



Side A JAPANESE
Side B ENGLISH

PROGRAMMABLE CONTROLLERS
MELSEC-F

FX3G-4EX-BD

USER'S MANUAL



Manual Number	JY997D51301
Revision	B
Date	April 2015

This manual describes the part names, dimensions, mounting, and specifications of the product. Before use, read this manual and manuals of relevant products fully to acquire proficiency in handling and operating the product. Make sure to learn all the product information, safety information, and precautions.

And, store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

Registration:

The company name and the product name to be described in this manual are the registered trademarks or trademarks of each company.

Effective April 2015

Specifications are subject to change without notice.

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Safety Precaution (Read these precautions before use.)

This manual classify the safety precautions into two categories:

WARNING and **CAUTION**

WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on the circumstances, procedures indicated by **CAUTION** may also cause severe injury.

It is important to follow all precautions for personal safety.

Associated Manuals

Manual name	Manual No.	Description
FX3S Series User's Manual - Hardware Edition	JY997D48601 MODEL CODE: 09R535	Explains FX3S Series PLC specification details for I/O, wiring, installation, and maintenance.
FX3G Series User's Manual - Hardware Edition	JY997D31301 MODEL CODE: 09R521	Explains FX3G Series PLC specification details for I/O, wiring, installation, and maintenance.
FX3S/FX3G/FX3GC/FX3U/FX3UC Series Programming Manual - Basic & Applied Instruction Edition	JY997D16601 MODEL CODE: 09R517	Describes PLC programming for basic/applied instructions and devices.

How to obtain manuals

For the necessary product manuals or documents, consult with the Mitsubishi Electric dealer from where you purchase your product.

Applicable standards

FX3G-4EX-BD units made in September, 2013 or later comply with the EC Directive (EMC Directive). Further information can be found in the following manual.

→ FX3s Series User's Manual - Hardware Edition
→ FX3g Series User's Manual - Hardware Edition

Regarding the standards that relate to the main unit, please refer to either the FX series product catalog or consult with your nearest Mitsubishi product provider.

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

1. Outline

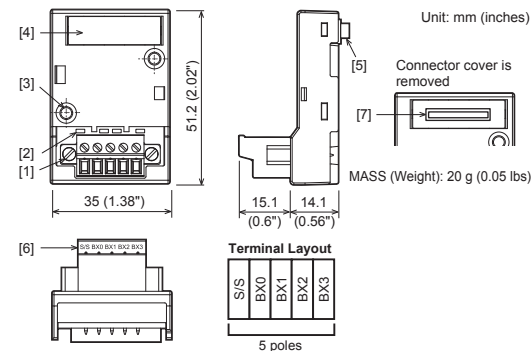
The FX3G-4EX-BD input expansion board (hereinafter referred to as "4EX-BD") is an expansion board to be installed in the FX3S or FX3G series programmable controller (hereinafter referred to as "PLC"), to add four additional inputs.

1.1 Incorporated Items

Verify that the following product and items are included in the package:

Product	FX3G-4EX-BD input expansion board
Accessories	<ul style="list-style-type: none"> M3×8 tapping screws for installation: 2 pcs. Side cover USER'S MANUAL (This manual)

1.2 External Dimensions and Part Names

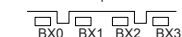


[1] Terminal block mounting screws

[2] Input LED

BX0 LED: The LED is lit when BX0 is on.
BX1 LED: The LED is lit when BX1 is on.
BX2 LED: The LED is lit when BX2 is on.
BX3 LED: The LED is lit when BX3 is on.

LEDs correspond to each input terminal



[3] Mounting holes (2-φ3.2)

[4] Connector cover

[5] Main unit connector

[6] Terminal block for input (European)

[7] Memory cassette/Display module connector

2. Installation

INSTALLATION PRECAUTIONS **WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.

INSTALLATION PRECAUTIONS **CAUTION**

- Use the product within the generic environment specifications described in PLC main unit manual (Hardware Edition). Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl₂, H₂S, SO₂, or NO_x), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or rain and wind. If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur.
- Make sure to affix the expansion board with tapping screws. Tightening torque should follow the specifications in the manual. Loose connections may cause malfunctions.
- Use screwdrivers carefully when performing installation work, thus avoiding accident or product damage.
- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits. Failure to do so may cause fire, equipment failures or malfunctions.
- Do not touch the conductive parts of the product directly. Doing so may cause device failures or malfunctions.
- Connect expansion board securely to their designated connectors. Loose connections may cause malfunctions.

