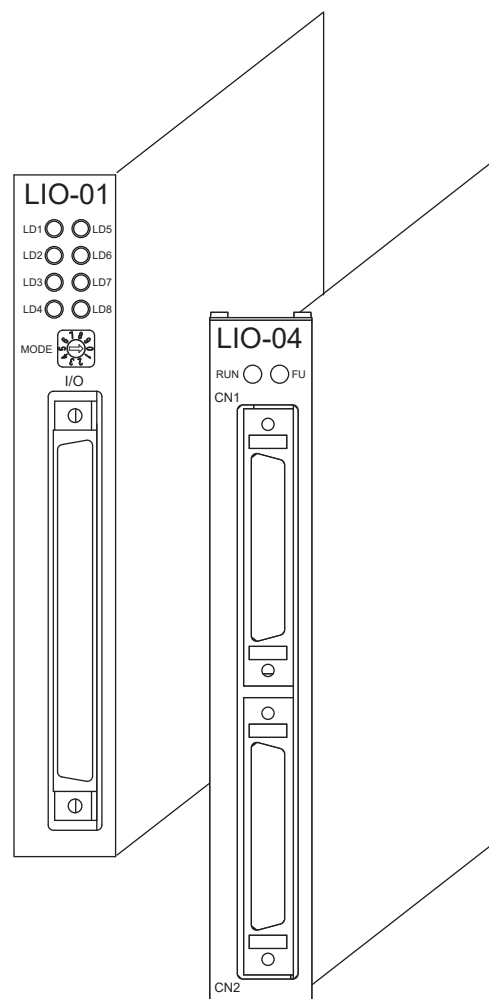


## Machine Controller MP2000 Series I/O Module USER'S MANUAL

Model JAPMC-IO23□□ (-E)  
JAPMC-DO2300 (-E)  
JAPMC-DI2300-E



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## Using this Manual

This Manual describes MP2000 Series Machine Controller I/O Modules, LIO-01, LIO-02, LIO-04, LIO-05, LIO-06, DO-01, and DI-01. Read this Manual thoroughly before using LIO-01, LIO-02, LIO-04, LIO-05, LIO-06, DO-01, and DI-01. Keep this in a safe, convenient location for future reference.

### ■ Basic Terms

Unless otherwise specified, the following definitions are used:

- MP2000 Series Machine Controller : MP2100M, MP2200, MP2300, MP2300S, and MP2310 Machine Controllers
- PLC : Programmable Logic Controller
- PP : Programming Panel
- MPE720 : The Programming Device Software or a personal computer running the Programming Device Software

### ■ Graphic Symbols Used in this Manual

The graphic symbols used in this manual indicate the following type of information.



- This symbol is used to indicate important information that should be memorized or minor precautions, such as precautions that will result in alarms if not heeded.

### ■ Indication of Reverse Signals

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following example:

<Notation Examples>      $\overline{S-ON}$      =   /S-ON  
                              $\overline{P-CON}$      =   /P-CON

### ■ Indication of I/O Register Numbers

In this manual, the I/O register numbers are written as shown in the following example:

Input register number: IW□□hh (or IL□□hh)

Indicates the input leading register number (IW□□□□) + hh (offset value from the leading register number in hexadecimal).

Output register number: OW□□hh (or OL□□hh)

Indicates output leading register number (OW□□□□) + hh (offset value from the leading register number in hexadecimal).

<Example> When hh is 02, the register number is “IW□□02” or “OW□□02.”

## ■ Related Manuals

The following table lists the manuals relating to the MP2000 Series Machine Controller I/O Modules. Refer to these manuals as required.

| Manual Name                                                                                 | Manual Number  | Contents                                                                                                                                      |
|---------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Machine Controller MP2100/MP2100M User's Manual Design and Maintenance                      | SIEPC88070001  | Describes how to use the MP2100 and MP2100M Machine Controllers.                                                                              |
| Machine Controller MP2200 User's Manual                                                     | SIEPC88070014  | Describes how to use the MP2200 Machine Controller and the modules that can be connected.                                                     |
| Machine Controller MP2300 Basic Module User's Manual                                        | SIEPC88070003  | Describes how to use the MP2300 Basic Module and the modules that can be connected.                                                           |
| Machine Controller MP2300S Basic Module User's Manual                                       | SIEPC88073200  | Describes how to use the MP2300S Basic Module and the modules that can be connected.                                                          |
| Machine Controller MP2310 Basic Module User's Manual                                        | SIEPC88073201  | Describes how to use the MP2310 Basic Module and the modules that can be connected.                                                           |
| Machine Controller MP2000 Series Motion Module User's Manual Built-in SVB/SVB-01 Module     | SIEPC88070033  | Provides a detailed description on the MP2000-series Machine Controller built-in SVB Module and slot-mounting optional SVB-01 Module.         |
| Machine Controller MP2000 Series Communication Module User's Manual                         | SIEPC88070004  | Provides the information on the Communication Module that can be connected to MP2000 Series Machine Controller and the communication methods. |
| Machine Controller MP900/MP2000 Series User's Manual, Ladder Programming                    | SIEZ-C887-1.2  | Describes the instructions used in MP900/MP2000 ladder programming.                                                                           |
| Machine Controller MP900/MP2000 Series User's Manual, Motion Programming                    | SIEZ-C887-1.3  | Describes the instructions used in MP900/MP2000 motion programming.                                                                           |
| Engineering Tool for MP2000 Series Machine Controller MPE720 Version 6 User's Manual        | SIEPC88070030  | Describes how to install and operate the programming tool MPE720 version 6 for MP2000 Series Machine Controllers.                             |
| Machine Controller MP2000/MP3000 Series Engineering Tool MPE720 Ver.7 USER'S MANUAL         | SIEPC88076103  | Describes how to operate MPE720 version 7.                                                                                                    |
| Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual | SIEPC88070005  | Describes how to install and operate the MP900/MP2000 Series programming system (MPE720).                                                     |
| Machine Controller MP900/MP2000 Series New Ladder Editor Programming Manual                 | SIEZ-C887-13.1 | Describes the programming instructions of the New Ladder Editor, which assists MP900/MP2000 Series design and maintenance.                    |
| Machine Controller MP900/MP2000 Series New Ladder Editor User's Manual                      | SIEZ-C887-13.2 | Describes the operating methods of the New Ladder Editor, which assists MP900/MP2000 Series design and maintenance.                           |

## ■ Copyrights

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- MECHATROLINK is a trademark of the MECHATROLINK Members Association.
- Other product names and company names are the trademarks or registered trademarks of the respective company. "TM" and the ® mark do not appear with product or company names in this manual.

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## Safety Information

The following conventions are used to indicate precautions in this manual. Information marked as shown below is important for the safety of the user. Always read this information and heed the precautions that are provided.

The conventions are as follows:



Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.



Indicates precautions that, if not heeded, could result in relatively serious or minor injury, or property damage.

If not heeded, even precautions classified under  CAUTION can lead to serious results depending on circumstances.



Indicates prohibited actions. Specific prohibitions are indicated inside .

For example,  indicates no fire or open flame.



Indicates mandatory actions. Specific actions are indicated inside .

For example,  indicates that grounding is required.

---

## Safety Precautions

The following precautions are for checking products on delivery, storage, transportation, installation, wiring, operation, application, inspection, and disposal. These precautions are important and must be observed.

