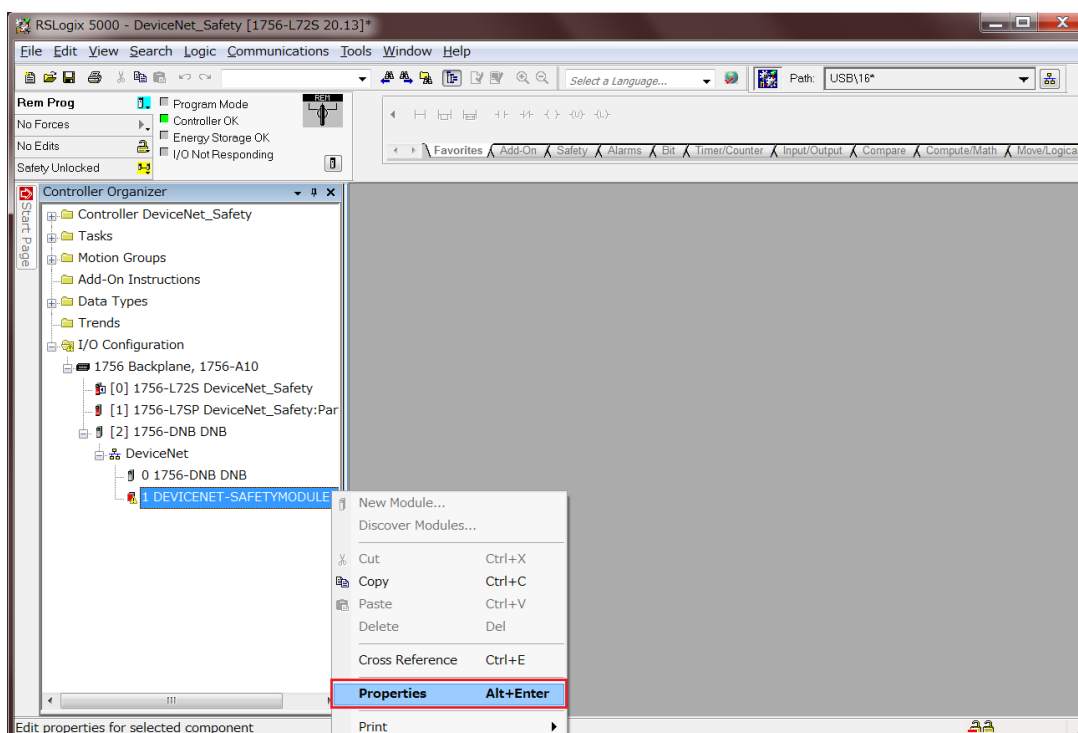
30. When the following dialog box appears, select {Download}.



31. When the following dialog box appears, select {No}.



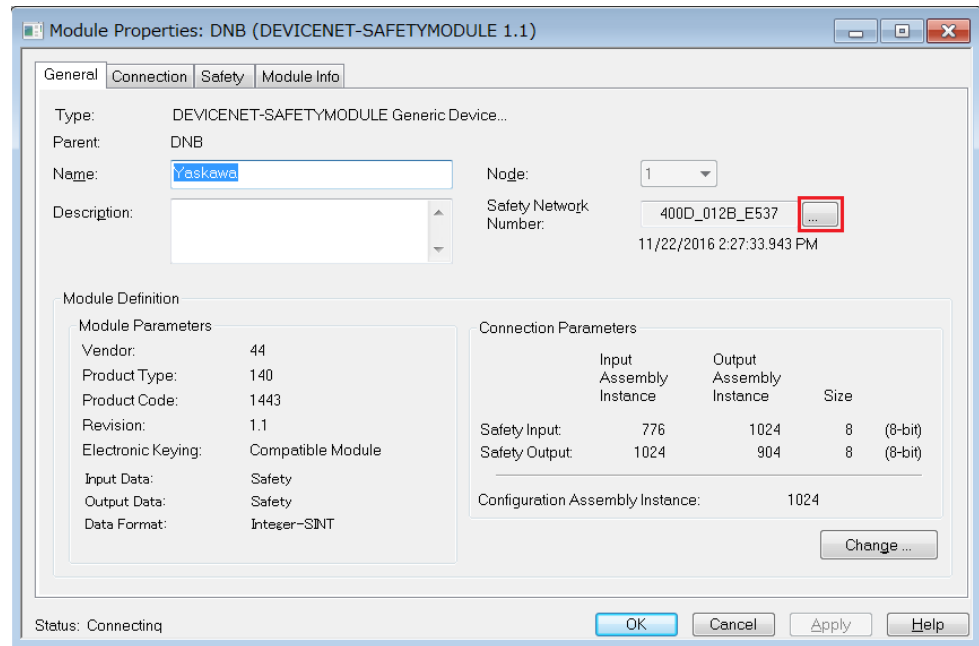
32. Right-click {DEVICENET-SAFETYMODULE}, and then select {Properties}.



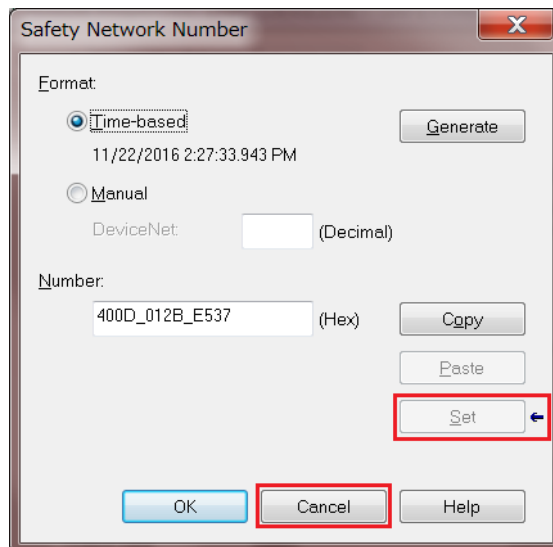
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

33. Select {...}.



34. When {Set} cannot be selected as below, select {Cancel}.
 When {Set} can be selected, the steps 35 to 44 are not necessary.
 Perform the operation from the step 45.



4 Setting for DeviceNet Safety

4.3 PLC Side Settings

35. Select the {Connection} tab.

Module Properties: DNB (DEVICENET-SAFETYMODULE 1.1)

General **Connection** Safety Module Info

Type: DEVICENET-SAFETYMODULE Generic Device...

