FX1N-4EX-BD Input Expansion Board

USER’S MANUAL

JY992D95001C

This manual contains texts, diagrams and explanations which will guide the reader in the correct installation, safe use and operation of the FX1N-4EX-BD Input Expansion Board and should be read and understood before attempting to install or use the unit. Further information can be found in the associated manuals listed below.

Specifications are subject to change without notice

Guidelines for the Safety of the User and Protection of the FX1N-4EX-BD.

This manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows:

a) Any engineer using the product associated with this manual, should be of a competent nature, trained and qualified to the local and national standards. These engineers should be fully aware of all aspects of safety with regards to automated equipment.
b) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards.
c) All operators of the completed equipment should be trained to use that product in a safe and coordinated manner in compliance to established safety practices.

Note: The term “completed equipment” refers to a third party constructed device which contains or uses the product associated with this manual.

Note’s on the Symbols Used in this Manual

At various times throughout this manual certain symbols will be used to highlight points of information which are intended to ensure the users personal safety and protect the integrity of equipment.

1) Indicates that the identified danger WILL cause physical and property damage.

2) Indicates that the identified danger could POSSIBLY cause physical and property damage.

- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- Owing to the very great variety in possible application of this equipment, you must satisfy yourself as to its suitability for your specific application.

Associated manuals

<table>
<thead>
<tr>
<th>Manual name</th>
<th>Manual No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S Series</td>
<td>JY992D83901</td>
<td>Describes contents related to hardware of FX1S Series PLC such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>FX1N Series</td>
<td>JY992D83901</td>
<td>Describes contents related to hardware of FX1N Series PLC such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>FX Programming</td>
<td>JY992D88101</td>
<td>Describes instructions in FX1S/FX1N/FX2N/FX2NC Series.</td>
</tr>
</tbody>
</table>

1. Introduction

The FX1N-4EX-BD Input Expansion Board (hereafter referred to as “FX1N-4EX-BD” or “Function expansion board”) is a function expansion board to be installed in the FX1S or FX1N series programmable controller (hereafter referred to as “PLC”), to increase the input of four points.

1.1 Features of the FX1N-4EX-BD

1) Additional increase of four input points.
2) Internal mounting in the top of the PLC meaning no need for change to the installation area of the PLC.
3) Additional inputs have special auxiliary relays allocated to each point, which are turned ON and OFF depending on the input state of the FX1N-4EX-BD. As special auxiliary relays are used in the PLC program for the input points, the additional inputs are not included in the regular system I/O count.

1.2 External Dimensions and Each Part Name

Dimensions: mm (inches)

Accessories: Top cover for board 1
M3 screw to mount board 2
M3 screw to fix top cover 1

1) Input terminal.
2) Mounting hole (2-φ3.5(0.14”))
3) Input LED
4) External port for display module FX1N-SDM or memory cassette FX1N-EEPROM-8L
5) External connector for PLC

1.3 System configuration

- Only one function expansion board can be used on one FX1S or FX1N series PLC main unit.
- FX1N-4EX-BD can be used together with an FX1N-SDM.
- Refer to the FX1S or FX1N HARDWARE MANUAL when using the FX1N-4EX-BD together with an FX1N-SDM.
- When using with the memory cassette FX1N-EEPROM-8L, only program transfer is possible. (The memory cassette cannot be connected permanently)

1.4 Applicable PLC

<table>
<thead>
<tr>
<th>Series name</th>
<th>Applicable version</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S</td>
<td>V2.0 or later</td>
</tr>
<tr>
<td>FX1N</td>
<td>V2.0 or later</td>
</tr>
</tbody>
</table>

2. Installation

Caution

1) Do not use the function expansion board in environments that contain excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration. Use in these environment may cause electric shock, fire, malfunction, damage or deterioration of the product.
2) Cut off all phases of power source before installing / removing or performing wiring work on the unit in order to avoid electric shock or damage of product.
3) After the installation and wiring etc. replace the PLCs top cover before power ON.
4) Securely install the function expansion board, and fix to the PLC. Defective contact can cause malfunction.

2.1 Mounting

Turn off all power to the PLC before installing the FX1N-4EX-BD.

a) Top cover for use with FX1N-4EX-BD (supplied as an accessory)
b) M3 screw to fix top cover (supplied as an accessory)
c) M3 screw to fix FX1N-4EX-BD (2 pieces) (supplied as accessories)
d) External port for optional equipment
e) FX1N-4EX-BD (function expansion board)

Note: Do not remove this screw on the PLC(FX1S).

