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

MOTOMAN INSTRUCTIONS
MOTOMAN-INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL
DX200 MAINTENANCE MANUAL

The DX200 Operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.
MANDATORY

- This manual explains the PROFIsafe of the DX200. Read this manual carefully and be sure to understand its contents before handling the DX200.
- General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 Instruction before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- 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.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX200.

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

- **DANGER**: Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.

- **WARNING**: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

- **CAUTION**: Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

- **MANDATORY**: Always be sure to follow explicitly the items listed under this heading.

- **PROHIBITED**: Must never be performed.

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

At any rate, be sure to follow these important items

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

• Do not use or keep the board in the following environmental conditions.
  – Where exposed to direct sunshine
  – Where vibration or impact occurs
  – Where high humidity exists
  – Where a strong magnetic field exists
  – Where much dust exists
  – Where a sudden change in the temperature occurs
  – Where corrosive gases occur
  – Where condensation occurs

Improper usage of the board may damage the board.
WARNING

• Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the DX200 and programming pendant are pressed. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

Figure 1: Emergency Stop Button

• Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Figure 2: Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

• Confirm that no persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the DX200 power
  – Moving the manipulator with the programming pendant
  – Running the system in the check mode
  – Performing automatic operations

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems. The emergency stop buttons are located on the right of the front door of the DX200 and the programming pendant.

• Before wiring, be sure to turn OFF the power supply and put up a warning sign, such as “DO NOT TURN ON THE POWER.”

Failure to observe this warning may result in an electric shock or an injury.
WARNING

- Do not touch the inside of the panel for 5 minutes after the power is turned OFF.
  The remaining charged voltage in the capacitor may cause an electric shock or an injury.
- Be sure to close the door and install the protection cover while the power is turned ON.
  Failure to observe this warning may result in a fire or an electric shock.
CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the DX200 after use.

The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

Read and understand the Explanation of Warning Labels in the DX200 Instructions before operating the manipulator:
- The wiring and mounting must be performed by authorized and qualified personnel.

Failure to observe this caution may result in a fire or an electric shock.
- Make sure that there is no foreign matter such as metal chips on the board.

In case of malfunction, etc. it may result in an injury or damage the board.
- Make sure that there is no damage or deflection of parts on the board.

In case of malfunction, etc. it may result in an injury or damage the board.
- Correctly connect each cable and connector.

Failure to observe this caution may result in a fire or damage the board.
- Set the switches, etc. correctly.

Malfunction, caused by an incorrect setting, may result in an injury or damage the board.
- Never touch the mounting surfaces of the board parts directly with fingers.

The generated static electricity may damage the IC.
- Never touch the soldered surfaces of the board directly with fingers.

Protrusions on the soldered surface may result in an injury.
- No shock to the board.

The shock may damage the board.
Definition of Terms Used 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:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td>Character Keys/ Symbol Keys</td>
</tr>
<tr>
<td></td>
<td>The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]</td>
</tr>
<tr>
<td>Axis Keys/ Number Keys</td>
<td>“Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td>Displays</td>
<td>The menu displayed in the programming pendant is denoted with { }. ex. (JOB)</td>
</tr>
</tbody>
</table>

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 the SELECT key 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.
Customer Support Information

If you need assistance with any aspect of your PROFIsafe for CP1616 system, please contact Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

For **routine** technical inquiries, you can also contact Motoman Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact Motoman Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for **routine** inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact Motoman Customer Support at the telephone number shown above.

Please have the following information ready before you call Customer Support:

- **System**
  PROFIsafe for CP1616

- **Primary Application**
  ___________________________

- **Controller**
  DX200

- **Software Version**
  Access this information on the Programming Pendant's LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}

- **Robot Serial Number**
  Located on the robot data plate

- **Robot Sales Order Number**
  Located on the DX200 controller data plate
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   4.1 CP1616 Communication Settings .....................................................................................4-1
      4.1.1 Network Interface Settings.......................................................................................4-1
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1 Outline

This instruction manual describes settings and other information required for the PROFIsafe communication using the PROFINET board CP1616 (made by Siemens, hereinafter referred to as CP1616).

The use of the CP1616 enables safety signals to be transferred to and from the safety PLC, and the safety signals can be used for the I/O signals of the safety logic circuit and for switching the condition files of functional safety.

The CP1616 has multiple firmware versions. Depending on the DX200 software version, use the following firmware version for the CP1616.

<table>
<thead>
<tr>
<th>DX200 software version</th>
<th>CP1616 firmware version</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN1.47.00A(□□)-00 or earlier</td>
<td>V2.5.2.0</td>
</tr>
<tr>
<td>From DN1.50.00A(□□)-00 to DN1.80.00A(□□)-00</td>
<td>V2.6.1.0</td>
</tr>
<tr>
<td>DN1.81.00A(□□)-00 or later</td>
<td>V2.6.1.6</td>
</tr>
</tbody>
</table>

If an unsupported firmware version is used with the software version of DN1.56.00A(□□)-00 or later, an alarm 4918 "PROFINET SETTING ERROR" occurs.