Parent: DNB

Name: Yaskawa

Node: 1

Description:

Safety Network Number: 400D_012B_E537

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Module Definition

Module Parameters

Vendor: 44

Product Type: 140

Product Code: 1443

Revision: 1.1

Electronic Keying: Compatible Module

Input Data: Safety

Output Data: Safety

Data Format: Integer-SINT

Connection Parameters

	Input Assembly Instance	Output Assembly Instance	Size
Safety Input	776	1024	8 (8-bit)
Safety Output	1024	904	8 (8-bit)

Configuration Assembly Instance: 1024

Change ...

Status: Shutting Down

OK Cancel Apply Help

36. Check the checkbox of {Inhibit Connection}, and then select {Apply}.

Module Properties: DNB (DEVICENET-SAFETYMODULE 1.1)

General Connection* Safety Module Info

Name	Requested Packet Interval (RPI) (ms)	Inhibit Connection	Major Fault On Controller If Connection Fails While in Run Mode
Safety Input	16	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Safety Output	16	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Module Fault

(Code 16#0204) Connection Request Error: Connection request timed out.

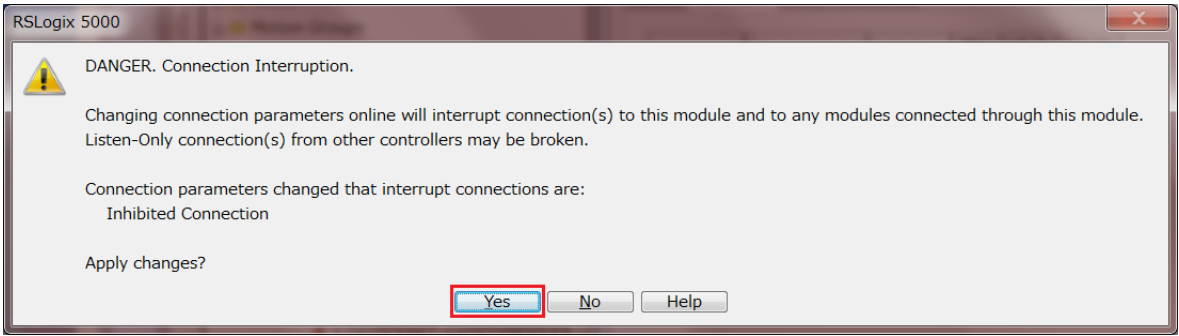
Status: Faulted

OK Cancel **Apply** Help

4 Setting for DeviceNet Safety

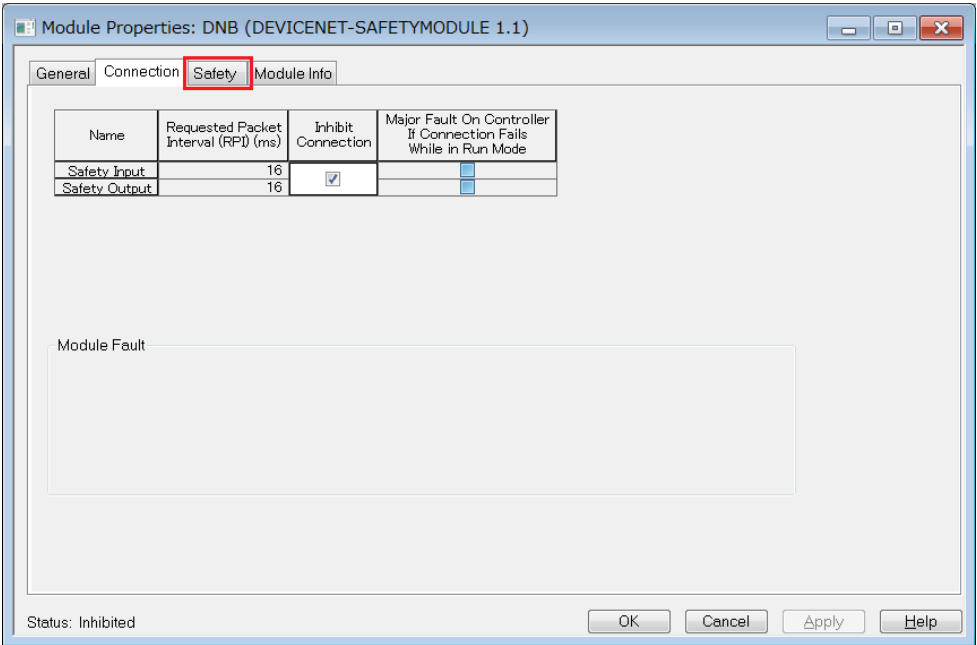
4.3 PLC Side Settings

37. When the following dialog box appears, select {Yes}.



After selecting {Yes}, if the alarm "AL1871 M-SAF SEQUENCE WATCH ERROR" occurs at the YRC1000, cycle the control power of the YRC1000 OFF/ON, start in Online mode, and then perform the following operations.

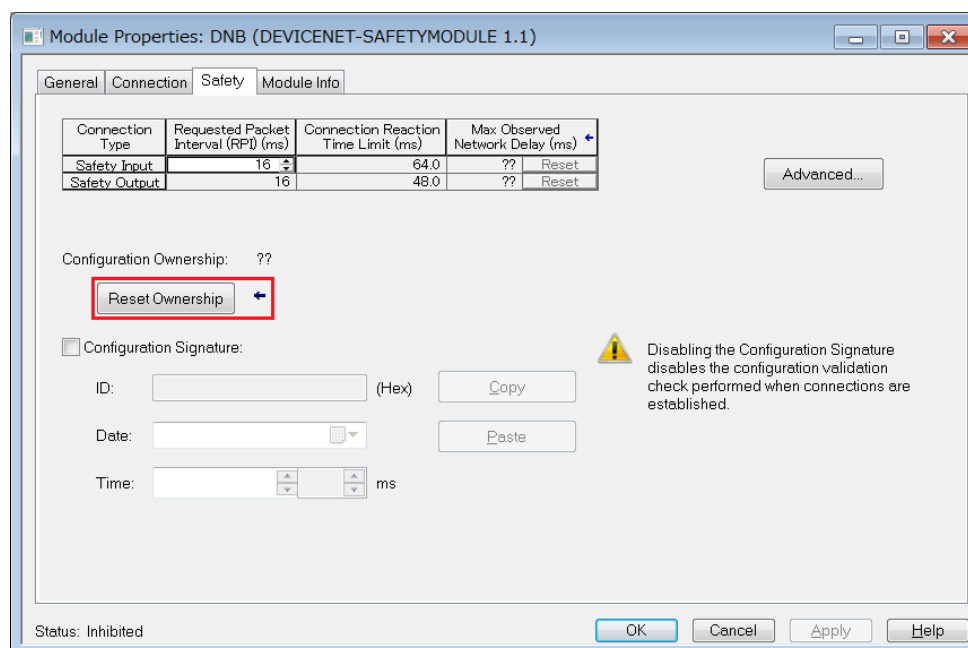
38. Select the {Safety} tab.