1) Remove the top cover of the main unit and keep.
2) Plug FX1N-4EX-BD a) to the external port d).
3) Fix the function expansion board to the main unit with two M3 screws d). (Tightening torque: 0.3 to 0.6 N-m)
4) Attach the top cover for use with FX1N-4EX-BD a) in place of the original cover. During attachment, remove d) with a suitable tool, so that the input terminals are exposed.
5) Fix the top cover with an M3 screw b). (Tightening torque: 0.3 to 0.6 N-m)
1. Introduction

The FX1N-4EX-BD Input Expansion Board (hereafter referred to as "FX1N-4EX-BD" or "Function expansion board") is a function expansion board to be installed in the FX1S or FX1N series programmable controller (hereafter referred to as "PLC"), to increase the input of four points.

1.1 Features of the FX1N-4EX-BD

1) Additional increase of four input points.
2) Internal mounting in the top of the PLC meaning no need for change to the installation area of the PLC.
3) Additional inputs have special auxiliary relays allocated to each point, which are turned ON and OFF depending on the input state of the FX1N-4EX-BD.

As special auxiliary relays are used in the PLC program for the input points, the additional inputs are not included in the regular system I/O count.

1.2 External Dimensions and Each Part Name

Dimensions: mm (inches)
- Accessories: Top cover for board 1
- M3 screw to mount board 2
- M3 screw to fix top cover 1

1) Input terminal.
- S/S: Power supply terminal
- BX0: Terminal of input BX0
- BX1: Terminal of input BX1
- BX2: Terminal of input BX2
- BX3: Terminal of input BX3

The top face of this connector is higher than the top face of the PLC panel cover by approximately 7 mm.

2) Mounting hole (2-φ7)

3) Input LED
- BX0 LED: The LED lights when BX0 is turn on.
- BX1 LED: The LED lights when BX1 is turn on.
- BX2 LED: The LED lights when BX2 is turn on.
- BX3 LED: The LED lights when BX3 is turn on.

4) External port for display module FX1N-SDM or memory cassette FX1N-EEPROM-6L

5) External connector for PLC

1.3 System configuration

- Only one function expansion board can be used on one FX1S or FX1N series PLC main unit. Do not try to install two or more expansion boards.
- FX1N-4EX-BD can be used together with an FX1N-SDM.
- Refer to the FX1S or FX1N HARDWARE MANUAL when using the FX1N-4EX-BD together with an FX1N-SDM.
- When using with the memory cassette FX1N-EEPROM-6L, only program transfer is possible. (The memory cassette cannot be connected permanently)

1.4 Applicable PLC

<table>
<thead>
<tr>
<th>Series name</th>
<th>Applicable version</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S</td>
<td>V2.0 or later</td>
</tr>
<tr>
<td>FX1N</td>
<td>V2.0 or later</td>
</tr>
</tbody>
</table>

Associated manuals

<table>
<thead>
<tr>
<th>Manual name</th>
<th>Manual No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S Series Hardware Manual</td>
<td>JY992D83901</td>
<td>Describes contents related to hardware of FX1S Series PLC such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>FX1N Series Hardware Manual</td>
<td>JY992D83901</td>
<td>Describes contents related to hardware of FX1N Series PLC such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>FX Programming Manual II</td>
<td>JY992D88101</td>
<td>Describes instructions in FX1S/FX1N/FX2Y/FX2NC Series.</td>
</tr>
</tbody>
</table>
1. Introduction

The FX1N-4EX-BD Input Expansion Board (hereafter referred to as "FX1N-4EX-BD" or "Function expansion board") is a function expansion board to be installed in the FX1S or FX1N series programmable controller (hereafter referred to as "PLC"), to increase the input of four points.

1.1 Features of the FX1N-4EX-BD

1) Additional increase of four input points.
2) Internal mounting in the top of the PLC meaning no need for change to the installation area of the PLC.
3) Additional inputs have special auxiliary relays allocated to each point, which are turned ON and OFF depending on the input state of the FX1N-4EX-BD. As special auxiliary relays are used in the PLC program for the input points, the additional inputs are not included in the regular system I/O count.