### ■ General Precautions

#### WARNING

- ♦ Before starting operation while connected to the machine, ensure that an emergency stop procedure has been provided and is working correctly.  
There is a risk of injury.
- ♦ Do not touch anything inside the product.  
There is a risk of electrical shock.
- ♦ Always keep the front cover attached when power is being supplied.  
There is a risk of electrical shock.
- ♦ Observe all procedures and precautions given in this manual for trial operation.  
Operating mistakes while the servomotor and machine are connected can cause damage to the machine or even accidents resulting in injury or death.
- ♦ Do not remove the front cover, cables, connector, or options while power is being supplied.  
There is a risk of electrical shock.
- ♦ Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch cables.  
There is a risk of electrical shock, operational failure of the product, or burning.
- ♦ Do not attempt to modify the product in any way.  
There is a risk of injury or device damage.
- ♦ Do not approach the machine when there is a momentary interruption to the power supply. When power is restored, the MP2000 Series Machine Controller or machine connected to it may start operation suddenly. Provide suitable safety measures to protect people when operation restarts.  
There is a risk of injury.
- ♦ Do not allow installation, disassembly, or repairs to be performed by anyone other than specified personnel.  
There is a risk of electrical shock or injury.

## ■ Storage and Transportation

### CAUTION

- ♦ Do not store or install the product in locations subject to the following. There is a risk of fire, electric shock, and machine product damage.
  - ♦ Direct sunlight
  - ♦ Ambient temperatures exceeding the storage or operating conditions
  - ♦ Ambient humidity exceeding the storage or operating conditions
  - ♦ Extreme changes in temperature that would result in condensation
  - ♦ Corrosive or flammable gas
  - ♦ Excessive dust, dirt, salt, or metallic powder
  - ♦ Water, oil, or chemicals
  - ♦ Vibration or shock
- ♦ Do not overload the product during transportation.  
There is a risk of injury or an accident.
- ♦ Never subject the product to an atmosphere containing halogen (fluorine, chlorine, bromine, or iodine) during transportation or installation.  
There is a risk of device damage or an accident.
- ♦ If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.  
Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.  
If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

## ■ Installation

### CAUTION

- ♦ Never use the product in locations subject to water, corrosive atmospheres, or flammable gas, or near burnable objects.  
There is a risk of electrical shock or fire.
- ♦ Do not step on the product or place heavy objects on the product.  
There is a risk of injury.
- ♦ Do not block the air exhaust port on the product. Do not allow foreign objects to enter the product.  
There is a risk of element deterioration inside, an accident, or fire.
- ♦ Always mount the product in the specified orientation.  
There is a risk of an accident.
- ♦ Do not subject the product to strong shock.  
There is a risk of an accident.

## ■ Wiring



### CAUTION

- ♦ Check the wiring to be sure it has been performed correctly.  
There is a risk of motor run-away, injury, or an accident.
- ♦ Always use a power supply of the specified voltage.  
There is a risk of burning.
- ♦ In places with poor power supply conditions, take all steps necessary to ensure that the input power is supplied within the specified voltage range.  
There is a risk of device damage.
- ♦ Install breakers and other safety measures to provide protection against shorts in external wiring.  
There is a risk of fire.
- ♦ Provide sufficient shielding when using the product in the locations subject to the following.  
There is a risk of device damage.
  - ♦ Noise, such as from static electricity
  - ♦ Strong electromagnetic or magnetic fields
  - ♦ Radiation
  - ♦ Near power lines

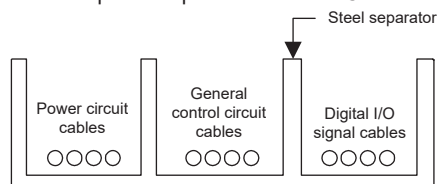
## ■ Selecting, Separating, and Laying External Cables



### CAUTION

- ♦ Consider the following items when selecting the I/O signal lines (external cables) to connect the product to external devices.
  - ♦ Mechanical strength
  - ♦ Noise interference
  - ♦ Wiring distance
  - ♦ Signal voltage, etc.
- ♦ Separate the I/O signal lines from the power lines both inside and outside the control box to reduce the influence of noise from the power lines.  
If the I/O signal lines and power lines are not separated properly, malfunctioning may result.

Example of Separated External Cables



## ■ Maintenance and Inspection Precautions



### CAUTION

- ♦ Do not attempt to disassemble the product.  
There is a risk of electrical shock or injury.
- ♦ Do not change wiring while power is being supplied.  
There is a risk of electrical shock or injury.

---

## ■ Disposal Precautions



### CAUTION

- ♦ Dispose of the product as general industrial waste.

## ■ General Precautions

### Observe the following general precautions to ensure safe application.

- ♦ The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual.
- ♦ The drawings presented in this manual are typical examples and may not match the product you received.
- ♦ If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.

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# Warranty

## ( 1 ) Details of Warranty

### ■ Warranty Period

The warranty period for a product that was purchased (hereinafter called “delivered product”) is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

### ■ Warranty Scope

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the warranty period above. This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.

This warranty does not cover failures that result from any of the following causes.

1. Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Abuse of the delivered product in a manner in which it was not originally intended
5. Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
6. Events for which Yaskawa is not responsible, such as natural or human-made disasters

## ( 2 ) Limitations of Liability

1. Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
2. Yaskawa shall not be responsible for any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
3. The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
4. Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

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### ( 3 ) Suitability for Use

1. It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
3. Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
  - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
  - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
  - Systems, machines, and equipment that may present a risk to life or property
  - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
  - Other systems that require a similar high degree of safety
4. Never use the product for an application involving serious risk to life or property without first ensuring that the system is designed to secure the required level of safety with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
5. The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
6. Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

### ( 4 ) Specifications Change

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

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## Mounting Modules

This chapter describes how to mount and remove an I/O Module from the Machine Controller, execute self-configuration after mounting, and display the **Module Configuration** Window.

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## 1.1 Applicable Machine Controllers and Corresponding Version

### 1.1.1 Applicable Machine Controllers

#### ( 1 ) MP2000 Series

The table below lists the MP2000-series Machine Controllers on which the I/O Module can be mounted.

| Name                 |        | Model             | Max. No. of Connectable Modules | Remarks                                                                                                        |
|----------------------|--------|-------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------|
| MP2300               |        | JEPMC-MP2300 (-E) | 2 modules                       | —                                                                                                              |
| MP2310               |        | JEPMC-MP2310-E    | 3 modules                       | —                                                                                                              |
| MP2300S              |        | JEPMC-MP2300S-E   | 1 module                        | —                                                                                                              |
| MP2200* <sup>1</sup> | CPU-01 | JAPMC-CP2200 (-E) | 30 modules                      | The maximum number of connectable Modules is the total for the maximum expansion to four racks.* <sup>2</sup>  |
|                      | CPU-02 | JAPMC-CP2210 (-E) | 31 modules                      |                                                                                                                |
|                      | CPU-03 | JAPMC-CP2220-E    |                                 |                                                                                                                |
|                      | CPU-04 | JAPMC-CP2230-E    |                                 |                                                                                                                |
| MP2100M              |        | JAPMC-MC2140 (-E) | 24 modules                      | The maximum number of connectable Modules is the total for the maximum expansion to three racks.* <sup>2</sup> |
| MP2101M              |        | JAPMC-MC2142-E    |                                 |                                                                                                                |
| MP2101TM             |        | JAPMC-MC2142T-E   |                                 |                                                                                                                |

\* 1. Mount a CPU module on the following base units.

| Name   | Model             | Remarks                               |
|--------|-------------------|---------------------------------------|
| MBU-01 | JEPMC-BU2200 (-E) | 100/200-VAC input base unit (9 slots) |
| MBU-02 | JEPMC-BU2210 (-E) | 24-VDC input base unit (9 slots)      |
| MBU-03 | JEPMC-BU2220-E    | 24-VDC input base unit (4 slots)      |

\* 2. The following module or board is required between racks.

| Name      | Model             | Remarks                                      |
|-----------|-------------------|----------------------------------------------|
| EXIOIF    | JAPMC-EX2200 (-E) | Inter-rack connection module                 |
| MP2100MEX | JAPMC-EX2100 (-E) | I/F board for MP2100M, MP2101M, and MP2101TM |

#### ( 2 ) MP3000 Series

The table below lists the MP3000-series Machine Controllers on which the I/O Module can be mounted.