For installation/uninstallation details, refer to the following manual.
→ FX3s Series User's Manual - Hardware Edition
→ FX3g Series User's Manual - Hardware Edition

3. Wiring

DESIGN PRECAUTIONS **WARNING**

- Make sure to have the following safety circuits outside of the PLC to ensure safe system operation even during external power supply problems or PLC failure. Otherwise, malfunctions may cause serious accidents.
 - Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
 - Note that when the PLC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
 - If an overload of the 24 V DC service power supply occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.

DESIGN PRECAUTIONS **CAUTION**

- Do not bundle the control line together with or lay it close to the main circuit or power line. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or power line. Noise may cause malfunctions.

WIRING PRECAUTIONS **WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.

WIRING PRECAUTIONS **CAUTION**

- Connect the DC power supply to the dedicated terminals specified in the manual of the PLC main unit. If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.

WIRING PRECAUTIONS **CAUTION**

- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits. Failure to do so may cause fire, equipment failures or malfunctions.
- Make sure to observe the following precautions in order to prevent malfunctions under the influence of noise:
 - Do not bundle the power line or input line together with or lay it close to the main circuit, high-voltage line or load line. Otherwise, noise disturbance and/or surge induction are likely to take place. As a guideline, lay the control line at least 100mm (3.94") or more away from the main circuit or high-voltage lines.
- Make sure to properly wire to the terminal block (European type) in accordance with the following precautions. Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
 - The disposal size of the cable end should follow the dimensions described in the manual.
 - Tightening torque should follow the specifications in the manual.
 - Twist the end of strand wire and make sure that there are no loose wires.
 - Do not solder-plate the electric wire ends.
 - Do not connect more than the specified number of wires or electric wires of unspecified size.
 - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

3.1 Applicable Cable and Terminal Tightening Torque

3.1.1 Terminal block (European type)

- Wire size
Wiring to input device should use 22 to 20 AWG wire.
- Applicable cable

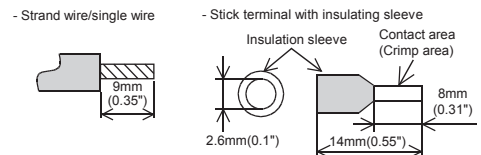
Type	Wire size
Single-wire	0.3 to 0.5 mm ² (AWG22 to 20)
2-wire	2 pieces of 0.3 mm ² (AWG22)

- Termination of cable end
Strip the coating of strand wire and twist the cable core before connecting it, or strip the coating of single wire before connecting it. An alternative connection is to use a ferrule with insulating sleeve. <Reference>

Manufacturer	Model	Caulking tool
Phoenix Contact Co., Ltd.	AI 0.5-8WH	CRIMPFOX 6 ¹ (or CRIMPFOX 6T-F ²)

*1 Old model name: CRIMPFOX ZA 3

*2 Old model name: CRIMPFOX UD 6

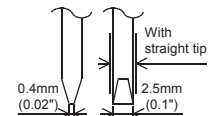


When using a stick terminal with insulating sleeve, choose a wire with proper cable sheath referring to the above outside dimensions, or otherwise, the wire cannot be inserted easily.

The tightening torque must be 0.22 to 0.25 N·m. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.

- Tool

For tightening the terminal, use a commercially available small screwdriver having a straight form that is not widened toward the end as shown right.



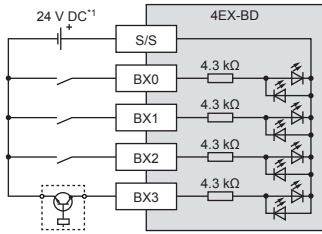
Caution:
If the diameter of screwdriver grip is too small, tightening torque will not be able to be achieved. Use the following recommended screwdriver or an appropriate replacement (grip diameter: approximately 25 mm (0.98")). <Reference>

Manufacturer	Model
Phoenix Contact Co., Ltd.	SZS 0.4×2.5

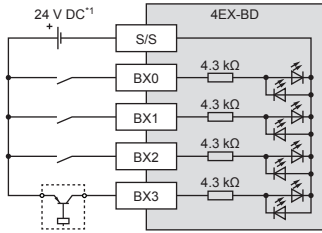
3.2 Wiring of input

→ For the terminal configuration, refer to Section 1.2

Sink input wiring



Source input wiring



*1 The service power supply of the PLC main unit can be used.