1.2 External Dimensions and Each Part Name

Dimensions: mm (inches)

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Top cover for board</th>
<th>M3 screw to mount board</th>
<th>M3 screw to fit top cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input terminal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S/S               : Power supply terminal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX0 : Terminal of input BX0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX1 : Terminal of input BX1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX2 : Terminal of input BX2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX3 : Terminal of input BX3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The top face of this connector is higher than the top face of the PLC panel cover by approximately 7 mm.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting hole (2 ± 0.5 mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX0 LED : The LED lights when BX0 is turn on.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX1 LED : The LED lights when BX1 is turn on.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX2 LED : The LED lights when BX2 is turn on.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX3 LED : The LED lights when BX3 is turn on.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External port for display module FX1N-5DM or memory cassette FX1N-EEPROM-8L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External connector for PLC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Installation

Caution

1) Do not use the function expansion board in environments that contain excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration. Use in these environment may cause electric shock, fire, malfunction, damage or deterioration of the product.
2) Cut off all phases of power source before installing / removing or performing wiring work on the unit in order to avoid electric shock or damage of product.
3) After the installation and wiring etc. replace the PLCs top cover before power ON.
4) Securely install the function expansion board, and fix to the PLC. Defective contact can cause malfunction.

2.1 Mounting

Turn off all power to the PLC before installing the FX1N-4EX-BD.

a) Top cover for use with FX1N-4EX-BD (supplied as an accessory)
b) M3 screw to fix top cover (supplied as an accessory)
c) M3 screw to fix FX1N-4EX-BD (2 pieces) (supplied as accessories)
d) External port for optional equipment
e) FX1N-4EX-BD (function expansion board)

Note: Do not remove this screw on the PLC(FX1S).

1) Remove the top cover of the main unit and keep.
2) Plug FX1N-4EX-BD e) in to the external port d).
3) Fix the function expansion board to the main unit with two M3 screws d). (Tightening torque: 0.3 to 0.6 N-m)
4) Attach the top cover for use with FX1N-4EX-BD a) in place of the original cover. During attachment, remove a) with a suitable tool, so that the input terminals are exposed.
5) Fix the top cover with an M3 screw b). (Tightening torque: 0.3 to 0.6 N-m)

1.3 System configuration

- Only one function expansion board can be used on one FX1S or FX1N series PLC main unit.
- FX1N-4EX-BD can be used together with an FX1N-5DM. Refer to the FX1S or FX1N HARDWARE MANUAL when using the FX1N-4EX-BD together with an FX1N-5DM.
- When using with the memory cassette FX1N-EEPROM-8L, only program transfer is possible. (The memory cassette cannot be connected permanently).

1.4 Applicable PLC

<table>
<thead>
<tr>
<th>Series name</th>
<th>Applicable version</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S</td>
<td>V3.0 or later</td>
</tr>
<tr>
<td>FX1N</td>
<td>V2.0 or later</td>
</tr>
</tbody>
</table>

Associated manuals

<table>
<thead>
<tr>
<th>Manual name</th>
<th>Manual No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S Series</td>
<td>JY992D8101</td>
<td>Describes instructions in FX1S/FX2S/FX3S/FX3U Series.</td>
</tr>
<tr>
<td>Hardware Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FX1N Series</td>
<td>JY992D8801</td>
<td>Describes contents related to hardware of FX1N Series PLC such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>Hardware Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FX Programming</td>
<td>JY992D8301</td>
<td>Describes contents related to hardware of FX1S Series PLC such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>Manual II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FX Programming</td>
<td>JY992D8301</td>
<td>Describes contents related to hardware of FX1S Series PLC such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>Manual II</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Input Wiring

3.1 Applicable cables
- Use AWG26-16 for connection with input equipment.
- Tighten the terminals to a torque of 0.5 to 0.6 Nm. Do not tighten terminal screws exceeding the specified torque.
- When using a different type of cable, defective contact of the terminal part is possible. Use a crimp terminal to achieve a good contact.

<table>
<thead>
<tr>
<th>Linear</th>
<th>Sectional area (mm²)</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG26</td>
<td>0.128</td>
<td>S/S</td>
</tr>
<tr>
<td>AWG18</td>
<td>1.309</td>
<td>S/S</td>
</tr>
</tbody>
</table>

3.2 Wiring of input

3.3 Diodes and inputs connected in series;
Voltage drop across the diode less than 4V
No more than 2 LEDs should be connected in series.