| Name     |                   | Model            | Max. No. of Connectable Modules | Remarks                                                                                            |
|----------|-------------------|------------------|---------------------------------|----------------------------------------------------------------------------------------------------|
| MP3100   | MP3100 (16 axes)  | JAPMC-MC3100-1-E | 24 modules                      | The maximum number of connectable Modules is the total for the maximum expansion to three racks.*2 |
|          | MP3100 (32 axes)  | JAPMC-MC3100-2-E | 24 modules                      |                                                                                                    |
| MP3200   | CPU-201           | JEPMC-CP3201-E   | 31 modules                      | The maximum number of connectable Modules is the total for the maximum expansion to four racks.*2  |
|          | CPU-202           | JEPMC-CP3202-E   | 31 modules                      |                                                                                                    |
| MP3300*1 | CPU-301 (16 axes) | JAPMC-CP3301-1-E | 31 modules                      |                                                                                                    |
|          | CPU-301 (32 axes) | JAPMC-CP3301-2-E | 31 modules                      |                                                                                                    |
|          | CPU-302 (16 axes) | JAPMC-CP3302-1-E | 31 modules                      |                                                                                                    |
|          | CPU-302 (32 axes) | JAPMC-CP3302-2-E | 31 modules                      |                                                                                                    |

\* 1. Mount a CPU module on the following base units.

| Name    | Model          | Remarks                               |
|---------|----------------|---------------------------------------|
| MBU-301 | JEPMC-BU3301-E | 100/200-VAC input base unit (8 slots) |
| MBU-302 | JEPMC-BU3302-E | 24-VDC input base unit (8 slots)      |
| MBU-303 | JEPMC-BU3303-E | 24-VDC input base unit (3 slots)      |
| MBU-304 | JEPMC-BU3304-E | 24-VDC input base unit (1 slot)       |

\* 2. The following module or board is required between racks.

| Name     | Model             | Remarks                                                       |
|----------|-------------------|---------------------------------------------------------------|
| EXIOIF   | JAPMC-EX2200 (-E) | Inter-rack connection module                                  |
| MP3100EX | JAPMC-EX3100-E    | Can be connected to rack expansion I/F unit and EXIOIF module |
| MP3101EX | JAPMC-EX3101-E    | Can be connected to EXIOIF module                             |

## 1.1.2 Corresponding CPU Version and MPE720 Version

The CPU versions and MPE720 versions of the Machine Controller corresponding to each I/O Module are listed in the following table.

| I/O Module | Machine Controller |                   | Corresponding Version |                    |                    |                    |
|------------|--------------------|-------------------|-----------------------|--------------------|--------------------|--------------------|
|            |                    |                   | CPU                   | MPE720 Ver.5       | MPE720 Ver.6       | MPE720 Ver.7       |
| LIO-01/02  | MP2300             |                   | All versions          | Ver. 4.41 or later | All versions       | All versions       |
|            | MP2310             |                   |                       | Ver. 5.38 or later | Ver. 6.04 or later |                    |
|            | MP2300S            |                   |                       | Ver. 5.10 or later | All versions       |                    |
|            | MP2200             | CPU-01            |                       | Ver. 5.30 or later | All versions       |                    |
|            |                    | CPU-02            |                       | Ver. 5.50 or later | Ver. 6.20 or later |                    |
|            |                    | CPU-03            |                       | Ver. 5.52 or later | Ver. 6.22 or later |                    |
|            |                    | CPU-04            |                       | Ver. 5.10 or later | All versions       |                    |
|            | MP2100M            |                   |                       | Ver. 5.54 or later | Ver. 6.24 or later |                    |
|            | MP2101M            |                   |                       |                    |                    |                    |
|            | MP2101TM           |                   |                       |                    |                    |                    |
|            | MP3100             | MP3100 (16 axes)  | All versions          | —                  | —                  | Ver. 7.38 or later |
|            |                    | MP3100 (32 axes)  |                       |                    |                    |                    |
|            | MP3200             | CPU-201           |                       |                    |                    | All versions       |
|            |                    | CPU-202           |                       |                    |                    |                    |
|            | MP3300             | CPU-301 (16 axes) |                       |                    |                    | Ver. 7.26 or later |
|            |                    | CPU-301 (32 axes) |                       |                    |                    | Ver. 7.28 or later |
|            |                    | CPU-302 (16 axes) |                       |                    |                    | Ver. 7.33 or later |
|            |                    | CPU-302 (32 axes) |                       |                    |                    |                    |
| LIO-04     | MP2300             |                   | Ver. 2.20 or later    | Ver. 5.12 or later | All versions       | All versions       |
|            | MP2310             |                   | All versions          | Ver. 5.38 or later | Ver. 6.04 or later |                    |
|            | MP2300S            |                   |                       |                    |                    |                    |
|            | MP2200             | CPU-01            | Ver. 2.20 or later    | Ver. 5.10 or later | All versions       |                    |
|            |                    | CPU-02            | All versions          | Ver. 5.30 or later | All versions       |                    |
|            |                    | CPU-03            |                       | Ver. 5.50 or later | Ver. 6.20 or later |                    |
|            |                    | CPU-04            |                       | Ver. 5.52 or later | Ver. 6.22 or later |                    |
|            | MP2100M            |                   | Ver. 2.30 or later    | Ver. 5.12 or later | All versions       |                    |
|            | MP2101M            |                   | All versions          | Ver. 5.54 or later | Ver. 6.24 or later |                    |
|            | MP2101TM           |                   |                       |                    |                    |                    |
|            | MP3100             | MP3100 (16 axes)  | All versions          | —                  | —                  | Ver. 7.38 or later |
|            |                    | MP3100 (32 axes)  |                       |                    |                    |                    |
|            | MP3200             | CPU-201           |                       |                    |                    | All versions       |
|            |                    | CPU-202           |                       |                    |                    |                    |
|            | MP3300             | CPU-301 (16 axes) |                       |                    |                    | Ver. 7.26 or later |
|            |                    | CPU-301 (32 axes) |                       |                    |                    | Ver. 7.28 or later |
|            |                    | CPU-302 (16 axes) |                       |                    |                    | Ver. 7.33 or later |
|            |                    | CPU-302 (32 axes) |                       |                    |                    |                    |

(cont'd)