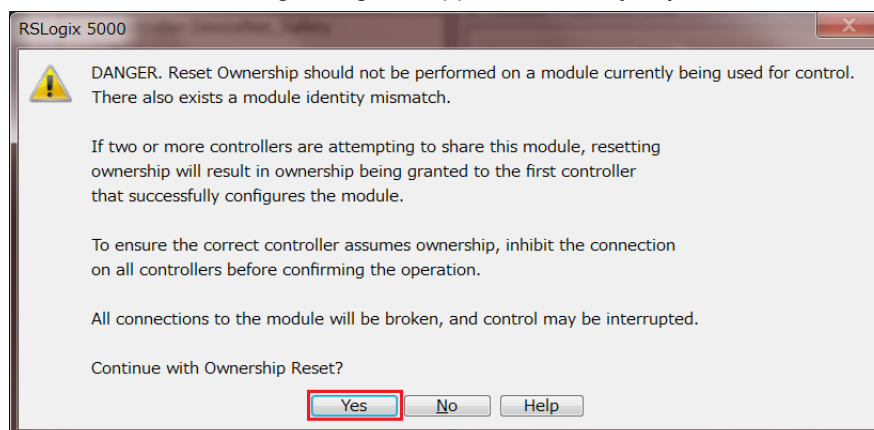
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

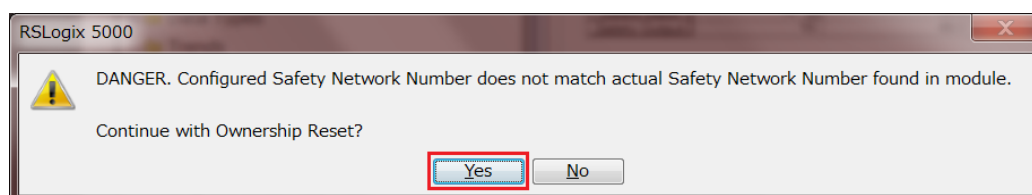
39. Select {Reset Ownership}.



40. When the following dialog box appears, select {Yes}.



And then, when the following dialog box appears, select {Yes}.



After selecting {Reset Ownership}, "AL0772 DeviceNet Safety Restart Request" occurs.

After the alarm occurs, cycle the control power of the YRC1000 OFF/ ON, start in Online mode, and then perform the following operations.

4

Setting for DeviceNet Safety

4.3

PLC Side Settings

41. Select the {Connection} tab.

Module Properties: DNB (DEVICENET-SAFETYMODULE 1.1)

GeneralConnection*SafetyModule Info

Connection Type	Requested Packet Interval (RPI) (ms)	Connection Reaction Time Limit (ms)	Max. Observed Network Delay (ms)
Safety Input	16	64.0	??
Safety Output	16	48.0	??

Advanced...

Configuration Ownership: ??

Reset Ownership

Ownership cannot be reset until pending edits are applied.

☐ Configuration Signature:

ID: (Hex)Copy

Date:Paste

Time: ms

Disabling the Configuration Signature disables the configuration validation check performed when connections are established.

Status: FaultedOKCancelApplyHelp

42. Uncheck {Inhibit Connection}, and then select {Apply}.

Module Properties: DNB (DEVICENET-SAFETYMODULE 1.1)

GeneralConnection*SafetyModule Info

Name	Requested Packet Interval (RPI) (ms)	Inhibit Connection	Major Fault On Controller If Connection Fails While in Run Mode
Safety Input	16	<input type="checkbox"/>	<input type="checkbox"/>
Safety Output	16	<input type="checkbox"/>	<input type="checkbox"/>

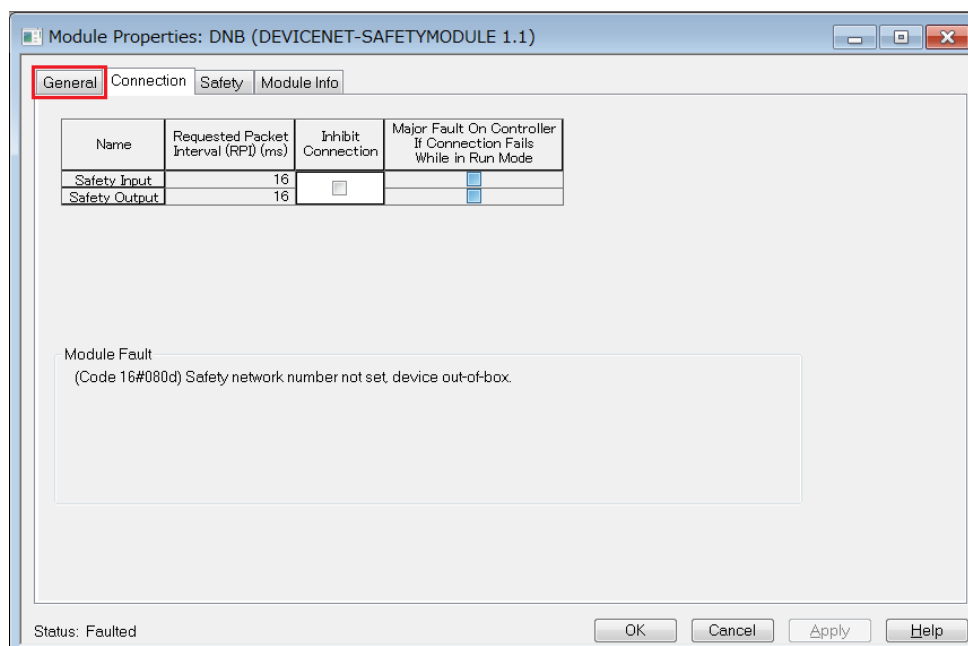
Module Fault
(Code 16#080d) Safety network number not set, device out-of-box.