This manual describes communication settings of CP1616 board using the Siemens “STEP 7” software application and the add on software “Distributed Safety.” When using other software, refer to the manual of each software.

1.1 System Configuration

The safety PLC will be the F-Host that is the master station for PROFIsafe communication. The DX200 machine safety unit will be the F-Device that is a slave station.

The CP1616 relays data between the F-Host and the F-Device as the IO device for PROFINET communication. In addition, the IO controller, which is the master station for PROFINET communication, usually functions within the safety PLC that is the F-Host.
2 Hardware Specifications

Refer to "INSTRUCTIONS FOR PROFINET COMMUNICATIONS FUNCTION (FOR CP1616 MADE BY Siemens) (165837-1CD)" for the information on the CP1616 hardware specifications.
3 Attaching of the Board

Refer to "INSTRUCTIONS FOR PROFINET COMMUNICATIONS FUNCTION (FOR CP1616 MADE BY Siemens) (165837-1CD)" for how to attach the CP1616.

**NOTE**

When the CP1616 is used for the PROFIsafe communication, make sure to insert the CP1616 into CN1 (slot 1) of the riser card (JANCD-YBB02-E).
4 Setting of the Board

4.1 CP1616 Communication Settings

To perform the CP1616 communication settings, it requires the setting tool made by Siemens. This section explains the setting method using the setting tool "STEP 7" on which the Distributed Safety software is installed. The STEP 7's version used is V5.5 + SP2 + HF1. Refer to the instruction manual of STEP 7 for more information on the setting method.

4.1.1 Network Interface Settings

In order to access to the devices, such as the CP1616 and the PLC, from the PC on which STEP 7 is installed, it requires the PC network interface settings.

1. Start SIMATIC Manager (STEP 7).
2. Select {Options} - {Set PG/PC Interface...} to display the following dialogue.

![Network Interface Settings Dialogue]

3. Select the network interface of the PC to be used from the {Access Path} tab list, and then press {OK} at the following dialogue.

![Warning Dialogue]

Caution: If you operate the "OK" button, you will no longer be able to establish an online connection via router!
4. Setting of the Board
4.1 CP1616 Communication Settings

For the network interface selected at this step, an optional fixed IP address should be set. When allocated automatically by DHCP, it is not allowed to access to the devices such as the CP1616 and the PLC.

4. The selected network interface is displayed at "Access Point of the Application:" and "Interface Parameter Assignment Used:"

5. Press {OK} to close the window.
4.1.2 IO Device Settings

1. Connect the PC with STEP 7 installed to the CP1616 with the Ethernet cable, and then turn ON the DX200 pressing (MAIN MENU).

2. Start SIMATIC Manager (STEP 7), and then select {PLC} - {Edit Ethernet Node...}.

3. Detect the CP1616 by pressing (Browse...), and then allocate the IP address, subnet mask and device name.
4. Setting of the Board

4.1 CP1616 Communication Settings

4.1.3 F-Host (IO Controller) Settings

When setting the F-Host, the CP1616 GSD file supplied by YASKAWA is necessary. Depending on the software version of the DX200, available GSD files vary.

In case modifying the IP address and device name allocated to CP1616, please do not fail to allocate them after the factory resetting is executed.

Press {Reset} on the Edit Ethernet Node window.

<table>
<thead>
<tr>
<th>DX200 software version</th>
<th>GSD File</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN1.47.00A(□□)-00 or earlier</td>
<td>GSDML-V2.25-Yaskawa-PROFIsafe-CP1616-20130906.xml</td>
</tr>
<tr>
<td>From DN1.50.00A(□□)-00 to DN1.70.01A(□□)-00</td>
<td>GSDML-V2.31-Yaskawa-PROFIsafe-CP1616-20140729.xml</td>
</tr>
<tr>
<td>DN1.71.00A(□□)-00 or later</td>
<td>GSDML-V2.31-Yaskawa-PROFIsafe-CP1616-20150514.xml or later</td>
</tr>
</tbody>
</table>

For how to obtain the GSD file, refer to section 4.3 “GSD File Creation”.

This section explains how to set the F-Host when using the safety PLC “CPU319F-3 PN/DP” made by Siemens as the F-Host, as an example.

When using an equipment not made by Siemens as the F-Host, refer to the instruction manual for each equipment.

1. Start SIMATIC Manager (STEP 7).
2. Select {File} - {New…}, and then create a new project.
3. Add a station. Right-click the created project name, and then select \{Insert New Object\} - \{SIMATIC 300 Station\}.