3.4 Resistors and inputs connected in parallel;
Parallel resistance Rp: FX1N-4EX-BD = 15kΩ
If resistance Rp is less than the stated value, then add Rb.
See equation 1 for Rb calculation.
Alternatively, Current leakage: FX1N-4EX-BD = 1.5mA
If the current leakage(I) is greater than the stated value, then add Rb. See equation 2 for Rb calculation.

\[
\text{Eqn 1: } R_b \leq \frac{4R_p}{16 - R_p} (\text{kΩ})
\]
\[
\text{Eqn 2: } R_b \leq \frac{6}{I - 1.5} (\text{kΩ})
\]

4. Device allocation and program example

4.1 Device allocation
Each input of FX1N-4EX-BD is allocated a special auxiliary relay.
The ON/OFF state of each input is reflected in its corresponding special auxiliary relay.
- BX0 input of FX1N-4EX-BD : M8112
- BX1 input of FX1N-4EX-BD : M8113
- BX2 input of FX1N-4EX-BD : M8114
- BX3 input of FX1N-4EX-BD : M8115

4.2 Program example

![Program example diagram]

- Use a contact instruction for each special auxiliary relay.
- When the END instruction of the program is executed, the input process is completed.
- When input information on FX1N-4EX-BD is used for the operand of each applied instruction as data, only four bit data (K1M8112) can be used.

5. Specifications

5.1 Environmental specifications
The environmental specifications are equivalent to those of the PLC main unit. (Refer to the manual of the PLC main unit.)

5.2 Power supply specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>6V DC</td>
<td>Supply by PLC.</td>
</tr>
<tr>
<td>24V DC</td>
<td>25mA or less. Supply from external power supply.</td>
</tr>
</tbody>
</table>

5.3 INPUT specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal voltage</td>
<td>24V DC ±20% -15%</td>
</tr>
<tr>
<td>Input signal current</td>
<td>About 6mA/24V DC</td>
</tr>
<tr>
<td>Input ON current</td>
<td>3.5mA or more</td>
</tr>
<tr>
<td>Input OFF current</td>
<td>1.5mA or less</td>
</tr>
<tr>
<td>Input response time</td>
<td>About 10ms</td>
</tr>
<tr>
<td>Input signal form</td>
<td>Without voltage contact or opening collector Transistor</td>
</tr>
<tr>
<td>Circuit insulation</td>
<td>Photo coupler</td>
</tr>
<tr>
<td>Operation display</td>
<td>LED lighting when photo coupler is driven</td>
</tr>
</tbody>
</table>

Attention
- This product is designed for use in industrial applications.

Note
- Authorized Representative in the European Community: Mitsubishi Electric Europe B.V.
- Gothaer Str. 8, 40880 Ratingen, Germany
3. Input Wiring

Wiring cautions
Observe the following cautions to avoid electrical shock, short-circuit, disconnection or damage to the unit.

- Do not lay signal cable near to high voltage power cable or house them in the same trunking duct. Effects of noise or surge induction may occur. Keep signal cables a safe distance of more than 100 mm (4") from these power cables.
- Where input signal lines are used over an extended distance consideration for voltage drop and noise interference should be made.
- Twist the end of each stranded cable so that barbed wires are not present.
- Never solder the end of any cables.
- Never connect cables of a non-permitted size.
- Fix cables so that any stress is not directly applied on the terminal block or the cable connection area.
- Tighten the terminals to a torque of 0.5 to 0.6 N·m. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.

3.1 Applicable cables
- Use AWG22-16 for connection with input equipment.
- Tighten the terminals to a torque of 0.5 to 0.6 N·m. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.
- When using a different type of cable, defective contact of the terminal part is possible. Use a crimp terminal to achieve a good contact.

<table>
<thead>
<tr>
<th>Linear</th>
<th>Sectional area (mm²)</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG20</td>
<td>0.128</td>
<td></td>
</tr>
<tr>
<td>IW</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AWG18</td>
<td>1.309</td>
<td></td>
</tr>
</tbody>
</table>

Terminal processing of wire

6mm (0.2 inches)

3.2 Wiring of input
Sink

3.3 Diodes and inputs connected in series;
Vdrop across the diode less than 4V
No more than 2 LEDs should be connected in series.