Status: FaultedOKCancelApplyHelp

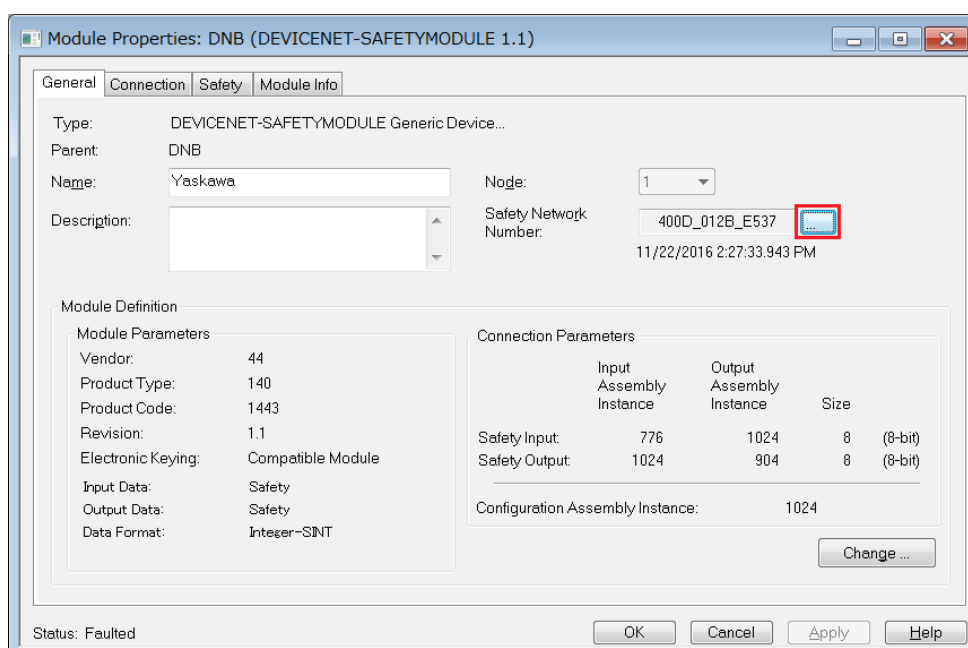
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

43. Select the {General} tab.



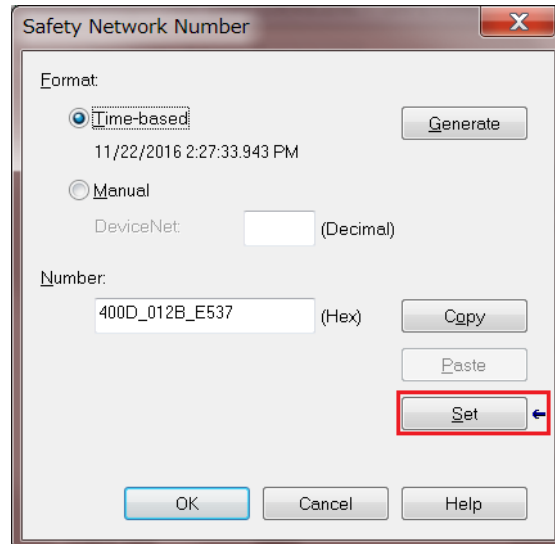
44. Select {...}.



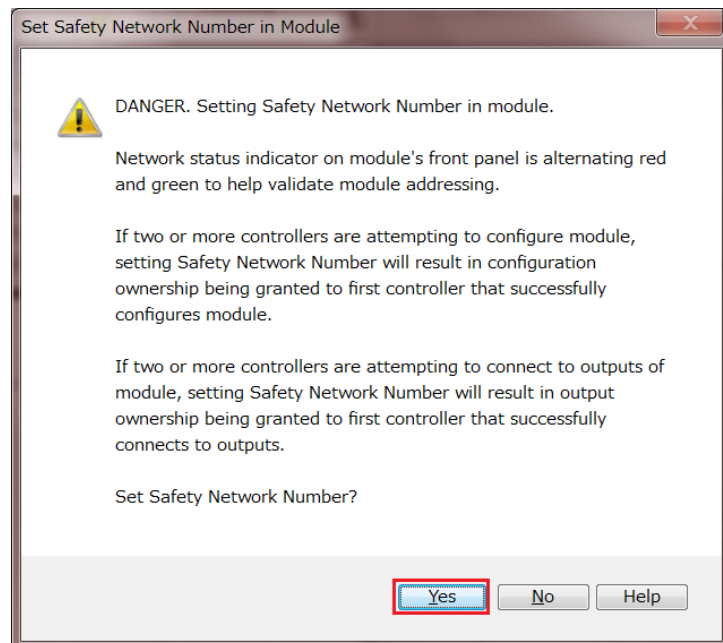
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

45. Select {Set} and then, set TUNID (Target Unique Network Identifier) to the YRC1000 safety adapter. TUNID is created by SNN (Safety Network Number: an unique number allocated to a node on the safety network of the safety adapter) and MAC ID.
The value of the SNN specified in this step can be confirmed on the screen of the programming pendant. For confirming procedures, refer to *chapter 4.4 “Confirming SNN”*.



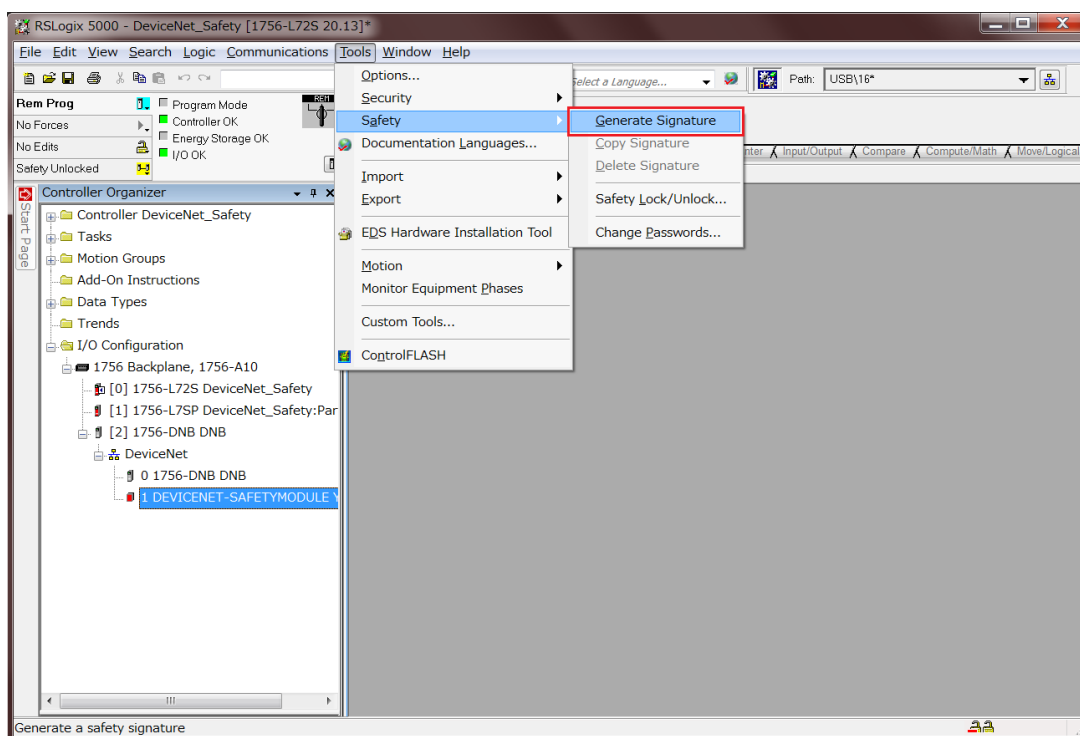
46. Select {Yes}.