4. Set the hardware. Double-click \{Hardware\} under the added station, and then start the \{HW Config\}. 
5. Locate a rack for the SIMATIC 300 from the hardware catalog, and then insert the power supply module and the CPU. Make sure to insert the module according to the actual configuration of the devices.

6. The network property window is displayed. Select {New…} to add a network. Also, enter an IP address for allocating to the CPU, and then press {OK}.
4. Setting of the Board
4.1 CP1616 Communication Settings

7. Double-click {CPU319F-3 PN/DP} to open the property window.

8. Select (Protection) tab to perform the password setting for access protection of CPU319F-3 PN/DP. Mark the check box of "Can be bypassed with password", and set the optional password. Also, in order to use the safety program, mark the check box of "CPU contains safety program", and then press {OK}.
4. Setting of the Board

4.1 CP1616 Communication Settings

9. For adding the CP1616 (IO Device), select {Options} - {Install GSD File...} to install the GSD file of the CP1616. After the installation, select (V2.6) from (6GK1 161-6AA02) or (6GK1 161-6AA02(Migration)) under (PROFINET IO) - {Additional Field Devices} - {I/O} - {SIMATIC PC-CP} - {CP1616} of the hardware catalog, and then drag and drop it on the network.

V2.6 (Non-migration module) under 6GK1 161-6AA02

: Select this when the CP1616 is used as an IO device only.

V2.6 (Migration module) under 6GK1 161-6AA02 (Migration)

: Select this when the CP1616 is used as an IO device + IO controller simultaneously.

- When the version of the GSD file is older than "GSDML-V2.25-Yaskawa-PROFIsafe-CP1616-20130906.xml", select V2.6 under (PROFINET IO) - {I/O} - {SIMATIC PC-CP} - {CP1616} of the hardware catalog. The start slot number of the CP1616 is 0.

- When the version of the GSD file is older than "GSDML-V2.31-Yaskawa-PROFIsafe-CP1616-20150514.xml", any non-migration modules are not displayed. Select a migration module in spite of the usage method of CP1616.
4 Setting of the Board
4.1 CP1616 Communication Settings

10. Double-click the added CP1616 icon to open the property window, and enter the same device name and IP address as the one allocated to the CP1616 in section 4.1.2 “IO Device Settings”, and then press {OK}.

11. For adding a module for safety signals to the CP1616. Select and add "PS 8 bytes". Also, modules for the standard IO can be added.
12. Set the parameter (F-Parameter) for the safety communication. Double-click (PS 8 bytes) added in step 11, and select {PROFIsafe} tab on the {Properties} dialog.

The details for each parameter are shown below. Make settings according to the environment.

<table>
<thead>
<tr>
<th>Item</th>
<th>Details</th>
<th>Initial Value</th>
<th>Value Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>F_SIL</td>
<td>Safety level guaranteed by the DX200</td>
<td>SIL3</td>
<td>SIL3 only</td>
</tr>
<tr>
<td>F_CRC_Length</td>
<td>Length of CRC to be added to the safety data</td>
<td>3-Byte-CRC</td>
<td>3-Byte-CRC only</td>
</tr>
<tr>
<td>F_Block_ID</td>
<td>Whether to set iParameter or not.</td>
<td>1: Can be set</td>
<td>1: Can be set only</td>
</tr>
<tr>
<td>F_Par_Version</td>
<td>Version of the F-Parameter</td>
<td>1: V2-mode</td>
<td>1: V2-mode only</td>
</tr>
<tr>
<td>F_Source_Add</td>
<td>Address set for the F-Host (safety PLC)</td>
<td>2000</td>
<td>1 - 65534</td>
</tr>
<tr>
<td>F_Dest_Add</td>
<td>Address set for the F-Device (DX200)</td>
<td>200</td>
<td>1 - 65534</td>
</tr>
<tr>
<td>F_WD_Time</td>
<td>Allowable value for the communication response time between the safety PLC and the DX200 (Unit: millisecond)</td>
<td>150</td>
<td>4 - 10000</td>
</tr>
<tr>
<td>F_iPar_CRC</td>
<td>CRC value to be added to iParameter</td>
<td>0</td>
<td>0 - 4294967295</td>
</tr>
</tbody>
</table>

**NOTE** The value for F_Dest_Add must be the same as the F_Dest_Add value set in step 8 in section 4.2 "Maintenance Mode Settings".
4. Setting of the Board

4.1 CP1616 Communication Settings

13. Save and compile the settings.

14. Download the compiled project to the CPU319F-3 PN/DP.
15. Download the error program (OB: Organization Block), which is executed when an error occurs, to the IO controller. For example, in order to enable to restore from the communication error such as disconnection, create and download OB86 to the IO controller. For the details of the organization block, refer to the instructions of STEP 7. Select {Blocks} - {Insert New Object} - {Organization Block} from the project tree in the SIMATIC Manager window to create OB86.
16. Select OB86 to download to the IO controller.