3.4 Resistors and inputs connected in parallel;
Parallel resistance Rp: FX1N-4EX-BD = 15kΩ.
If resistance Rp is less than the stated value, then add Rb.
See equation 1 for Rb calculation.
Alternatively, Current leakage: FX1N-4EX-BD = 1.5mA. If the current leakage(I) is greater than the stated value, then add Rb. See equation 2 for Rb calculation.

\[ Rb = \frac{V_{leakage}}{I} \]

4. Device allocation and program example

4.1 Device allocation
Each input of FX1N-4EX-BD is allocated a special auxiliary relay. The ON/OFF state of each input is reflected in its corresponding special auxiliary relay.
- BX0 input of FX1N-4EX-BD : M8112
- BX1 input of FX1N-4EX-BD : M8113
- BX2 input of FX1N-4EX-BD : M8114
- BX3 input of FX1N-4EX-BD : M8115

4.2 Program example
- Use a contact instruction for each special auxiliary relay.
- When the END instruction of the program is executed, the input process is completed.
- REF (I/O refreshing) instruction cannot be used.
- When input information on FX1N-4EX-BD is used for the operand of each applied instruction as data, only four bit data (K1M8113) can be used.

5. Specifications

Caution
- Do not touch the terminals while power is ON. Electric shock is possible.
- Clearing and additional tightening of the terminal should only be done after turning OFF the power supply. Electric shock is possible while the power is ON.
- For repair please contact a service representative. Incorrect repair can cause malfunction or electric shock.
- Install and uninstall FX1N-4EX-BD after turning OFF the power supply. Installing and uninstalling while the power supply is ON may cause malfunction.
- Treat as industrial waste when disposing of the product.

5.1 Environmental specifications
The environmental specifications are equivalent to those of the PLC main unit. (Refer to the manual of the PLC main unit.)

5.2 Power supply specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consump. current</td>
<td>6V DC: Supply by PLC.</td>
</tr>
<tr>
<td>24V DC: 25mA or less. Supply from external power supply.</td>
<td></td>
</tr>
</tbody>
</table>

5.3 INPUT specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal voltage</td>
<td>24V DC ±20% -15%</td>
</tr>
<tr>
<td>Input signal current</td>
<td>About 6mA/24V DC</td>
</tr>
<tr>
<td>Input ON current</td>
<td>3.5mA or more</td>
</tr>
<tr>
<td>Input OFF current</td>
<td>1.5mA or less</td>
</tr>
<tr>
<td>Input response time</td>
<td>About 10mS</td>
</tr>
<tr>
<td>Input signal form</td>
<td>Without voltage contact or opening collector Transistor</td>
</tr>
<tr>
<td>Circuit insulation</td>
<td>Photo coupler</td>
</tr>
<tr>
<td>Operation display</td>
<td>LED lighting when photo coupler is driven</td>
</tr>
</tbody>
</table>

Attention
- This product is designed for use in industrial applications.
Note
- Authorized Representative in the European Community: Mitsubishi Electric Europe B.V.
  Gothaer Str. 8, 40880 Ratingen, Germany
3. Input Wiring

Wiring cautions
Observe the following cautions to avoid electrical shock, short-circuit, disconnection or damage to the unit.

- Do not lay signal cable near to high voltage power cable or house them in the same trunking duct. Effects of noise or surge induction may occur. Keep signal cables a safe distance of more than 100 mm (4") from these power cables.
- Where input signal lines are used over an extended distance consider for voltage drop and noise interference should be made.
- Keep the ends of each stranded cable so that bare wires are not present.
- Never solder the end of any cables.
- Never connect cables of a non permitted size. Make sure that the number of connected cables is not more than the unit has been designed for.
- Fix cables so that any stress is not directly applied on the terminal block or the cable connection area.
- Tighten the terminals to a torque of 0.5 to 0.6 N·m. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.

3.1 Applicable cables
- Use AWG26-16 for connection with input equipment.
- Tighten the terminals to a torque of 0.5 to 0.6 N·m. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.
- When using a different type of cable, defective contact of the terminal part is possible. Use a crimp terminal to achieve a good contact.

3.2 Wiring of input
Sink

<table>
<thead>
<tr>
<th>Linear</th>
<th>Sectional area (mm²)</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG26</td>
<td>0.128</td>
<td>I</td>
</tr>
<tr>
<td>AWG18</td>
<td>1.309</td>
<td>I</td>
</tr>
</tbody>
</table>

Terminal processing of wire

- Single cable: Remove sheath, then connect cable.
- Stranded cable: Remove sheath, twist core wires, then connect cable.

3.3 Diodes and inputs connected in series;
Vdrop across the diode less than 4V
No more than 2 LEDs should be connected in series.