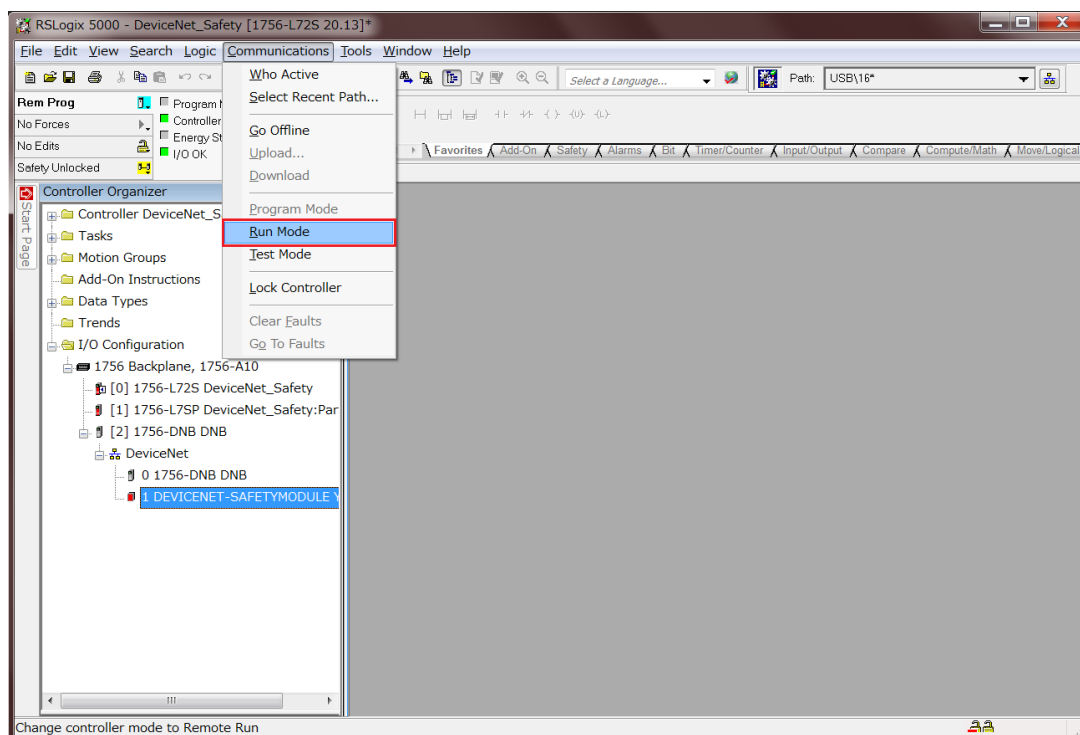
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

47. Select {Tools} - {Safety} - {Generate Signature} to create Safety Signature.



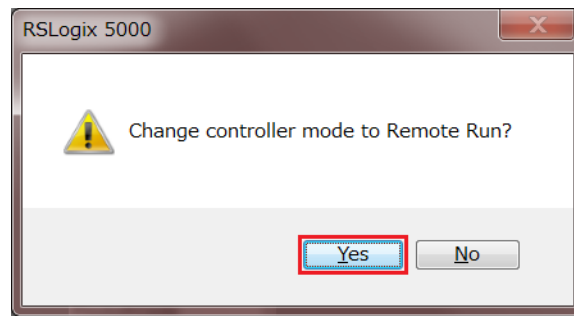
48. Select {Communications} - {Run Mode} to change the operation mode to {Run Mode}.