| I/O Module | Machine Controller |                   | Corresponding Version |                     |                    |                    |
|------------|--------------------|-------------------|-----------------------|---------------------|--------------------|--------------------|
|            |                    |                   | CPU                   | MPE720 Ver.5        | MPE720 Ver.6       | MPE720 Ver.7       |
| LIO-05     | MP2300             |                   | Ver. 2.32 or later    | Ver. 5.21 or later  | All versions       | All versions       |
|            | MP2310             |                   | All versions          | Ver. 5.38 or later  | Ver. 6.04 or later |                    |
|            | MP2300S            |                   |                       |                     |                    |                    |
|            | MP2200             | CPU-01            | Ver. 2.32 or later    | Ver. 5.21 or later  | All versions       |                    |
|            |                    | CPU-02            | All versions          | Ver. 5.30 or later  | All versions       |                    |
|            |                    | CPU-03            |                       | Ver. 5.50 or later  | Ver. 6.20 or later |                    |
|            |                    | CPU-04            |                       | Ver. 5.52 or later  | Ver. 6.22 or later |                    |
|            | MP2100M            |                   | Ver. 2.32 or later    | Ver. 5.21 or later  | All versions       |                    |
|            | MP2101M            |                   | All versions          | Ver. 5.54 or later  | Ver. 6.24 or later |                    |
|            | MP2101TM           |                   |                       |                     |                    |                    |
|            | MP3100             | MP3100 (16 axes)  | All versions          | —                   | —                  | Ver. 7.38 or later |
|            |                    | MP3100 (32 axes)  |                       |                     |                    |                    |
|            | MP3200             | CPU-201           |                       |                     |                    | All versions       |
|            |                    | CPU-202           |                       |                     |                    |                    |
|            | MP3300             | CPU-301 (16 axes) |                       |                     |                    | Ver. 7.26 or later |
|            |                    | CPU-301 (32 axes) |                       |                     |                    | Ver. 7.28 or later |
|            |                    | CPU-302 (16 axes) |                       |                     |                    | Ver. 7.33 or later |
|            |                    | CPU-302 (32 axes) |                       |                     |                    |                    |
| LIO-06     | MP2300             |                   | Ver. 2.63 or later    | Ver. 5.40A or later | Ver. 6.06 or later | All versions       |
|            | MP2310             |                   |                       |                     |                    |                    |
|            | MP2300S            |                   |                       |                     |                    |                    |
|            | MP2200             | CPU-01            | All versions          | Ver. 5.50 or later  | Ver. 6.20 or later |                    |
|            |                    | CPU-02            |                       |                     |                    |                    |
|            |                    | CPU-03            |                       |                     |                    |                    |
|            |                    | CPU-04            |                       |                     |                    |                    |
|            | MP2100M            |                   | Ver. 2.63 or later    | Ver. 5.40A or later | Ver. 6.06 or later |                    |
|            | MP2101M            |                   | All versions          | Ver. 5.54 or later  | Ver. 6.24 or later |                    |
|            | MP2101TM           |                   |                       |                     |                    |                    |
|            | MP3100             | MP3100 (16 axes)  | All versions          | —                   | —                  | Ver. 7.38 or later |
|            |                    | MP3100 (32 axes)  |                       |                     |                    |                    |
|            | MP3200             | CPU-201           |                       |                     |                    | All versions       |
|            |                    | CPU-202           |                       |                     |                    |                    |
|            | MP3300             | CPU-301 (16 axes) |                       |                     |                    | Ver. 7.26 or later |
|            |                    | CPU-301 (32 axes) |                       |                     |                    | Ver. 7.28 or later |
|            |                    | CPU-302 (16 axes) |                       |                     |                    | Ver. 7.33 or later |
|            |                    | CPU-302 (32 axes) |                       |                     |                    |                    |

## 1.1 Applicable Machine Controllers and Corresponding Version

## 1.1.2 Corresponding CPU Version and MPE720 Version

(cont'd)

| I/O Module | Machine Controller |                   | Corresponding Version            |                    |                    |                    |
|------------|--------------------|-------------------|----------------------------------|--------------------|--------------------|--------------------|
|            |                    |                   | CPU                              | MPE720 Ver.5       | MPE720 Ver.6       | MPE720 Ver.7       |
| DO-01      | MP2300             |                   | Ver. 2.32 or later               | Ver. 5.21 or later | All versions       | All versions       |
|            | MP2310             |                   | All versions                     | Ver. 5.38 or later | Ver. 6.04 or later |                    |
|            | MP2300S            |                   |                                  |                    |                    |                    |
|            | MP2200             | CPU-01            | Ver. 2.32 or later               | Ver. 5.21 or later | All versions       |                    |
|            |                    | CPU-02            | All versions                     | Ver. 5.30 or later | All versions       |                    |
|            |                    | CPU-03            |                                  | Ver. 5.50 or later | Ver. 6.20 or later |                    |
|            |                    | CPU-04            |                                  | Ver. 5.52 or later | Ver. 6.22 or later |                    |
|            | MP2100M            |                   | Ver. 2.32 or later               | Ver. 5.21 or later | All versions       |                    |
|            | MP2101M            |                   | All versions                     | Ver. 5.54 or later | Ver. 6.24 or later |                    |
|            | MP2101TM           |                   |                                  |                    |                    |                    |
|            | MP3100             | MP3100 (16 axes)  | All versions                     | —                  | —                  | Ver. 7.38 or later |
|            |                    | MP3100 (32 axes)  |                                  |                    |                    |                    |
|            | MP3200             | CPU-201           | Ver. 1.02 or later               |                    |                    | All versions       |
|            |                    | CPU-202           |                                  |                    |                    |                    |
|            | MP3300             | CPU-301 (16 axes) | All versions                     |                    |                    | Ver. 7.26 or later |
|            |                    | CPU-301 (32 axes) |                                  |                    |                    | Ver. 7.28 or later |
|            |                    | CPU-302 (16 axes) |                                  |                    |                    | Ver. 7.33 or later |
|            |                    | CPU-302 (32 axes) |                                  |                    |                    |                    |
| DI-01      | MP2300             |                   | Ver. 3.07 or later               | —                  | —                  | Ver. 7.45 or later |
|            | MP2310             |                   |                                  |                    |                    |                    |
|            | MP2300S            |                   |                                  |                    |                    |                    |
|            | MP2200             | CPU-01            |                                  |                    |                    |                    |
|            |                    | CPU-02            |                                  |                    |                    |                    |
|            |                    | CPU-03            |                                  |                    |                    |                    |
|            |                    | CPU-04            |                                  |                    |                    |                    |
|            | MP2100M            |                   |                                  |                    |                    |                    |
|            | MP2101M            |                   |                                  |                    |                    |                    |
|            | MP2101TM           |                   |                                  |                    |                    |                    |
|            | MP3100             | MP3100 (16 axes)  | Ver. 1.47 or later* <sup>1</sup> |                    |                    |                    |
|            |                    | MP3100 (32 axes)  |                                  |                    |                    |                    |
|            | MP3200             | CPU-201           | Ver. 1.47 or later               |                    |                    |                    |
|            |                    | CPU-202           |                                  |                    |                    |                    |
|            | MP3300             | CPU-301 (16 axes) | Ver. 1.47 or later* <sup>2</sup> |                    |                    |                    |
|            |                    | CPU-301 (32 axes) |                                  |                    |                    |                    |
|            |                    | CPU-302 (16 axes) |                                  |                    |                    |                    |
|            |                    | CPU-302 (32 axes) |                                  |                    |                    |                    |

\* 1. Ver. A04 or later in hardware version

\* 2. Ver. A03 or later in hardware version

## 1.2 Mounting and Removing a Module on Machine Controller

This section describes mounting and removing an I/O Module.

### 1.2.1 Mounting an I/O Module

Use the following procedure to mount an I/O Module.

- When replacing an I/O Module, first refer to 1.2.2 *Removing an I/O Module* on page 1-9 and remove the I/O Module that needs to be replaced.

#### ( 1 ) Preparation

##### 1. Backup the Programs.

Save the programs written to the Machine Controller in the personal computer using MPE720.

##### 2. Remove the Machine Controller and Expansion Rack.

Turn OFF the power supply and remove all the cables connected to the Machine Controller or Expansion Rack (MP2200 Base Unit). Then, remove the Machine Controller and Expansion Rack from the panel or rack, and place them where there is sufficient space, such as on a work table.

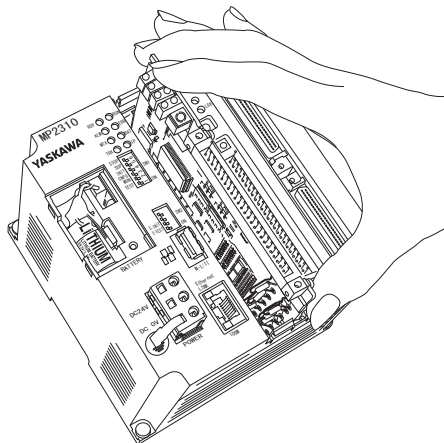
#### ( 2 ) Installing Optional Modules

Use the following procedure to install Optional Modules.

1. Hold the top and bottom of the Optional Module to be installed, line up the Module with the left side of the guide rail inside the option slot, and then insert the Module straight in.

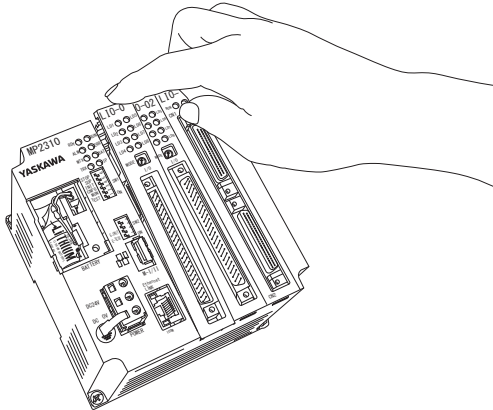


- The FG bar inside and on the bottom may be damaged if the Module is not inserted along the guide rail.