3.4 Resistors and inputs connected in parallel;
Parallel resistance \( R_p \) of FX1N-4EX-BD = 15kΩ. If \( R_p \) is less than the stated value, then add \( R_b \). See equation 1 for \( R_b \) calculation.
Alternatively, Current leakage: FX1N-4EX-BD = 1.5mA. If the current leakage(\( I \)) is greater than the stated value, then add \( R_b \). See equation 2 for \( R_b \) calculation.

\[
\text{Eqn 1: } R_b \leq \frac{4R_p}{16 - R_p} (\Omega)
\]

\[
\text{Eqn 2: } R_b = \frac{6}{I_x + 1.5} (\Omega)
\]

4. Device allocation and program example

4.1 Device allocation
Each input of FX1N-4EX-BD is allocated a special auxiliary relay. The ON/OFF state of each input is reflected in its corresponding special auxiliary relay.

- BX0 input of FX1N-4EX-BD = M8112
- BX1 input of FX1N-4EX-BD = M8113
- BX2 input of FX1N-4EX-BD = M8114
- BX3 input of FX1N-4EX-BD = M8115

4.2 Program example

- Use a contact instruction for each special auxiliary relay.
- When the END instruction of the program is executed, the input process is completed.
- When input information on FX1N-4EX-BD is used for the operand of each applied instruction as data, only four bit data (K1M8112) can be used.

4.3 Resistors and inputs connected in parallel;
Parallel resistance \( R_p \) of FX1N-4EX-BD = 15kΩ. If \( R_p \) is less than the stated value, then add \( R_b \). See equation 1 for \( R_b \) calculation.
Alternatively, Current leakage: FX1N-4EX-BD = 1.5mA. If the current leakage(\( I \)) is greater than the stated value, then add \( R_b \). See equation 2 for \( R_b \) calculation.

\[
\text{Eqn 1: } R_b \leq \frac{4R_p}{16 - R_p} (\Omega)
\]

\[
\text{Eqn 2: } R_b = \frac{6}{I_x + 1.5} (\Omega)
\]

5. Specifications

Caution
- Do not touch the terminals while power is ON. Electric shock is possible.
- Clearing and additional tightening of the terminal should only be done after turning OFF the power supply. Electric shock is possible while the power is ON.
- For repair please contact a service representative. Incorrect repair can cause malfunction or electric shock.
- Install and uninstall FX1N-4EX-BD after turning OFF the power supply. Installing and uninstalling while the power supply is ON may cause malfunction.
- Treat as industrial waste when disposing of the product.
- Where input signal lines are used over an extended distance consideration for voltage drop and noise interference should be made.
- T weak the end of each stranded cable so that barbed wires are not present.
- Never connect cables of a non permitted size. Make sure that the number of connected cables is not more than the unit has been designed for.
- Never connect cables of a non permitted size. Make sure that the number of connected cables is not more than the unit has been designed for.

5.1 Environmental specifications
The environmental specifications are equivalent to those of the PLC main unit. (Refer to the manual of the PLC main unit.)

5.2 Power supply specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption current</td>
<td>6V DC</td>
</tr>
<tr>
<td>24V DC</td>
<td>25mA or less, Supply from external power supply</td>
</tr>
</tbody>
</table>

5.3 INPUT specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal voltage</td>
<td>24V DC ±20% -15%</td>
</tr>
<tr>
<td>Input signal current</td>
<td>About 6mA/24V DC</td>
</tr>
<tr>
<td>Input ON current</td>
<td>3.5mA or more</td>
</tr>
<tr>
<td>Input OFF current</td>
<td>1.5mA or less</td>
</tr>
<tr>
<td>Input response time</td>
<td>About 10mS</td>
</tr>
<tr>
<td>Input signal form</td>
<td>Without voltage contact or opening collector Transistor</td>
</tr>
<tr>
<td>Circuit insulation</td>
<td>Photo coupler</td>
</tr>
<tr>
<td>Operation display</td>
<td>LED lighting when photo coupler is driven</td>
</tr>
</tbody>
</table>

Attention
- This product is designed for use in industrial applications.

Note
- Authorized Representative in the European Community: Mitsubishi Electric Europe B.V.
  Gothaer Str. 8, 40880 Ratingen, Germany

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

Manual number: JY9929D95001
Manual revision: C
Date: April 2015
1. Introduction

The FXN-4EX-BD Input Expansion Board (hereafter referred to as “FXN-4EX-BD” or “Function expansion board”) is a function expansion board to be installed in the FX1S or FX1N series programmable controller (hereafter referred to as “PLC”), to increase the input of four points.