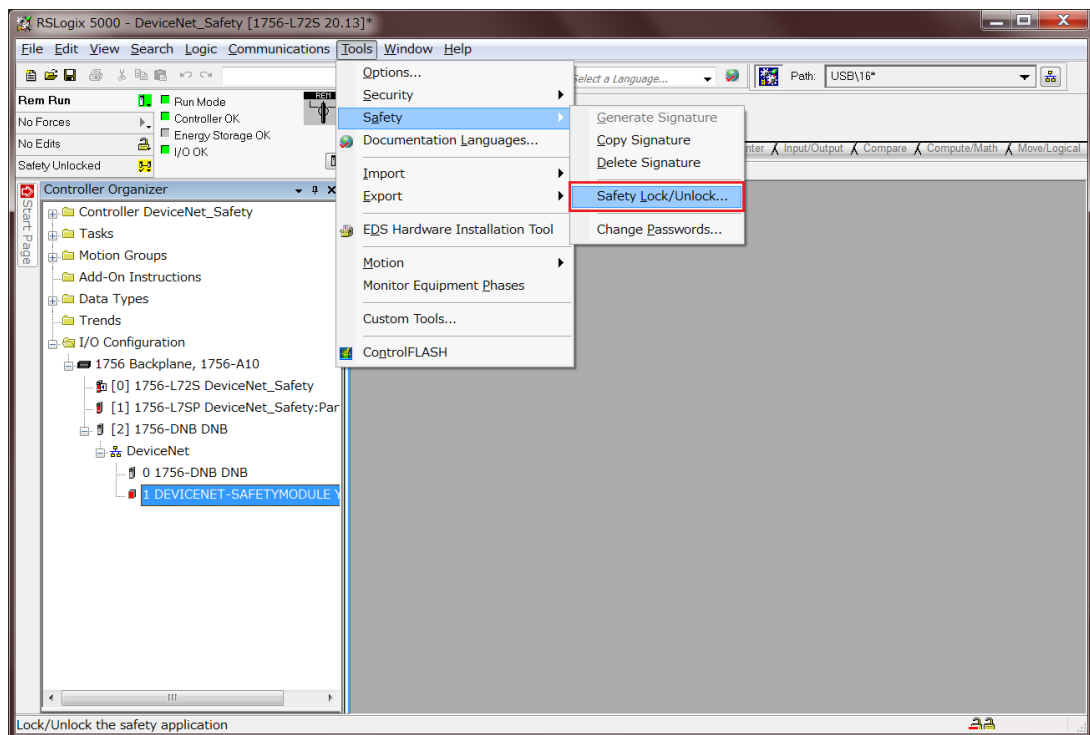
4 Setting for DeviceNet Safety

4.3 PLC Side Settings

49. Select {Yes}.



50. Select {Tools} - {Safety} - {Safety Lock/Unlock...}.



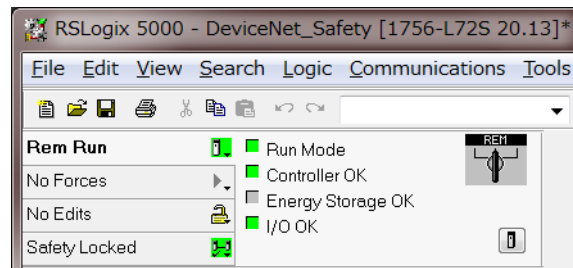
51. Select {Lock}.



4 Setting for DeviceNet Safety

4.3 PLC Side Settings

52. When the check box of {I/O OK} turns to green for RSLogix 5000, it means that communication is established.

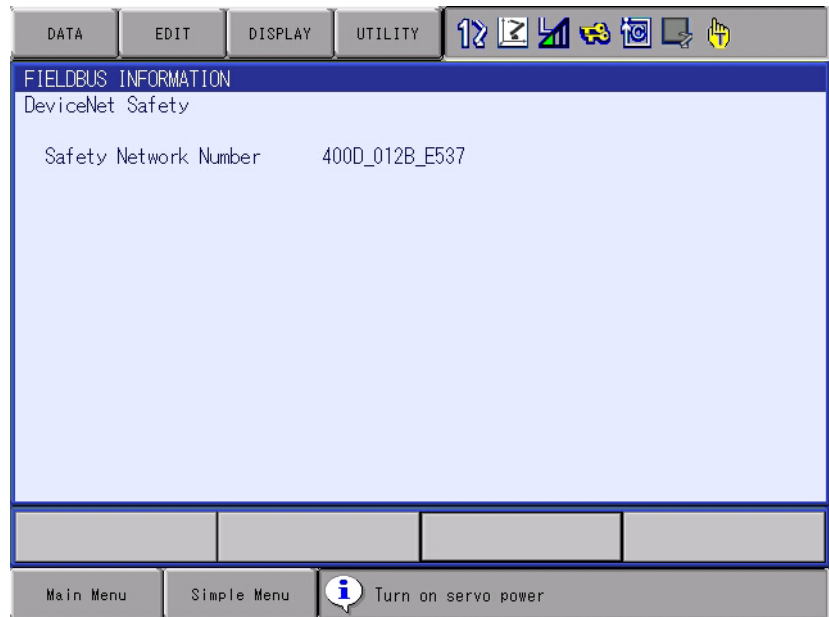


4 Setting for DeviceNet Safety
4.4 Confirming SNN

4.4 Confirming SNN

The procedures of confirming the SNN specified in the step 45 of *chapter 4.3.2 "Safety PLC Settings"* are described below.

1. Start up the YRC1000 in the online mode.
2. Select {SYSTEM} under the Main Menu.
3. Select {FIELDBUS INFORMATION}.
 - The value of the SNN currently set is shown in hexadecimal notation.



5	Safety Signals
5.1	Safety Signal Specifications

5 Safety Signals

5.1 Safety Signal Specifications

Among safety signals handled by DeviceNet Safety, there are an 8-byte (max) safety output signal output from the safety PLC to the YRC1000, and an 8-byte (max) safety input signal input from the YRC1000 to the safety PLC. These signals can be used for safety logic circuits and for functional safety.

Specifications for the safety signals are as follows:

- When communication between the safety PLC and the YRC1000 has not been established, or when a communication error has occurred, the value of the YRC1000 safety output signal will be set to OFF (0) regardless of the safety PLC output signal.
- The safety PLC output signal is duplicated in the safety circuit board. When a duplicated signal value mismatch is detected, the value of the YRC1000 safety output signal will be set to OFF (0) regardless of the safety PLC output signal.
- When a major alarm occurs in the safety circuit board, the safety output signal and safety input signal values are set to OFF (0) regardless of their actual values.
- When allocating safety signals to safety logic circuits etc., the safety IO size is changed to a smaller value and the allocation definition is not changed even if the allocation in use falls outside the range of the safety IO. For allocation definitions outside the range, the safety output signal and safety input signal values are set to OFF (0) regardless of the actual values.

5 Safety Signals

5.2 Safety Signal Allocation

The data for safety signals is allocated to concurrent I/O Internal Control Status Signals. Control status signals are allocated as follows:

5.2.1 Output Signal from Safety PLC (8 byte)

80527	80526	80525	80524	80523	80522	80521	80520
Safety signal (Byte 0)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80537	80536	80535	80534	80533	80532	80531	80530
Safety signal (Byte 1)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80547	80546	80545	80544	80543	80542	80541	80540
Safety signal (Byte 2)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80557	80556	80555	80554	80553	80552	80551	80550
Safety signal (Byte 3)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80567	80566	80565	80564	80563	80562	80561	80560
Safety signal (Byte 4)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80577	80576	80575	80574	80573	80572	80571	80570
Safety signal (Byte 5)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80587	80586	80585	80584	80583	80582	80581	80580
Safety signal (Byte 6)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80597	80596	80595	80594	80593	80592	80591	80590
Safety signal (Byte 7)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5 Safety Signals

5.2 Safety Signal Allocation

5.2.2 Input Signal to Safety PLC (8 byte)

80607	80606	80605	80604	80603	80602	80601	80600
Safety signal (Byte 0)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80617	80616	80615	80614	80613	80612	80611	80610
Safety signal (Byte 1)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80627	80626	80625	80624	80623	80622	80621	80620
Safety signal (Byte 2)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80637	80636	80635	80634	80633	80632	80631	80630
Safety signal (Byte 3)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80647	80646	80645	80644	80643	80642	80641	80640
Safety signal (Byte 4)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80657	80656	80655	80654	80653	80652	80651	80650
Safety signal (Byte 5)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80667	80666	80665	80664	80663	80662	80661	80660
Safety signal (Byte 6)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
80677	80676	80675	80674	80673	80672	80671	80670
Safety signal (Byte 7)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5 Safety Signals