17. Continuously, refer to section 4.2.1 “IO Device Settings”, and perform the settings of CP1616.
4.2 Maintenance Mode Settings

4.2.1 IO Device Settings

Make sure to perform this setting in the management mode after installing the CP1616 on CN1 (slot 1) of the riser card (JANCD-YBB02-E).

If the CP1616 is not installed or the DX200 is in the operation mode or in the editing mode, the settings cannot be performed.

To use the CP1616 for the DX200 PROFIsafe communication, the option board and I/O module settings must be performed using the following steps.

1. Turn the power supply ON again while pressing {Main Menu} simultaneously.
   - The maintenance mode is displayed.

2. Change the security mode to the management mode.

3. Select {SYSTEM} under the main menu.
   - The sub menu is displayed.
4. Select {SETUP}.
   - The SETUP window is displayed.

5. Select “OPTION BOARD”.
   - The option board screen is displayed.

6. Select “CP1616”.
   - The CP1616 setting window is displayed.
4. Setting of the Board
4.2 Maintenance Mode Settings

– (Description of each setting item)

(1) CP1616
Set whether the CP1616 will be used. "USED" and "NOT USED" can be selected and switched using the toggle.

(2) IO SIZE
The IO size is automatically calculated if the IO size (IN/OUT) is set on the IO controller or the IO device window.

(3) IO Controller
Perform the IO Controller settings.

(4) IO Device
Perform the IO Device settings.

(5) ALARM AT INITIALIZE ERROR
To use the CP1616, perform the communication settings using STEP 7 made by Siemens. (Refer to section 4.1 “CP1616 Communication Settings”.) If this communication settings are not performed, the initializing process of the CP1616 at the start of the DX200 will be terminated abnormally. In this setting item, set whether the alarm which indicates that the abnormal termination of initializing process occurs will be displayed on the window.

(6) PROFIsafe
Set whether to use the safety communication using PROFIsafe. The setting of this item cannot be changed. (Fixed to "USED").

(7) F_Dest_Address
Set the address of the DX200 (F-Device) used for the PROFIsafe communication in the range of 1 to 65534.

(8) PROFIsafe VIRTUAL COMM.
This item is a mode which is used when the robot performs the trial operation. When starting the DX200 without connecting the CP1616 to the safety PLC, set this item as "VIRTUAL". To change the setting of this item, change the security mode to the safe mode only when setting this item.

NOTE

PROFIsafe Virtual Communication

• When performing the normal operation, make sure to set this item to "SAFETY". If the connection with the safety PLC establishes with the setting remaining as "VIRTUAL", the setting will automatically be changed to "SAFETY" and then, the safety communication using PROFIsafe starts.

• In order to use the DX200 in the virtual mode, all the following settings need to be set.
  – CP1616 is set as "USED". (CP1616 window)
  – IO device is set as "ENABLE". (IO device window)
  – "PS 8 byte" is set to IO device. (IO device window)
4 Setting of the Board
4.2 Maintenance Mode Settings

7. Change CP1616 to "USED".

8. Select "DETAIL" of the IO device.
   - The IO device setting window is displayed.
     (The display depends on the DX200 software version.)

When the software version is DN1.47.00A(□□)-00 or earlier.

9. "ENABLE" or "DISABLE" for Slot 0 - CP1616 can be selected and switched using the toggle.
   When using the CP1616 as the IO device, "ENABLE" should be selected.
10. Set the IO size used for the communication to Slot 1-64. Set "PS 8 byte", which is the IO size for the safety signals, to DI and DO of Slot 1. Setting the regular IO data to DI and DO of Slot 2 - 64 is also possible. The IO allocation set in the IO device settings and the IO allocation set in the F-Host settings (Refer to the step 9 of section 4.1.3 “F-Host (IO Controller) Settings”) should match.

When the software version is from DN1.50.00A(□□)-00 to DN1.70.01A(□□)-00,

9. "ENABLE" or "DISABLE" for Slot 1 - CP1616 can be selected and switched using the toggle.
When using the CP1616 as the IO device, "ENABLE" should be selected.
10. Set the IO size used for the communication to Slot 2-64. Set "PS 8 byte", which is the IO size for the safety signals, to DI and DO of Slot 2.

Setting the regular IO data to DI and DO of Slot 3-64 is also possible. The IO allocation set in the IO device settings and the IO allocation set in the F-Host settings (Refer to the step 9 of section 4.1.3 "F-Host (IO Controller) Settings") should match.

When the software version is DN1.71.00A(□□)-00 or later.