1.1 Features of the FXN-4EX-BD

1) Additional increase of four input points.
2) Internal mounting in the top of the PLC meaning no need for change to the installation area of the PLC.
3) Additional inputs have special auxiliary relays allocated to each point, which are turned ON and OFF depending on the input state of the FXN-4EX-BD. As special auxiliary relays are used in the PLC program for the input points, the additional inputs are not included in the regular system I/O count.

1.2 External Dimensions and Each Part Name

Dimensions: mm (inches)

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Top cover for board 1</th>
<th>M3 screw to mount board 2</th>
<th>M3 screw to fix top cover 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BX0</td>
<td>BX1</td>
<td>BX2</td>
<td>BX3</td>
</tr>
<tr>
<td>BX0 LED</td>
<td>BX1 LED</td>
<td>BX2 LED</td>
<td>BX3 LED</td>
</tr>
<tr>
<td>BX0 LED: The LED lights when BX0 is turned on.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX1 LED: The LED lights when BX1 is turned on.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX2 LED: The LED lights when BX2 is turned on.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX3 LED: The LED lights when BX3 is turned on.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Installation

Caution

1) Do not use the function expansion board in environments that contain excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration. Use in these environments may cause electric shock, fire, malfunction, damage or deterioration of the product.
2) Cut off all phases of power source before installing / removing or performing wiring work on the unit in order to avoid electric shock or damage of product.
3) After the installation and wiring etc. replace the PLCs top cover before power ON.
4) Securely install the function expansion board, and fix to the PLC. Defective contact can cause malfunction.

2.1 Mounting

Turn off all power to the PLC before installing the FXN-4EX-BD.

a) Top cover for use with FXN-4EX-BD (supplied as an accessory)

b) M3 screw to fix top cover (supplied as an accessory)

c) M3 screw to fix FXN-5DM-B (2 pieces) (supplied as accessories)

d) External port for optional equipment

e) FXN-4EX-BD (function expansion board)

Note: Do not remove this screw on the PLC (FX1S).

1) Remove the top cover of the main unit and keep.
2) Plug FXN-4EX-BD a) in to the external port d).
3) Fix the function expansion board to the main unit with two M3 screws c) to the top face of the PLC panel cover by approximately 7 mm.
4) During attachment, remove a) with a suitable tool, so that the input terminals are exposed.
5) Fix the top cover with an M3 screw b). (Tightening torque: 0.3 to 0.6 Nm)

1.3 System configuration

• Only one function expansion board can be used on one FX1S or FX1N series PLC main unit.

1.4 Applicable PLC

<table>
<thead>
<tr>
<th>Series name</th>
<th>Applicable version</th>
</tr>
</thead>
<tbody>
<tr>
<td>FXN</td>
<td>V2.0 or later</td>
</tr>
<tr>
<td>FXN</td>
<td>V2.0 or later</td>
</tr>
</tbody>
</table>

2. Associated manuals

<table>
<thead>
<tr>
<th>Manual name</th>
<th>Manual No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S Series Hardware Manual</td>
<td>JY992D83901</td>
<td>Describes contents related to hardware of FX1S Series PLC such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>FXN Series Hardware Manual</td>
<td>JY992D88301</td>
<td>Describes contents related to hardware of FXN Series PLC such as specifications, wiring and installation.</td>
</tr>
</tbody>
</table>
### 3. Input Wiring

**Wiring cautions**

- Do not lay signal cable near to high voltage power cable or house them in the same trunking duct. Effects of noise or surge induction may occur. Keep signal cables a safe distance of more than 100 mm (4") from these power cables.
- Where input signal lines are used over an extended distance consideration for voltage drop and noise interference should be made. Keep the input cables as short as possible.
- Twist the end of each stranded cable so that barbed wires are not present.
- Never solder the end of any cables.
- Never connect cables of a non permitted size. Make sure that the number of connected cables is not more than the unit has been designed for.
- Fix cables so that any stress is not directly applied on the terminal block or the cable connection area.
- Tighten the terminals to a torque of 0.5 to 0.6 N·m. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.