5.2 Safety Signal Allocation

5.2.3 Output Signal Status from Safety PLC (1 byte)

80847	80846	80845	80844	80843	80842	80841	80840
Consumer Data Variables							
					Init_Complete_Out	S_Con_Flt_C_Out	S_Run_Idle_Out

S_Run_Idle_Out It notifies execution status of the safety adapter.
(0:Idle 1:Run)

S_Con_Flt_C_Out It notifies failure detection in the safety adapter.
(0:Fault 1:OK)

Init_Complete_Out It notifies initialization completion status of the safety adapter.
(0: Not completed 1: Completed)

5.2.4 Input Signal Status to Safety PLC (1 byte)

80857	80856	80855	80854	80853	80852	80851	80850
Run_Idle							
							Run_Idle

Run_Idle It notifies input connection status.
(0:Idle 1:Run)

5 Safety Signals

5.2 Safety Signal Allocation

5.2.5 Status Information (43 byte)

Control Input	Name	Description	Valid States	Size (bytes)
80860 to 80867	Input Connection Status	Safety input connection status	0x00-Unallocated: Connection establishment failure 0x01-Initializing: Connection start 0x02-Established: Connection completion 0x03-Close (Fail): Connection failure	1
80870 to 80877	Input Connection Error	Error reason when safety input connection status is [Closed].	0x00-No Error: No error 0x01-Timeout: Timeout 0x02-CRC Error: CRC error 0x03-Packet Error: Reception error 0x04-Data Error: Data mismatch (DATA_IN_A and DATA_IN_B are different.) 0x05-General Stack Error: CIP stack internal error occurrence	1
80880 to 80887	Input Connection Consumer Count	Number of the input connections which are currently valid	0x00-0x0F	1
80890 to 80897	Input Connection Data Size	Safety data size of the input connections which are currently valid.	0x00-0x08	1
80900 to 81047	Producing Connection Status Bytes (For up to 15 connections)	Bit0: Received data status	0x00:Idle 0x01:Active	15
		Bit1: Connection status	0x00:Fault 0x02:OK	
		Bit2-7: Reserved	0x00:Reserved	
81050 to 81057	Output Connection New Data Flag	A flag indicating data are currently been updated	0x00: Output data not updated 0x01: Output data updating	1
81060 to 81067	Output Connection Status	Safety output connection status	0x00-Unallocated: Connection establishment failure 0x01-Initializing: Connection start 0x02-Established: Connection completion 0x03-Close (Fail): Connection failure	1
81070 to 81077	Output Connection Error	Error reason when safety output connection status is [Closed].	0x00-No Error: No error 0x01-Timeout: Timeout 0x02-CRC Error: CRC error 0x03-Packet Error: Reception error 0x04-Data Error: Data mismatch (DATA_OUT_A and DATA_OUT_B are different.) 0x05-General Stack Error: CIP stack internal error occurrence	1
81080 to 81087	Output Connection Data Size	Safety data size of the output connections which are currently valid.	0x00-0x08	1
81090 to 81097	Safety Supervisor Device Status	Safety Supervisor device status	0x00:Undefined 0x01:Self-Testing 0x02:Idle 0x03:Self-Test Exception 0x04:Executing 0x05:Abort 0x06:Critical Fault 0x07:Configuring 0x08:Waiting for TUNID	1

5 Safety Signals

5.2 Safety Signal Allocation

Control Input	Name	Description	Valid States	Size (bytes)
81100 to 81117	General Stack Status	Value of the software attribute When the Bit signal is TRUE, set a value. When the Bit signal is FALSE, reset the value.	Bit0: Interface card detection Bit1: Network cable detection Bit2: Network Level Stack Load OK Bit3: Network Level Stack enabled	2
81120 to 81137	General Stack Error	General error code	File ID code	2
81140 to 81157			Function ID code	2
81160 to 81197			Specific Error code	4
81200 to 81217	Firmware Assertion MainCode	Main code of the firmware assertion	N/A	2
81220 to 81237	Firmware Assertion AddCode	Additional code of the firmware assertion	N/A	2
81240 to 81257	Safety Message Tx Count	Counter value of the sent safety I/O message	N/A	2
81260 to 81277	Safety Message Rx Count	Counter value of the received safety I/O message	N/A	2
81280 to 81287	Activity Check	A flag for checking the execution status of the software	N/A	1

5.2.6 Communication Status (1 Byte)

81317	81316	81315	81314	81313	81312	81311	81310
	DeviceNet Safety processing status	Virtual communication execution status	Specifying virtual communication mode	DeviceNet Safety communication status	DeviceNet Safety communication establishment		

DeviceNet Safety communication establishment

DeviceNet Safety communication status

Specifying virtual communication mode

Virtual communication execution status

DeviceNet Safety processing status

Communication establishment status between the safety scanner (safety PLC) and the safety adapter (safety circuit board).
(0: establishment failure 1: establishment completion)

Safety communication status after establishing communication between the safety scanner (safety PLC) and the safety adapter (safety circuit board).
(0: not during communication 1: during communication)

Specifying the virtual communication mode which is set in the maintenance mode
(0: not used 1: used)

Actual communication mode
(0: during virtual communication 1: during safety communication)

DeviceNet Safety processing status
(0: error 1: normal)



The concurrent I/O is not the function for the safety product. For this reason, the signals allocated to the Internal Control Status Signal cannot be used as the safety-related signals.

5	Safety Signals
5.3	Standard I/O Signal Allocation

5.3 Standard I/O Signal Allocation

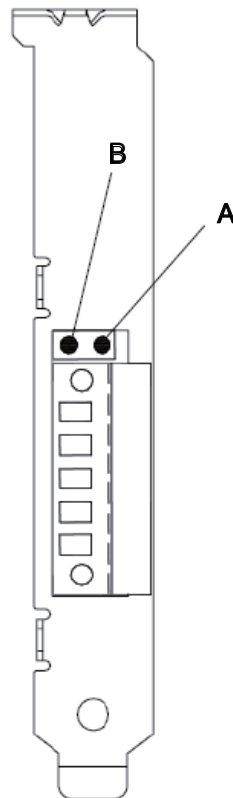
For how to allocate the standard I/O signal, refer to “YRC1000 OPTIONS DeviceNet COMMUNICATIONS FUNCTION INSTRUCTIONS (HW1483856)”.