2. After the Optional Module is completely inserted, place your hand on the front of the Optional Module and press the Optional Module firmly until it mates with the Mounting Base connectors in the Unit. The front of the Optional Module and the tabs will be aligned if the Optional Module has been installed properly.

3. Place the hole on the bottom of the panel of the Optional Module onto the tab on the bottom of the Unit. Next, hook the hole at the top of the panel of the Optional Module onto the tab on the Unit.



This completes the installation procedure.



- Always use Option Covers (model: JEPMC-OP2300) to cover unused slots.

### ( 3 ) Procedure after Mounting the Module

#### 1. Connect the I/O Devices.

Connect the I/O devices, such as switches and sensors, to the I/O Module.

- Refer to 2.2 *Specifications of LIO-01/LIO-02 Module Connections* on page 2-6 for information on connecting I/O devices to the LIO-01/LIO-02 Module.
- Refer to 3.2 *Specifications of LIO-04/LIO-05 Module Connections* on page 3-5 for information on connecting I/O devices to the LIO-04/LIO-05 Module.
- Refer to 4.2 *Specifications of LIO-06 Module Connections* on page 4-6 for information on connecting I/O devices to the LIO-06 Module.
- Refer to 5.2 *Specifications of DO-01 Module Connections* on page 5-5 for information on connecting I/O devices to the DO-01 Module.
- Refer to 6.2 *Specifications of DI-01 Module Connections* on page 6-6 for information on connecting I/O devices to the DI-01 Module.

#### 2. Create Module Configurations.

##### a) Mounting New Modules

Execute self-configuration for each slot in which an I/O Module was mounted.

- Refer to 1.3 *Self-configuration* on page 1-12 for information on self-configuration.

##### b) Replacing Modules

Turn OFF the CNFG and INIT DIP switch pins on the Machine Controller and turn ON the power supply. Once the power has been turned ON, the module configuration can be modified as required.

- Refer to 1.4 *Module Configuration Definition* on page 1-15 for information on the Module configuration.

## 1.2.2 Removing an I/O Module

Use the following procedure to remove an I/O Module.

### ( 1 ) Preparation

#### 1. Backup the Programs.

Save the programs written to the Machine Controller in the personal computer using MPE720.

#### 2. Remove the Machine Controller and Expansion Rack.

Turn OFF the power supply and remove all the cables connected to the Machine Controller or Expansion Rack. Then, remove the Machine Controller and Expansion Rack from the panel or rack, and place them where there is sufficient space, such as on a work table.

### ( 2 ) Replacing and Adding Optional Modules

Use the following procedure to replace or add Optional Modules.

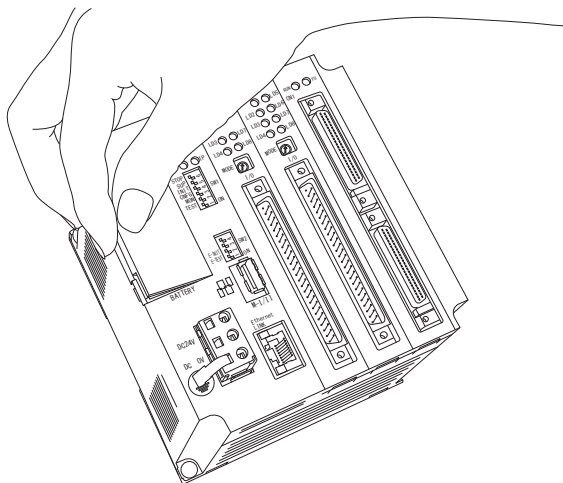


- Always create a backup before replacing or adding Optional Modules.
- Back up the program from the Machine Controller to the PC using the MPE720.

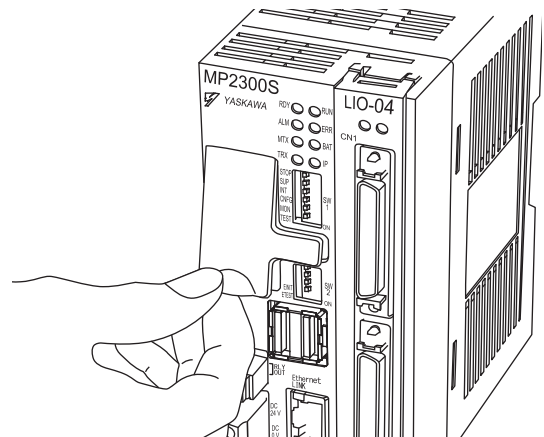
#### 1. Turn OFF the power supply and disconnect all cables from the Machine Controller.

#### 2. Pull the notch on the side toward you to remove the battery cover.

<MP2200/MP2300>



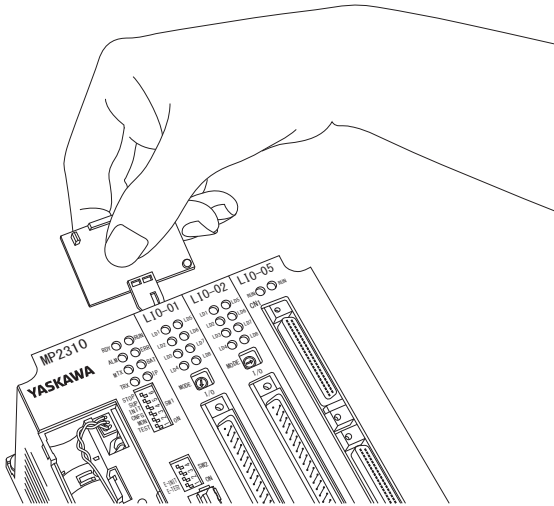
<MP2310/MP2300S>



3. Insert the protruding part of the battery cover into the slot on top of the Optional Module panel to unhook the tab. Face the front of the battery cover toward you for this operation.

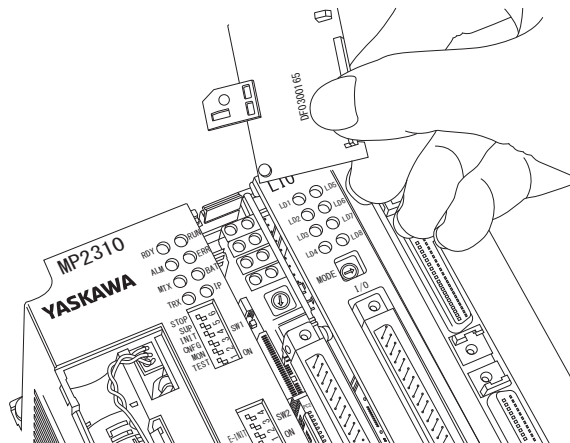


- Use the same method to remove the Option Cover from an unused slot before adding an Optional Module.
- 

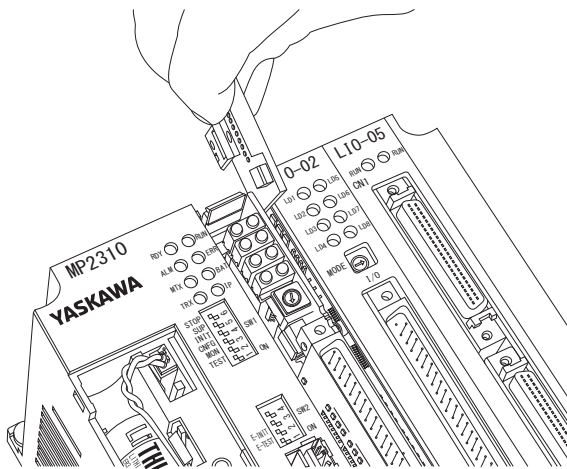


Unhook the bottom tab in the same way.