9. Press "CP1616" of Slot 1, and then select one from "DISABLE", "ENABLE(No Migration)", or "ENABLE(Migration)".

When a non-migration module is set, in step 7 of section 4.1.3 "F-Host (IO Controller) Settings", select "ENABLE(No Migration)", when a migration module is set, select "ENABLE(Migration)".

When the CP1616 is used as an IO device + IO controller simultaneously, "ENABLE(Migration)" should be set.
4. Setting of the Board
4.2 Maintenance Mode Settings

10. Set the IO size used for the communication to Slot 2-64.
   Set "PS 8 byte", which is the IO size for the safety signals, to DI and DO of Slot 2.
   Setting the regular IO data to DI and DO of Slot 3-64 is also possible.
   The IO allocation set in the IO device settings and the IO allocation set in the F-Host settings (Refer to the step 9 of section 4.1.3 “F-Host (IO Controller) Settings”) should match.

   – Return to the CP1616 setting window.
   * The data size for the safety signals is not included in the displayed IO size.
12. Press [ENTER].
   – The confirmation dialog box is displayed.

13. Select {YES}.
   – The IO module window is displayed.

The CP1616 settings are complete here. Next, the IO module needs to be set based on the board settings. Continue the settings for the following items.

When “Select "Machine Safety Board FLASH Reset" is displayed in the message area, after the IO module settings and the external IO settings described in the following chapters are completed, select (FILE) - (INITIALIZE) - "Machine Safety Board FLASH Reset" under the Main Menu to set the machine safety board FLASH data again.

If there is an unconformity between the option board and IO module settings, the DX200 cannot operate properly. To avoid such unconformity, be sure to perform the IO module settings displayed successively after the option board settings.
4.2.2 IO Module Settings

If the CP1616 settings are changed, the IO module needs to be set as well. Set the IO module settings using the following steps.

1. (the continuation of the CP1616 settings)
   - The IO module window (the first half) is displayed.

   ![IO Module Window (First Half)]

2. Press [ENTER].
   - The IO module window (the latter half) is displayed.

   ![IO Module Window (Latter Half)]

   - Ensure that the following value is allocated to DI and DO for the number of the slot (ST#16) to which the CP1616 is installed: the set IO size (unit: bit) + 8.
   - However, the data size for the safety signals is not included.
3. Press [ENTER].
   - The confirmation dialog box is displayed.

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 is displayed.
4.2.3 External IO Settings

1. The EXTERNAL IO SETUP window is displayed.

2. Select "AUTO" or "MANUAL" for the allocation mode.
   - After "AUTO"/"MANUAL" is selected, the selection menu is displayed.

   [Diagram of EXTERNAL IO SETUP window]

   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 need to be kept, save the data in the external memory menu in advance.
4 Setting of the Board

4.2 Maintenance Mode Settings

3. Select the 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 5-7 are not necessary. Perform the operation from step 8.
   – When selecting "MANUAL" for the allocation mode, perform the following steps 5-7 for the items necessary for manual settings.
5. Select the external I/O signal number to be changed from the original. (*#20060* is selected in the setting example.)
   - The select menu is displayed.

6. Select "MODIFY" and enter the desired external input signal number to replace 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 of the Board

4.2 Maintenance Mode Settings

8. Press [ENTER].

- The external output signal allocation window is displayed.

9. Select and change the external output signal number with 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 is displayed.

11. Select {YES}.

- Return to the setting window after the setting contents are confirmed.
4.3 GSD File Creation

When performing the communication settings of the PROFIsafe communication, a GSD (Generic Station Description) file is required for setting of the communication master (F-Host). Use a GSD file created with the following procedures.

- GSD file creation by this procedure can be performed when the software version of the DX200 is DN1.71.00A(-00 or later. When the version DN1.70.01A(-00 or earlier is used, contact your YASKAWA representative.

- Before creating a GSD file, complete the settings described in section 4.2.1 “IO Device Settings”. Before completing the settings of the optional board and/or IO module, a GSD file cannot be created correctly.

4.3.1 Creating Procedures of GSD File

1. Turn ON the power supply while pressing Main Menu.
   - The maintenance mode is displayed.

2. Select {EX. MEMORY} under the main menu.
   - The sub menu is displayed.
3. Select {SAVE}.
   – The SAVE window is displayed.

4. Select "EDS/GSD FILE SAVE".
   – The EDS/GSD FILE SAVE window is displayed.
   A list of such as the CP1616 board which is set for the IO device and
   the DeviceNet board which is set for the slave is displayed.

5. Select "CP1616" of ST#16.
   – "★" is displayed before the name of the selected board.
6. Press [ENTER].
   – The confirmation dialog box is displayed.