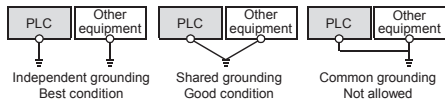
3.3 Grounding

Grounding should be performed as stated below.

- The grounding resistance should be 100 Ω or less.
- Independent grounding should be performed for best results. When independent grounding is not performed, perform "shared grounding" of the following figure.

For details, refer to the following manual.

→ FX3S Series User's Manual - Hardware Edition
→ FX3G Series User's Manual - Hardware Edition



- The grounding wire size should be AWG 22 to 20 (0.3 to 0.5 mm²).
- The grounding point should be close to the PLC, and all grounding wire should be as short as possible.

3.4 Instructions for connecting input devices

The input current of this PLC is 5 mA/24 V DC. Use input devices applicable to this minute current.

If no-voltage contacts (switches) for large current are used, contact failure may occur. <Example> Products of OMRON

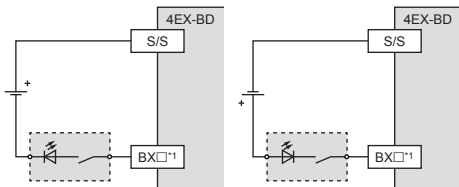
Type	Model name	Type	Model name
Microswitch	Models Z, V and D2RV	Operations switch	Model A3P
Proximity switch	Model TL	Photoelectric switch	Model E3S

3.4.1 In the case of input device with built-in series diode

The voltage drop of the series diode should be approx. 4 V or less. When lead switches with a series LED are used, up to two switches can be connected in series. Also make sure that the input current is over the input-sensing level while the switches are ON.

Sink input wiring

Source input wiring



*1 BX□: □ represents the input number of 4EX-BD.

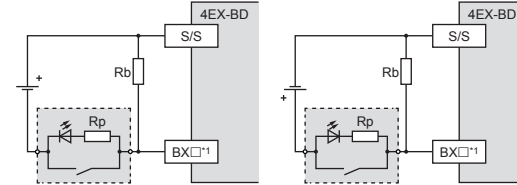
3.4.2 In the case of input device with built-in parallel resistance

Use a device having a parallel resistance, Rp, of 15 kΩ or more. If the resistance is less than 15 kΩ, connect a bleeder resistance, Rb (kΩ), obtained by the following formula as shown in the following figure.

$$R_b(k\Omega) \leq \frac{4R_p}{15-R_p}$$

Sink input wiring

Source input wiring



*1 BX□: □ represents the input number of 4EX-BD.

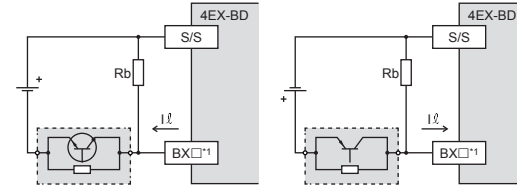
3.4.3 In the case of 2-wire proximity switch

Use a two-wire proximity switch whose leakage current, |I_l|, is 1.5 mA or less when the switch is off. When the current is larger than 1.5 mA, connect a bleeder resistance, Rb (kΩ), determined by the following formula.

$$R_b(k\Omega) \leq \frac{6}{|I_l| - 1.5}$$

Sink input wiring

Source input wiring



*1 BX□: □ represents the input number of 4EX-BD.

4. Device allocation and program example

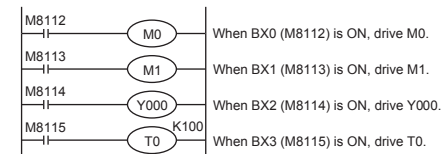
4.1 Device allocation

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

Input terminal	Special auxiliary relays
BX0	M8112
BX1	M8113
BX2	M8114
BX3	M8115

4.2 Program example

Use a contact instruction for each special auxiliary relay.



4.3 Caution on Creation of Programs

- When the END instruction of the program is executed, the input process is completed. REF instruction cannot be used.
- When input information on 4EX-BD is used for the operand of each applied instruction as data, only four bit data (K1M8112) can be used.

5. Specification

STARTUP AND MAINTENANCE PRECAUTIONS	WARNING
<ul style="list-style-type: none"> Do not touch any terminal while the PLC's power is on. Doing so may cause electric shock or malfunctions. Before cleaning or retightening terminals, cut off all phases of the power supply externally. Failure to do so may cause electric shock. Before modifying or disrupting the program in operation or running the PLC, carefully read through this manual and the associated manuals and ensure the safety of the operation. An operation error may damage the machinery or cause accidents. 	