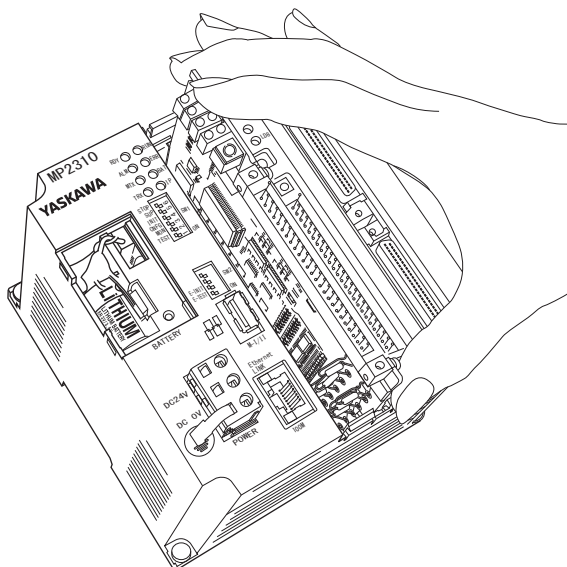
4. Pull the top of the Optional Module panel toward you and remove it. A notch on the Optional Module will be visible from the gap with the panel. Hook the round knob on the battery cover into the notch in the Optional Module.



5. Hold the center of the battery cover, and turn it around the round knob while pushing it toward the back to disconnect the Module from the Mounting Base connectors. Then, pull the Module forward.



6. Hold the Optional Module at the top and bottom and pull it straight out. Hold the edges of the Module and avoid touching the components on the Module.



- \* Put the Module that you removed into the bag that was supplied when you purchased it and store the Module in this bag.

## 1.3 Self-configuration

The self-configuration function automatically detects the Option Modules connected to the Machine Controller and automatically generates the files for the Module configuration definitions and the detailed definition of each Module. Executing self-configuration will greatly reduce the system startup procedure.



- After executing self-configuration, always save data to flash memory so that the results of self-configuration are saved in the Machine Controller.
- When self-configuration is executed, I/O registers are allocated in order of the slot numbers from the leading register. If register allocations have been changed manually, the register allocations will be overwritten when self-configuration is executed.  
To keep any register allocations that were changed manually, do not use self-configuration again, but rather manually allocate I/O registers for the added Option Modules.
- Refer to 1.4.3 ( 2 ) *Manual Allocation of I/O Registers* on page 1-17 for information on manually allocating I/O registers.

### 1.3.1 Executing Self-configuration

The methods used to execute self-configuration are described below.

#### ( 1 ) Setting the CNFG DIP Switch Pin and Cycling Power (MP2200/MP2300/MP2300S/MP2310)

Self-configuration can be executed by turning ON the CNFG DIP switch pin on the Machine Controller and turning the power OFF and then ON again. The result will depend on the setting of the INIT DIP switch pin.

| CNFG | INIT | Result                                                                                                                                                                                                                                                                                                          |
|------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ON   | ON   | <ul style="list-style-type: none"> <li>• The Module configuration definitions are updated.</li> <li>• The default allocations are made for all of the I/O Modules that are detected.</li> </ul>                                                                                                                 |
| ON   | OFF  | <ul style="list-style-type: none"> <li>• The Module configuration definitions are updated.</li> <li>• The definitions for any Modules for which there are already definitions are not changed.</li> <li>• The default values are allocated in the definitions for any new Modules that are detected.</li> </ul> |

- The DIP switch is not normally used for the MP2100M. For these Machine Controllers, use the MPE720 as described next.

#### ( 2 ) Using the MPE720

Start the MPE720, start the Engineering Manager, and then select **Order - Self Configure All Modules** from the Main Menu. Alternatively, select the Module for which self-configuration is to be executed in the **Module Configuration** Window, and then select **Order - Module Self-configuration** from the Main Menu.

- Refer to 1.4.1 *Displaying the Module Configuration Window* on page 1-15 for the procedure to display the **Module Configuration** Window.

The result depends on the command that is used, as described below.

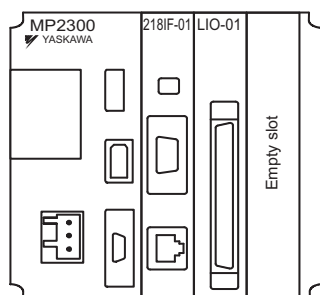
| INIT                               | Result                                                                                                                                                                                                                                                                                                                |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Self-configuration for all Modules | <ul style="list-style-type: none"> <li>• The Module configuration definitions are updated.</li> <li>• The definitions for any Modules for which there are already definitions are not changed.</li> <li>• The default values are allocated in the definitions for any new Modules that are detected.</li> </ul>       |
| Module Self-configuration          | <ul style="list-style-type: none"> <li>• Definitions are allocated only for the selected Module.</li> <li>• The definitions for any Modules for which there are already definitions are not changed.</li> <li>• The default values are allocated in the definitions for any new Modules that are detected.</li> </ul> |

### 1.3.2 Example of I/O Register Allocation by Self-Configuration

I/O registers are allocated to each Function Module when self-configuration is executed. The allocated leading I/O registers, IW□□00 and OW□□00, are integral multiples of 16 words.

An example of the I/O register allocation by self-configuration is shown below.

<Register Allocations with 218IF-01 Mounted in Slot No.1 and LIO-01 in Slot No.2 of the MP2300>



With this configuration, I/O registers will be reserved for each Function Module as shown in the following table.

| Function Module Name       | I/O Size            |
|----------------------------|---------------------|
| CPU I/O <sup>*1</sup>      | 2 words (0002h)     |
| Built-in SVB <sup>*2</sup> | 1,024 words (0400h) |
| LIO-01/LIO                 | 2 words (0002h)     |
| LIO-01/CNTR                | 32 words (0020h)    |

- \* 1. The I/O Module built into the CPU of the Machine Controller.
- \* 2. The SVB Module built into the CPU of the Machine Controller.

Registers are allocated as a result of self-configuration as shown in the following window.

| Module                  | Function Module/Slave | Status  | Circuit No/AxisAddress                          |               | Motion Register | Register(Input/Output)                                            |                |      |      | Comment |
|-------------------------|-----------------------|---------|-------------------------------------------------|---------------|-----------------|-------------------------------------------------------------------|----------------|------|------|---------|
|                         |                       |         | Start                                           | Occupied circ |                 | Disabled                                                          | Start - End    | Size | Scan |         |
| 01 MP2300 : ---         |                       |         |                                                 |               |                 |                                                                   |                |      |      |         |
| 00 [MP2300][Driving]    | 01 CPU                | Driving | ---                                             | ---           | ---             | ---                                                               | ---            | ---  | ---  |         |
|                         | 02 IO                 | Driving | ---                                             | 1             | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0000 - 0001[H] | 2    | ---  |         |
|                         | 03 [SVB]              | Driving | <input checked="" type="checkbox"/> Circuit No1 | 1             | 8000 - 87FF[H]  | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0010 - 040F[H] | 1024 | ---  |         |
|                         | 04 [SVR]              | Driving | <input checked="" type="checkbox"/> Circuit No2 | 1             | 8800 - 8FFF[H]  | ---                                                               | ---            | ---  | ---  |         |
| 01 [218IF-01][Driving]  | 01 217IF              | Driving | <input checked="" type="checkbox"/> Circuit No1 | 1             | ---             | ---                                                               | ---            | ---  | ---  |         |
|                         | 02 218IF              | Driving | <input checked="" type="checkbox"/> Circuit No1 | 1             | ---             | ---                                                               | ---            | ---  | ---  |         |
| 02 [LIO-01][Empty]      | 01 LIO                | Driving | ---                                             | 1             | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0410 - 0411[H] | 2    | ---  |         |
|                         | 02 CNTR               | Driving | ---                                             | 1             | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0420 - 043F[H] | 32   | ---  |         |
| 03 -- UNDEFINED --[---] |                       | ---     |                                                 |               |                 |                                                                   |                |      |      |         |