7. Select {YES}.
   – A GSD file is created in an enabled device (CompactFlash or USB memory).

The file name to be created will be as follows:
GSDML-Version-Yaskawa-PROFIsafe-CP1616-Date.xml

Version: GSD file version
Date: Released date of GSD file

<File name example>
GSDML-V2.31-Yaskawa-PROFIsafe-CP1616-20150514.xml
5 Concurrent I/O

5.1 I/O Signal Allocation

For the information about how to allocate the I/O signals, refer to "INSTRUCTIONS FOR PROFINET COMMUNICATIONS FUNCTION (FOR CP1616 MADE BY Siemens) (165837-1CD)".

5.2 Safety Signal Allocation

The data for safety signals are not allocated to the external I/O signal, but to the control input. The allocations for the control input are as follows.

<table>
<thead>
<tr>
<th>80447</th>
<th>80446</th>
<th>80445</th>
<th>80444</th>
<th>80443</th>
<th>80442</th>
<th>80441</th>
<th>80440</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIsafe Status Byte</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cons_nr_R</td>
<td>Toggle_d</td>
<td>FV_activated</td>
<td>WD_timeout</td>
<td>CE_CRC</td>
<td>Device_Fault</td>
<td>iPar_OK</td>
<td></td>
</tr>
</tbody>
</table>

- iPar_OK: Completion for allocating the iParameter value from the F-Host
- Device_Fault: F-Device failure notice
- CE_CRC: CRC error for safety signals
- WD_timeout: Timeout of the communication response time
- FV_activated: Completion for switching to the fail safe value
- Toggle_d: Trigger for incrementing the sequence number for the safety signals sent from the F-Host
- cons_nr_R: Completion for resetting the sequence number for the safety signals sent from the F-Device

<table>
<thead>
<tr>
<th>80457</th>
<th>80456</th>
<th>80455</th>
<th>80454</th>
<th>80453</th>
<th>80452</th>
<th>80451</th>
<th>80450</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIsafe Control Byte</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toggle_h</td>
<td>activate_FV</td>
<td>R_cons_nr</td>
<td>OA_Req</td>
<td>iPar_EN</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- iPar_EN: Request for allocating the iParameter value to the F-Device
- OA_Req: Request for switching from the fail safe value to the process value
- R_cons_nr: Request for resetting the sequence number for the safety signals sent from the F-Device
- activate_FV: Request for switching to the fail safe value due to communication error, etc.
- Toggle_h: Trigger for incrementing the sequence number for the safety signals sent from the F-Device
Followings are Status Byte and Control Byte signals under each communication situation of PROFIsafe.

While in safety communication status:
“Toggle_d” of Status Byte and “Toggle_h” of Control Byte alternate 0 → 1 → 0 → 1 → • • • consecutively.

When communication error occured:
The value of Status Byte’s “WD_timeout” and “FV_activated” becomes 1.
In case the operation for restoration from communication errors is necessary
(Refer to section 7.2 “Returning to the Original Status from the Alarm Occurred Status”):
The value of Control Byte’s “OA_Req” and “activate_FV” becomes 1.
### 5.2 Safety Signal Allocation

<table>
<thead>
<tr>
<th></th>
<th>Virtual communication execution status</th>
<th>Specifying virtual communication mode</th>
<th>PROFIsafe communication status</th>
<th>PROFINET communication status</th>
<th>PROFINET communication establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>80517</td>
<td>80516</td>
<td>80515</td>
<td>80514</td>
<td>80513</td>
<td>80512</td>
</tr>
</tbody>
</table>

- **PROFINET communication establishment status**: Communication establishment status between the IO controller (safety PLC) and the IO device (CP1616) (0: establishment failure 1: establishment completion)
- **PROFINET communication status**: Communication status after establishing the communication between the IO controller (safety PLC) and the IO device (CP1616) (0: not during communication 1: during communication)
- **PROFIsafe communication establishment status**: Safety communication establishment status between the F-Host (safety PLC) and the F-Device (machine safety unit) (0: establishment failure 1: establishment completion)
- **PROFIsafe communication status**: Safety communication status after establishing the communication between the F-Host (safety PLC) and the F-Device (machine safety unit) (0: not during communication 1: during communication)
- **Specifying virtual communication mode**: Specifying the virtual communication mode which is set in the maintenance mode (0: not used 1: used)
- **Virtual communication execution status**: Actual communication mode (0: during virtual communication 1: during safety communication)

**Safety input signal (Byte 0)**

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>80527</td>
<td>80526</td>
<td>80525</td>
<td>80524</td>
<td>80523</td>
<td>80522</td>
<td>80521</td>
<td>80520</td>
</tr>
</tbody>
</table>

**Safety input signal (Byte 1)**

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>80537</td>
<td>80536</td>
<td>80535</td>
<td>80534</td>
<td>80533</td>
<td>80532</td>
<td>80531</td>
<td>80530</td>
</tr>
</tbody>
</table>