6 LED Status Display

DeviceNet Safety status (the module status and the network status) can be confirmed with the LED on the SST-DN4-PCle board.

Read HLTH LED of the board as a module status, and COMM LED as the network status respectively.

SST-DN4-PCle



A	HLTH LED
B	COMM LED

6.1 Status Display Pattern

Status	Module Status (HLTH)	Network Status (COMM)
When the power supply is off (cannot display)	Off	Off
Self-diagnostic underway	Alternating red and green blinking (0.5 sec intervals)	Off
TUNID waiting status	Alternating red and green blinking (0.5 sec intervals)	Undefined
TUNID waiting status (After receiving Propose_TUNID service)	Alternating red and green blinking (0.5 sec intervals)	Alternating red and green blinking (0.25 sec intervals)
Idle status (Waiting for establishment of communication)	Green blinking (0.5 sec intervals)	Undefined
Communication occurring	Green lights up	Green lights up
For example, when the YRC1000 MAC ID was changed after setting the TUNID.	Red blinking (0.5 sec intervals)	Undefined
Duplicate MAC ID with other device	Red blinking (0.5 sec intervals)	Red lights up
DeviceNet Safety major alarm occurring	Red lights up	Undefined

7 Requirements for CIP Safety

DeviceNet Safety is a function to secure safety as an entire system including the YRC1000 and peripheral safety devices. Each device has a different setting method for safety. This chapter shows notes and reminders to configure the safety system with the YRC1000 as the main component.

Normally, setting for safety of the YRC1000 is performed by using the programming pendant and saved in the YRC1000. It is impossible to make settings for the YRC1000 by using Safety Network Configuration Tool (SNCT).

Please keep in mind following items when you use the YRC1000:

- The replacement of safety devices requires that the replacement device be configured properly and operation of the replacement device shall be user verified.
- If you choose to configure safety connections with an SCID=0, you are responsible for ensuring that originators (data senders) and targets (data receivers) have the correct configurations. SCID (Safety Configuration Identifier) enables to identify the safety configuration. SCID is not used in the YRC1000.
- The user should assign SNNs (Safety Network Numbers) for each safety network or safety sub-net that are unique system-wide. An SNN is a unique number allocated to each node on the safety network.
- Please clear any pre-existing configuration from any safety device before installing it onto the safety network.
For the clearing procedures, refer to the Rockwell Automation, Inc. manual "GuardLogix Controllers User Manual (1756-UM020I-EN-P – August 2012)," chapter 5 "Add, Configure, Monitor, and Replace CIP Safety I/O."
When using a safety PLC manufactured by a company other than Rockwell Automation, Inc., refer to that manufacturer's manual.
- Please confirm a valid and unique MAC ID is assigned for each safety device before installing it onto the safety network.
For the MAC ID confirming procedures, refer to the Rockwell Automation, Inc. manual "GuardLogix Controllers User Manual (1756-UM020I-EN-P – August 2012)," chapter 5 "Add, Configure, Monitor, and Replace CIP Safety I/O."
When using a safety PLC manufactured by a company other than Rockwell Automation, Inc., refer to that manufacturer's manual.
- Please test safety connection configurations after they are applied in an originator to confirm the target safety connection is operating as intended.
- Please note that LEDs are NOT reliable indicators and cannot be guaranteed to provide accurate information. They should ONLY be used for general diagnosis during commissioning or troubleshooting. Do not attempt to use LEDs as operational indicators.
- Please note that originators that have an "automatic" SNN setting feature can use that feature only when the safety system does not rely on the feature to secure safety.

The following points about the safety system are described for informational purposes:

- When a SIL3 device is configured directly from a workstation, please compare the transferred SCID and safety setting data with the SCID and safety setting data originally viewed in the workstation.
- Please note that user testing is the means by which all downloads are validated.
Also, before using the system, confirm that all safety functions are operating as intended.
- Please note that the signature should only be considered “verified” (and configuration locked) after user testing.
For information on safety signatures, refer to the Rockwell Automation, Inc. manual “GuardLogix Controllers User Manual (1756-UM020I-EN-P – August 2012),” chapter 6 “Develop Safety Applications.”
When using a safety PLC manufactured by a company other than Rockwell Automation, Inc., refer to that manufacturer’s manual.
- Please note that when the originator configures communication setting data and/or target setting data, these data must be downloaded to the target and be tested and verified. Only when the verification result is valid, SCIDs from the target can be confirmed.
For the downloading procedures, refer to the Rockwell Automation, Inc. manual “GuardLogix Controllers User Manual (1756-UM020I-EN-P – August 2012),” chapter 7 “Go Online with the Controller.”
When using a safety PLC manufactured by a company other than Rockwell Automation, Inc., refer to that manufacturer’s manual.
- Please completely test a device’s operation before setting the Lock Attribute.
For information on the Lock Attribute, refer to the Rockwell Automation, Inc. manual “GuardLogix Controllers User Manual (1756-UM020I-EN-P – August 2012),” chapter 6 “Develop Safety Applications.”
When using a safety PLC manufactured by a company other than Rockwell Automation, Inc., refer to that manufacturer’s manual.
- Please upload the setting data from each safety device and compare those with the data sent from the SNCT for verification before setting the Lock Attribute in each device.
For the uploading procedure, refer to the Rockwell Automation, Inc. manual “GuardLogix Controllers User Manual (1756-UM020I-EN-P – August 2012),” chapter 7 “Go Online with the Controller.”
When using a safety PLC manufactured by a company other than Rockwell Automation, Inc., refer to that manufacturer’s manual.
- Please lock the safety device which can be configured via the SNCT interface after verification has been completed.
- Please verify that all originator-configured safety devices which can be configured by a Type 1 SafetyOpen have their ownership assignments as part of the final verification process.
- Please visually verify that all configuration data was downloaded correctly.
For the downloading procedures, refer to the Rockwell Automation, Inc. manual “GuardLogix Controllers User Manual (1756-UM020I-EN-P – August 2012),” chapter 7 “Go Online with the Controller.”
When using a safety PLC manufactured by a company other than Rockwell Automation, Inc., refer to that manufacturer’s manual.

YRC1000 OPTIONS INSTRUCTIONS

FOR DeviceNet Safety FUNCTION

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