STARTUP AND MAINTENANCE PRECAUTIONS	CAUTION
<ul style="list-style-type: none"> Do not disassemble or modify the unit. Doing so may cause fire, equipment failures, or malfunctions. For repair, contact your local Mitsubishi Electric representative. Do not drop the product or exert strong impact to it. Doing so may cause damage. 	

DISPOSAL PRECAUTIONS	CAUTION
<ul style="list-style-type: none"> Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device. 	

TRANSPORTATION AND STORAGE PRECAUTIONS	CAUTION
<ul style="list-style-type: none"> The product is a precision instrument. During transportation, avoid any impacts. Failure to do so may cause failures in the product. After transportation, verify the operations of the product. 	

5.1 Applicable PLC

Model name	Applicability
FX3S Series PLC	Ver. 1.10 or later
FX3G Series PLC	Ver. 2.20 or later

The version number can be checked by monitoring D8001/D8101, as well the last three digits indicate the version number.

- Only one 4EX-BD can be used per main unit. Never stack up two or more expansion boards.

For details on the system configuration, refer to the following manual.

→ FX3S Series User's Manual - Hardware Edition
→ FX3G Series User's Manual - Hardware Edition

5.2 General Specifications

The general specifications are equivalent to the PLC main unit. For general specifications, refer to the following manuals.

→ FX3S Series User's Manual - Hardware Edition
→ FX3G Series User's Manual - Hardware Edition

5.3 Power Supply Specifications

Item	Specification
Consumption current	5 V DC
	24 V DC
	Supply by PLC.
	1.5 mA max. Supply from external power supply.

5.4 Performance Specification

Item	Specification
Number of input points	4 points
Input connecting type	Terminal block (European type)
Input form	Sink/Source
Input signal voltage	24 V DC +20% -15%
Input impedance	4.3 kΩ
Input signal current	5 mA/24 V DC
ON input sensitivity current	3.5 mA or more
OFF input sensitivity current	1.5 mA or less
Input response time	Approx. 10 ms
Input signal form	Sink
	Source
Input circuit insulation	Photocoupler insulation
Input operation display	LED lighting when photocoupler is driven
Number of occupied I/O points	0 point (This number is not related to the maximum number of input/output points of the PLC.)

This manual confers no industrial property rights or any rights of any other kind, nor does it confer any patent licenses. Mitsubishi Electric Corporation cannot be held responsible for any problems involving industrial property rights which may occur as a result of using the contents noted in this manual.

Warranty

Mitsubishi will not be held liable for damage caused by factors found not to be the cause of Mitsubishi; opportunity loss or lost profits caused by faults in the Mitsubishi products; damage, secondary damage, accident compensation caused by special factors unpredictable by Mitsubishi; damages to products other than Mitsubishi products; and to other duties.

For safe use

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

MITSUBISHI ELECTRIC CORPORATION

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



PROGRAMMABLE CONTROLLERS MELSEC-F

JAPANESE ENGLISH

FX3G-4EX-BD

USER'S MANUAL



Table with 2 columns: Field (Manual Number, Revision, Date) and Value (JY997D51301, B, April 2015)

This manual describes the part names, dimensions, mounting, and specifications of the product. Before use, read this manual and manuals of relevant products fully to acquire proficiency in handling and operating the product.

Effective April 2015
Specifications are subject to change without notice.

Safety Precaution (Read these precautions before use.)

This manual classify the safety precautions into two categories:

Table with 2 columns: Precaution Type (WARNING, CAUTION) and Description

Depending on the circumstances, procedures indicated by CAUTION may also cause severe injury. It is important to follow all precautions for personal safety.

Associated Manuals

Table with 3 columns: Manual name, Manual No., Description

How to obtain manuals

For the necessary product manuals or documents, consult with the Mitsubishi Electric dealer from where you purchase your product.

Applicable standards

FX3G-4EX-BD units made in September, 2013 or later comply with the EC Directive (EMC Directive). Further information can be found in the following manual.

Regarding the standards that relate to the main unit, please refer to either the FX series product catalog or consult with your nearest Mitsubishi product provider.

Attention

- This product is designed for use in industrial applications.
Authorized Representative in the European Community: Mitsubishi Electric Europe B.V.