**Safety input signal (Byte 2)**

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>80547</td>
<td>80546</td>
<td>80545</td>
<td>80544</td>
<td>80543</td>
<td>80542</td>
<td>80541</td>
<td>80540</td>
</tr>
</tbody>
</table>

**Safety input signal (Byte 3)**

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>80557</td>
<td>80556</td>
<td>80555</td>
<td>80554</td>
<td>80553</td>
<td>80552</td>
<td>80551</td>
<td>80550</td>
</tr>
</tbody>
</table>

**Safety input signal (Byte 4)**

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>80567</td>
<td>80566</td>
<td>80565</td>
<td>80564</td>
<td>80563</td>
<td>80562</td>
<td>80561</td>
<td>80560</td>
</tr>
</tbody>
</table>

**Safety input signal (Byte 5)**

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>80577</td>
<td>80576</td>
<td>80575</td>
<td>80574</td>
<td>80573</td>
<td>80572</td>
<td>80571</td>
<td>80570</td>
</tr>
</tbody>
</table>

**Safety input signal (Byte 6)**

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>80587</td>
<td>80586</td>
<td>80585</td>
<td>80584</td>
<td>80583</td>
<td>80582</td>
<td>80581</td>
<td>80580</td>
</tr>
</tbody>
</table>
5.2  Safety Signal Allocation

<table>
<thead>
<tr>
<th>Safety Input Signal (Byte 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80597</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Output Signal (Byte 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80607</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Output Signal (Byte 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80617</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Output Signal (Byte 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80627</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Output Signal (Byte 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80637</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Output Signal (Byte 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80647</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Output Signal (Byte 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80657</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Output Signal (Byte 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80667</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Output Signal (Byte 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 7</td>
</tr>
<tr>
<td>80677</td>
</tr>
</tbody>
</table>

The concurrent I/O is not the function for the safety product. For this reason, the signals allocated to the control input cannot be used as the safety-related signals.
6 Management of Setting Data

Setting information of PROFIsafe (CP1616 board) can be saved/loaded using the external memory devices. The procedures are as follows. For the operation of external memory devices, refer to chapter 7 "External Memory Devices" of "DX200 OPERATOR'S MANUAL".

6.1 Procedures for Saving

1. Turn ON the DX200.
2. Select {EX. MEMORY} under the Main Menu.
   - The sub menu is displayed.
3. Select {SAVE}.
   - The SAVE window is displayed.
4. Select "SYSTEM DATA".
   - The SYSTEM DATA selection window is displayed.

5. Select "CP1616 INFO".
   - "★" is displayed before the name of the selected system data.

6. Press [ENTER].
   - The confirmation dialog box is displayed.
6.2 Procedures for Loading

1. Turn ON the DX200.
2. Change the security mode to the management mode.
3. Select {EX. MEMORY} under the Main Menu.
   - The sub menu is displayed.
6. Management of Setting Data

6.2 Procedures for Loading

4. Select {LOAD}.
   – The LOAD window is displayed.

5. Select "SYSTEM DATA".
   – The SYSTEM DATA selection window is displayed.

6. Select "CP1616 INFO".
   – "★" is displayed before the name of the selected data.
6 Management of Setting Data
6.2 Procedures for Loading

7. Press [ENTER].
   - The confirmation dialog box is displayed.

8. Select [YES].
   - File loading is started, and the transmission window is displayed. When loading is completed, the display returns to the file selection window.

   ![Transmission Window]

   ![Confirmation Dialog Box]

   ![File Loading Window]

   • When, at saving, the slot in which the CP1616 board is inserted or the IO size (total size used for the IO controller and the IO device) differ from the current settings, the message "Error 1520 'Cannot be used on this system configuration'" appears, and loading cannot be executed.
   • "PROFIsafe virtual communication" settings (refer to step 6 in section 4.2.1 "IO Device Settings") cannot be changed with file loading.

9. After loading is completed, turn the power supply ON again.
7 Error Indication

7.1 LED Display

For the information about the LED display of the CP1616, refer to "INSTRUCTIONS FOR PROFINET COMMUNICATIONS FUNCTION (FOR CP1616 MADE BY Siemens) (165837-1CD)".

7.2 Returning to the Original Status from the Alarm Occurred Status

If a communication alarm occurs due to the cable disconnection, etc., the safety input signal to the DX200 is forcefully cleared to 0 in order to maintain the safety. This action is called passivation.

In order to return the safety input signal cleared to 0 due to the passivation to the original value, operating the safety program created in STEP 7 is necessary after the communication is established. This operation is called reintegration.

The following is the example of how to create or operate the safety program. For the details, refer to the Siemens manual.

■ Creating Method of Safety Program

1. After the settings described in section 4.1.3 “F-Host (IO Controller) Settings” is completed, check that the following programs exist in the (Blocks) list of SIMATIC Manager.
2. Select {Blocks} - {Insert New Object} - {Organization Block} from the project tree to create OB35 which is the cycle interruption program.