**3.1 Applicable cables**

- Use AWG26-18 for connection with input equipment.
- Tighten the terminals to a torque of 0.5 to 0.6 N·m. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.
- When using a different type of cable, defective contact of the terminal part is possible. Use a crimp terminal to achieve a good contact.

**3.2 Wiring of input**

#### Sink

<table>
<thead>
<tr>
<th>Linear</th>
<th>Sectional area (mm²)</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG26</td>
<td>0.128</td>
<td>Stranded cable: Remove sheath, twist core wires, then connect cable. Single cable: Remove sheath, then connect cable.</td>
</tr>
<tr>
<td>AWG18</td>
<td>0.309</td>
<td></td>
</tr>
</tbody>
</table>

#### Source

- BX0: Input of FX1N-4EX-BD: M8112
- BX1: Input of FX1N-4EX-BD: M8113
- BX2: Input of FX1N-4EX-BD: M8114
- BX3: Input of FX1N-4EX-BD: M8115

**3.3 Diodes and inputs connected in series;**

- Vdrop across the diode less than 4V
- No more than 2 LEDs should be connected in series.

**3.4 Resistors and inputs connected in parallel;**

- Parallel resistance Rp: FX1N-4EX-BD = 15kΩ. If resistance Rp is less than the stated value, then add Rb. See equation 1 for Rb calculation. Alternatively, Current leakage: FX1N-4EX-BD = 1.5mA. If the current leakage(I) is greater than the stated value, then add Rb. See equation 2 for Rb calculation.

- Eqn 1: \[ Rb \leq \frac{4R_p}{16 - R_p} \]  \( k\Omega \)
- Eqn 2: \[ Rb \leq \frac{6}{I - 1.5} \]  \( k\Omega \)

**4. Device allocation and program example**

#### 4.1 Device allocation

Each input of FX1N-4EX-BD is allocated a special auxiliary relay. The ON/OFF state of each input is reflected in its corresponding special auxiliary relay.

- BX0 input of FX1N-4EX-BD : M8112
- BX1 input of FX1N-4EX-BD : M8113
- BX2 input of FX1N-4EX-BD : M8114
- BX3 input of FX1N-4EX-BD : M8115

**4.2 Program example**

- Use a contact instruction for each special auxiliary relay.

- When the END instruction of the program is executed, the input process is completed. REF (I/O refreshing) instruction cannot be used.

- When input information on FX1N-4EX-BD is used for the operand of each applied instruction as data, only four bit data (K1M8112) can be used.

**5. Specifications**

### Caution

- Do not touch the terminals while power is ON. Electric shock is possible.
- Cleaning and additional tightening of the terminal should only be done after turning OFF the power supply. Electric shock is possible while the power supply is ON.
- For repair please contact a service representative. Incorrect repair can cause malfunction or electric shock.
- Install and uninstall FX1N-4EX-BD after turning OFF the power supply. Installing and uninstalling while the power supply is ON may cause malfunction.
- Treat as industrial waste when disposing of the product.

#### 5.1 Environmental specifications

The environmental specifications are equivalent to those of the PLC main unit. (Refer to the manual of the PLC main unit.)

#### 5.2 Power supply specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>5V DC</td>
<td>Supply by PLC.</td>
</tr>
<tr>
<td>24V DC</td>
<td>25mA or less. Supply from external power supply.</td>
</tr>
</tbody>
</table>

#### 5.3 INPUT specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal voltage</td>
<td>24V DC ±20% ±15%</td>
</tr>
<tr>
<td>Input signal current</td>
<td>About 6mA/24V DC</td>
</tr>
<tr>
<td>Input ON current</td>
<td>About 5mA/24V DC</td>
</tr>
<tr>
<td>Input OFF current</td>
<td>About 1.5mA or less</td>
</tr>
<tr>
<td>Input response time</td>
<td>About 10mS</td>
</tr>
<tr>
<td>Input signal form</td>
<td>Without voltage contact or opening collector Transistor</td>
</tr>
<tr>
<td>Circuit insulation</td>
<td>Photo coupler</td>
</tr>
<tr>
<td>Operation display</td>
<td>LED lighting when photo coupler is driven</td>
</tr>
</tbody>
</table>

**Attention**

- This product is designed for use in industrial applications.

**Note**

- Authorized Representative in the European Community: Mitsubishi Electric Europe B.V.
  Gothaer Str. 8, 40880 Ratingen, Germany

---

**Manual number**: JY992D95001  
**Manual revision**: C  
**Date**: April 2015