1. Outline

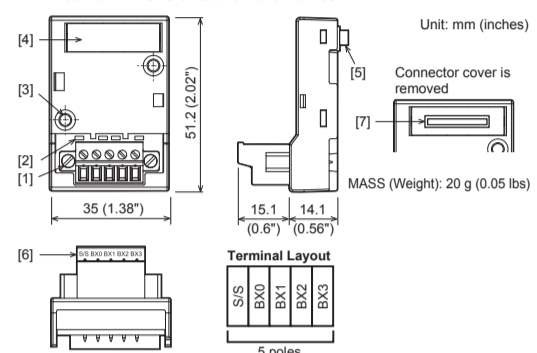
The FX3G-4EX-BD input expansion board (hereinafter referred to as "4EX-BD") is an expansion board to be installed in the FX3S or FX3G series programmable controller (hereinafter referred to as "PLC"), to add four additional inputs.

1.1 Incorporated Items

Verify that the following product and items are included in the package:

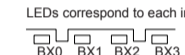
Table with 2 columns: Product, Accessories

1.2 External Dimensions and Part Names



[1] Terminal block mounting screws

[2] Input LED
BX0 LED: The LED is lit when BX0 is on.
BX1 LED: The LED is lit when BX1 is on.
BX2 LED: The LED is lit when BX2 is on.
BX3 LED: The LED is lit when BX3 is on.



[3] Mounting holes (2-φ3.2)

[4] Connector cover
[5] Main unit connector
[6] Terminal block for input (European)
[7] Memory cassette/Display module connector

2. Installation

Installation Precautions section containing WARNING and CAUTION boxes with detailed instructions on power supply, wiring, and terminal handling.

For installation/uninstallation details, refer to the following manual.
FX3S Series User's Manual - Hardware Edition
FX3G Series User's Manual - Hardware Edition

3. Wiring

Wiring Design Precautions section containing WARNING and CAUTION boxes with instructions on safety circuits, emergency stop, and power supply overloads.

Wiring Design Precautions section containing CAUTION box with instructions on bundling control lines and wire placement.

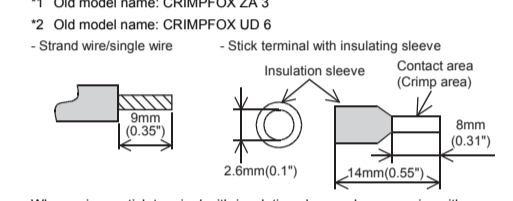
Wiring Precautions section containing WARNING box with instructions on power supply phases and electric shock prevention.

Wiring Precautions section containing CAUTION box with instructions on DC power supply connection and terminal torque.

Wiring Precautions section containing CAUTION box with instructions on drilling screw holes, wire debris, and terminal block placement.

3.1 Applicable Cable and Terminal Tightening Torque

3.1.1 Terminal block (European type) section containing wire size and applicable cable tables.

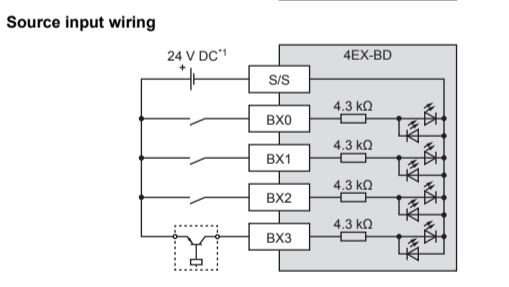
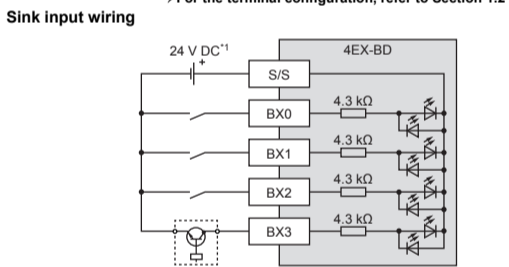


When using a stick terminal with insulating sleeve, choose a wire with proper cable sheath referring to the above outside dimensions, or otherwise, the wire cannot be inserted easily.

3.1.2 Terminal block (European type) section containing tool specifications table and tightening torque instructions.

3.2 Wiring of input

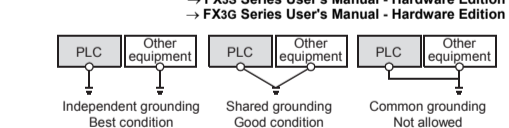
For the terminal configuration, refer to Section 1.2



*1 The service power supply of the PLC main unit can be used.