3. At the same time, create F-Call (FC1) to call the safety program from the standard program (OB35), and also create a safety program (FC10).
7. Error Indication

7.2 Returning to the Original Status from the Alarm Occurred Status

4. As shown below, OB35, FC1, and FC10 are created in the Blocks list.

5. Open OB35, create a ladder to call F-Call (FC1). Save it, and then close it.
7. Error Indication
7.2 Returning to the Original Status from the Alarm Occurred Status

6. Open FC10, and then add the following command for reintegration (M0.0 / "F00000_PS_8bytes".ACK_REQ / "F00000_PS_8bytes".ACK_REI). Save it, and then close the window.

7. Select the following icon in the red frame, or select {Options} - {Edit safety program}. 
7.2 Returning to the Original Status from the Alarm Occurred Status

8. Select {F-Runtime groups...}.

9. Select {New…}.

10. Check that FC1 is selected in F-CALL block and FC10 is selected in F-program block, and then select (OK).
11. An F-Runtime group is created. Select (OK).

12. Select (Compile) to compile the safety program.
7. Error Indication

7.2 Returning to the Original Status from the Alarm Occurred Status

13. After compiling is normally completed, close the window, and then check that 2 values of the collective signatures are the same.

14. With the PC and the safety PLC connected, select {Download} to perform downloading to the safety PLC.
7 Error Indication

7.2 Returning to the Original Status from the Alarm Occurred Status

- Operating Method for Safety Program

When the restoration operation from the communication error state (Reintegration) is required, the activate_FV bit and the OA_Req bit of PROFIsafe Control Byte will be 1. (Refer to section 5.2 “Safety Signal Allocation”)

Reintegration is performed by following the procedures described below.

1. Open FC10 from the (Blocks) list of SIMATIC Manager.

2. With the PC and the safety PLC connected, select the following icon in the red frame, or select (Debug) - (Monitor).
7 Error Indication
7.2 Returning to the Original Status from the Alarm Occurred Status

3. When turning ON the contact point "M0.0", "F00000_PS_8_bytes".ACK_REI" is turned ON, and reintegration is performed. (After turned ON, it goes back to OFF soon.) Check that the safety input signal cleared to 0 due to the passivation is returned to the original value.

When "F00000_PS_8_bytes".PASS_ON" is ON, passivation is forcibly performed, and safety input signal remains cleared to 0. Turning OFF "F00000_PS_8_bytes".PASS_ON" can return the original value.
8 Trouble Shooting

If communication is not properly executed or communication is not safely executed even if CP1616 is connected with the safe PLC while in the PROFIsafe virtual communication mode, confirm followings.

■ When Communication is Not Established:

When the communication with the safety PLC is not established, the system will be in the following status:

• LEDs of the safety PLC and the CP1616 are in the error status (red lighting up/blinking).

• The communication status of PROFINET/PROFIsafe is in an error state. (The control input is in the following status.)
  All or either of the signals from 80510 to 80513 and 80515 are turned OFF (0).

• The value of WD_timeout and FV_activated of PROFIsafe Status Byte is 1. (The control input is in the following status.)
  The signals of 80443 and 80444 are turned ON (1).

When system is in one of the above mentioned conditions, check the followings.

• Confirm that the value of F_Dest_Address set to CP1616 and the value of F_Dest_Address set at STEP 7 are the same. (Refer to Step 10 in section 4.1.3 “F-Host (IO Controller) Settings”. (Refer to Step 6 in section 4.2.1 “IO Device Settings”.

• Confirm that settings are executed for the CP1616 to be used as an IO device. For the details, refer to chapter 7. "Trouble Shooting" in "DX200 OPTIONS INSTRUCTIONS FOR PROFINET COMMUNICATIONS FUNCTION (FOR CP1616 MADE BY Siemens) (165837-1CD)".

■ When Safety Signals Cannot be Delivered:

When the signals with the safety PLC cannot be delivered, it will be in the following status:

• Toggle_d of PROFIsafe Status Byte and Toggle_h of PROFIsafe Control Byte are not switched continuously. (The control input is in the following status.)
  The signals of 80445 and 80455 remained to be ON (1) or remained to be OFF (0).

• The value of OA_Req and activate_FV of PROFIsafe Control Byte is 1. (The control input is in the following status.)
  The signals of 80451 and 80454 are turned ON (1).

When system is in one of the above mentioned conditions, check the followings.

• Operate the safety program to perform reintegration. (Refer to section 7.2 “Returning to the Original Status from the Alarm Occurred Status”).
DX200 OPTIONS
INSTRUCTIONS
FOR PROFIsafe FUNCTION
FOR CP1616 MADE BY Siemens

Specifications are subject to change without notice for ongoing product modifications and improvements.