Fig. 1.1 Module Details of a Basic Module

| Module                  | Function Module/Slave | Status  | Circuit No./AxisAddress                                                                       |               | Motion Register | Register(Input/Output)                                                                                                                                                              |                |      |      | Comment |
|-------------------------|-----------------------|---------|-----------------------------------------------------------------------------------------------|---------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------|------|---------|
|                         |                       |         | Start                                                                                         | Occupied circ |                 | Disabled                                                                                                                                                                            | Start - End    | Size | Scan |         |
| 01 MP2300 :---          |                       |         |                                                                                               |               |                 |                                                                                                                                                                                     |                |      |      |         |
| 00 MP2300[Driving]      | 01 CPU                | Driving | ---                                                                                           | ---           | ---             |                                                                                                                                                                                     | ---            | ---  | ---  |         |
|                         | 02 IO                 | Driving | ---                                                                                           | 1             | ---             |  Input<br> OutPut | 0000 - 0001[H] | 2    | ---  |         |
|                         | 03 SVB                | Driving |  Circuit No1 | 1             | 8000 - 87FF[H]  |  Input<br> OutPut | 0010 - 040F[H] | 1024 | ---  |         |
|                         | 04 SVR                | Driving |  Circuit No2 | 1             | 8800 - 8FFF[H]  |                                                                                                                                                                                     | ---            | ---  | ---  |         |
| 01 218IF-01[Driving]    | 01 217IF              | Driving |  Circuit No1 | 1             | ---             |                                                                                                                                                                                     | ---            | ---  | ---  |         |
|                         | 02 218IF              | Driving |  Circuit No1 | 1             | ---             |                                                                                                                                                                                     | ---            | ---  | ---  |         |
| 02 LIO-01[Empty]        | 01 LIO                | Driving | ---                                                                                           | 1             | ---             |  Input<br> OutPut | 0410 - 0411[H] | 2    | ---  |         |
|                         | 02 CNTR               | Driving | ---                                                                                           | 1             | ---             |  Input<br> OutPut | 0420 - 043F[H] | 32   | ---  |         |
| 03 -- UNDEFINED --[---] |                       |         |                                                                                               |               |                 |                                                                                                                                                                                     |                |      |      |         |

Fig. 1.2 Module Details of the LIO-01 Module

♦ Refer to 1.4.1 *Displaying the Module Configuration Window* on page 1-15 for information on displaying the **Module Configuration Window**.  
The following figure illustrates I/O register allocation.

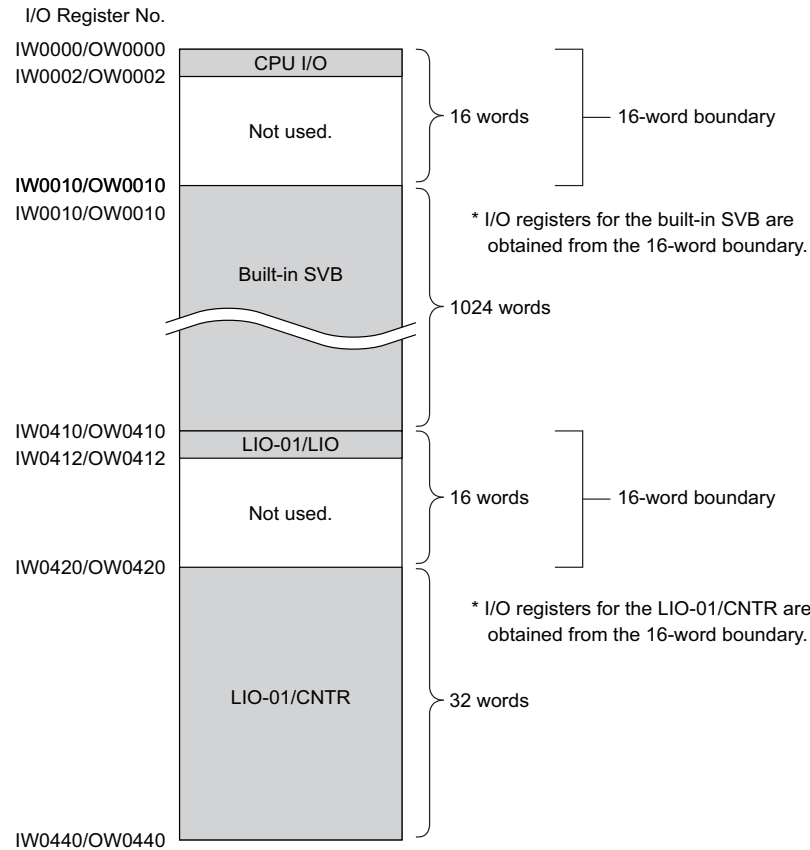


Fig. 1.3 Illustration of I/O Register Allocation

## 1.4 Module Configuration Definition

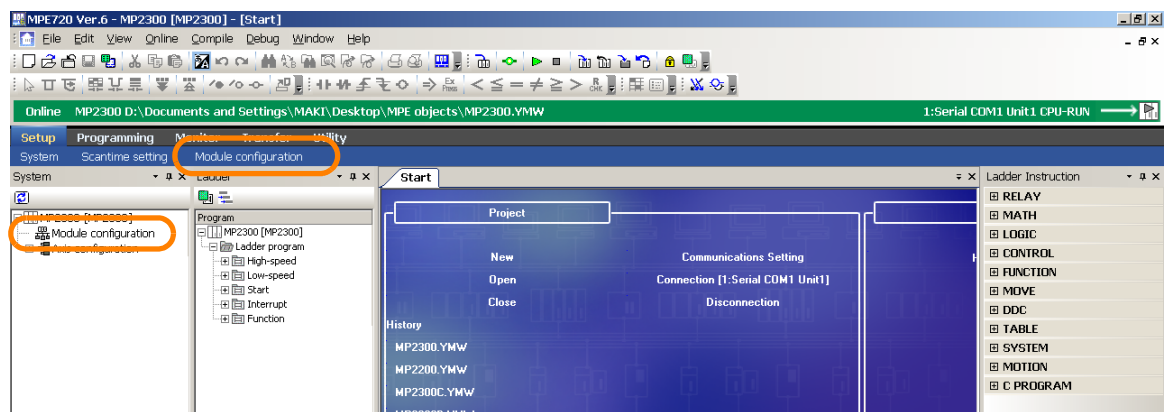
Execution of the self-configuration generates the files for the Module configuration definitions of the default settings. To change the Module configuration definition, call up the **Module Configuration** Window as described below to change the definition data.

### 1.4.1 Displaying the Module Configuration Window

Use the following procedure to display the **Module Configuration** Window.

#### ■ MPE720 Ver. 6 and Ver.7

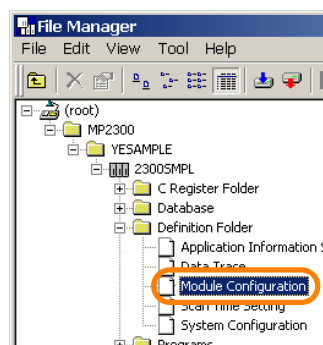
1. Start the MPE720 on the personal computer connected to the Machine Controller and open the project file.
  - ♦ For information on starting the MPE720, refer to *Engineering Tool for MP2000 Series Machine Controller MPE720 Version 6 User's Manual (Manual No.: SIEPC88070030)* and *Machine Controller MP2000/MP3000 Series Engineering Tool MPE720 Ver.7 USER'S MANUAL (Manual No.: SIEPC88076103)*.
2. Select **Setup - Module configuration** in the Launcher, or double-click **Module configuration** of system sub-program.



The **Module Configuration** Window will be displayed (see next page).