3.3 Grounding

Grounding should be performed as stated below.
The grounding resistance should be 100 Ω or less.
Independent grounding should be performed for best results.



- The grounding wire size should be AWG 22 to 20 (0.3 to 0.5 mm²).
The grounding point should be close to the PLC, and all grounding wire should be as short as possible.

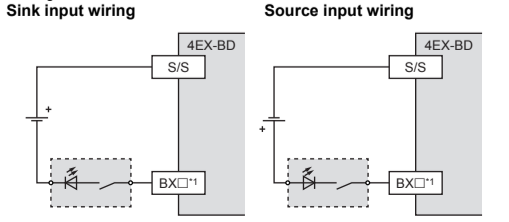
3.4 Instructions for connecting input devices

The input current of this PLC is 5 mA/24 V DC. Use input devices applicable to this minute current.
If no-voltage contacts (switches) for large current are used, contact failure may occur.

Table with 4 columns: Type, Model name, Type, Model name

3.4.1 In the case of input device with built-in series diode

The voltage drop of the series diode should be approx. 4 V or less.
When lead switches with a series LED are used, up to two switches can be connected in series.

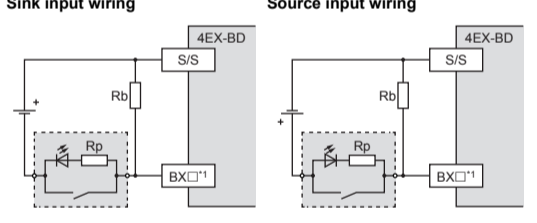


*1 BX□: □ represents the input number of 4EX-BD.

3.4.2 In the case of input device with built-in parallel resistance

Use a device having a parallel resistance, Rp, of 15 kΩ or more.
If the resistance is less than 15 kΩ, connect a bleeder resistance, Rb (kΩ), obtained by the following formula as shown in the following figure.

Rb(kΩ) ≤ 4Rp / 15 - Rp

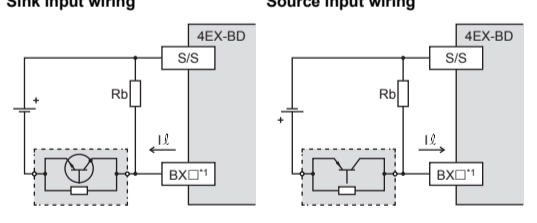


*1 BX□: □ represents the input number of 4EX-BD.

3.4.3 In the case of 2-wire proximity switch

Use a two-wire proximity switch whose leakage current, Iℓ, is 1.5 mA or less when the switch is off. When the current is larger than 1.5 mA, connect a bleeder resistance, Rb (kΩ), determined by the following formula.

Rb(kΩ) ≤ 6 / Iℓ - 1.5



*1 BX□: □ represents the input number of 4EX-BD.

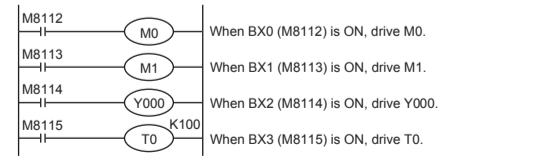
4. Device allocation and program example

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

Table with 2 columns: Input terminal, Special auxiliary relays

4.2 Program example

Use a contact instruction for each special auxiliary relay.



4.3 Caution on Creation of Programs

- When the END instruction of the program is executed, the input process is completed. REF instruction cannot be used.
When input information on 4EX-BD is used for the operand of each applied instruction as data, only four bit data (K1M8112) can be used.

5. Specification

Startup and Maintenance Precautions section containing WARNING box with instructions on terminal handling and power supply.

Startup and Maintenance Precautions section containing CAUTION box with instructions on disassembly and dropping.

Disposal Precautions section containing CAUTION box with instructions on electronic waste disposal.

Transportation and Storage Precautions section containing CAUTION box with instructions on impacts and operations.

5.1 Applicable PLC table with columns: Model name, Applicability

The version number can be checked by monitoring D8001/D8101, as well as the last three digits indicate the version number.

Only one 4EX-BD can be used per main unit. Never stack up two or more expansion boards.

5.2 General Specifications

The general specifications are equivalent to the PLC main unit. For general specifications, refer to the following manuals.

5.3 Power Supply Specifications

Table with 3 columns: Item, Specification

5.4 Performance Specification

Table with 2 columns: Item, Specification

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Warranty
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For safe use section containing CAUTION box with instructions on product safety and handling.