#### ■ MPE720 Ver. 5

1. Start the MPE720 on the personal computer connected to the Machine Controller and use the File Manager to log in and go online with the application for the Machine Controller.
  - ♦ For information on starting the MPE720 and logging on, refer to *Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual (Manual No.: SIEPC88070005)*.
2. Double-click the **Module Configuration** Icon in the **Definition Folder**.



The **Module Configuration** Window will be displayed (see next page).

## 1.4.2 Module Configuration Window

The **Module Configuration** Window displays the built-in functions of the Machine Controller and information about Function Modules and Slave Modules.

| Module             | Function Module/Slave | Status | Circuit No/AxisAddress |             | Motion Register | Register(Input/Output) |                |      |      | Comment |
|--------------------|-----------------------|--------|------------------------|-------------|-----------------|------------------------|----------------|------|------|---------|
|                    |                       |        | Start                  | cupied circ |                 | Disabled               | Start - End    | Size | Scan |         |
| 01 [MP2300] : --   |                       |        |                        |             |                 |                        |                |      |      |         |
| 00 [MP2300] : --   | 01 CPU                | ----   | ----                   | ----        | ----            | ----                   | ----           | ---- | ---- |         |
|                    | 02 IO                 |        | ----                   | 1           | ----            | Input<br>OutPut        | 0000 - 0001[H] | 2    | ---- |         |
|                    | 03 [SVB]              |        | Circuit No1            | 1           | 8000 - 87FF[H]  | Input<br>OutPut        | 0010 - 040F[H] | 1024 | ---- |         |
|                    | 04 [SVR]              | ----   | Circuit No2            | 1           | 8800 - 8FFF[H]  | ----                   | ----           | ---- | ---- |         |
| 01 [LIO-01] : --   | 01 LIO                |        | ----                   | 1           | ----            | Input<br>OutPut        | 0420 - 0421[H] | 2    | ---- |         |
|                    | 02 CNTR               |        | ----                   | 1           | ----            | Input<br>OutPut        | 0430 - 044F[H] | 32   | ---- |         |
| 02 [LIO-02] : --   | 01 LIO                |        | ----                   | 1           | ----            | Input<br>OutPut        | 0410 - 0411[H] | 2    | ---- |         |
|                    | 02 CNTR               |        | ----                   | 1           | ----            | Input<br>OutPut        | 0460 - 047F[H] | 32   | ---- |         |
| 03 -- UNDEFINED -- |                       | ----   |                        |             |                 |                        |                |      |      |         |

Fig. 1.4 MP2300/MP2300S/MP2310 Module Configuration Window

| Module              | Function Module/Slave | Status | Circuit No/AxisAddress |             | Motion Register | Register(Input/Output) |                |      |      | Comment |
|---------------------|-----------------------|--------|------------------------|-------------|-----------------|------------------------|----------------|------|------|---------|
|                     |                       |        | Start                  | cupied circ |                 | Disabled               | Start - End    | Size | Scan |         |
| 01 [MP2200-02] : -- |                       |        |                        |             |                 |                        |                |      |      |         |
| 00 [CPU-02] : --    | 01 CPU                | ----   | ----                   | ----        | ----            | ----                   | ----           | ---- | ---- |         |
|                     | 02 [SVR]              | ----   | Circuit No1            | 1           | 8000 - 87FF[H]  | ----                   | ----           | ---- | ---- |         |
|                     | 03 CARD               | ----   | ----                   | ----        | ----            | ----                   | ----           | ---- | ---- |         |
|                     | 04 USB                |        | Circuit No1            | 1           | ----            | ----                   | ----           | ---- | ---- |         |
| 01 [SVB-01] : --    | 01 [SVB01]            |        | Circuit No2            | 1           | 8800 - 8FFF[H]  | Input<br>OutPut        | 0000 - 03FF[H] | 1024 | ---- |         |
| 02 [218IF-01] : --  | 01 217IF              |        | Circuit No1            | 1           | ----            | ----                   | ----           | ---- | ---- |         |
|                     | 02 218IF              |        | Circuit No1            | 1           | ----            | ----                   | ----           | ---- | ---- |         |
| 03 [LIO-01] : --    | 01 LIO                |        | ----                   | 1           | ----            | Input<br>OutPut        | 0400 - 0401[H] | 2    | ---- |         |
|                     | 02 CNTR               |        | ----                   | 1           | ----            | Input<br>OutPut        | 0410 - 042F[H] | 32   | ---- |         |
| 04 -- UNDEFINED --  |                       | ----   |                        |             |                 |                        |                |      |      |         |
| 05 -- UNDEFINED --  |                       | ----   |                        |             |                 |                        |                |      |      |         |
| 06 -- UNDEFINED --  |                       | ----   |                        |             |                 |                        |                |      |      |         |
| 07 -- UNDEFINED --  |                       | ----   |                        |             |                 |                        |                |      |      |         |
| 08 -- UNDEFINED --  |                       | ----   |                        |             |                 |                        |                |      |      |         |
| 02 -- UNDEFINED --  |                       | ----   |                        |             |                 |                        |                |      |      |         |
| 03 -- UNDEFINED --  |                       | ----   |                        |             |                 |                        |                |      |      |         |
| 04 -- UNDEFINED --  |                       | ----   |                        |             |                 |                        |                |      |      |         |

Fig. 1.5 MP2100M/MP2200 Module Configuration Window

## 1.4.3 Changing the Module Configuration Definition

### ( 1 ) Module Details

Function details can be set in the **Module Configuration** Window.

- Refer to 2.3 *LIO-01/LIO-02 Module Details* on page 2-16 for information on setting LIO-01/LIO-02 Module details.
- Refer to 3.3 *LIO-04/ LIO-05 Module Details* on page 3-20 for information on setting LIO-04/LIO-05 Module details.
- Refer to 4.3 *LIO-06 Module Details* on page 4-15 for information on setting LIO-06 Module details.
- Refer to 5.3 *DO-01 Module Details* on page 5-14 for information on setting DO-01 Module details.
- Refer to 6.3 *DI-01 Module Details* on page 6-13 for information on setting DI-01 Module details.

### ( 2 ) Manual Allocation of I/O Registers

I/O registers can be changed in the **Module Configuration** Window.

Double-click the I/O leading register, input the desired value, and confirm the change.

| Module           | Function Module/Slave | Status | Circuit No/AxisAddress |           | Motion Register | Register(Input/Output) |                |      |      | Comment |
|------------------|-----------------------|--------|------------------------|-----------|-----------------|------------------------|----------------|------|------|---------|
|                  |                       |        | Start                  | Used circ |                 | Disabled               | Start - End    | Size | Scan |         |
| 01 [MP2300] :--- | 01 CPU                | ---    | ---                    | ---       | ---             | ---                    | ---            | ---  | ---  | ---     |
| 00 [MP2300] :--- | 02 IO                 | ---    | ---                    | 1         | ---             | Input<br>Output        | 0000 - 0001[H] | 2    | ---  | ---     |
|                  | 03 [SVB]              | ---    | Circuit No1            | 1         | 8000 - 87FF[H]  | Input<br>Output        | 0010 - 040F[H] | 1024 | ---  | ---     |
|                  | 04 [SVR]              | ---    | Circuit No2            | 1         | 8800 - 8FFF[H]  | ---                    | ---            | ---  | ---  | ---     |
|                  | 01 LIO                | ---    | ---                    | 1         | ---             | Input<br>Output        | 0420 - 0421[H] | 2    | ---  | ---     |
| 01 [LIO-02] :--- | 02 CNTR               | ---    | ---                    | 1         | ---             | Input<br>Output        | 0430 - 044F[H] | 32   | ---  | ---     |
| 02 [LIO-04] :--- | 01 LIO32              | ---    | ---                    | 1         | ---             | Input<br>Output        | 0410 - 0411[H] | 2    | ---  | ---     |
| 03 [DO-01] :---  | 01 DO                 | ---    | ---                    | 1         | ---             | Input<br>Output        | 0450 - 0453[H] | 4    | ---  | ---     |

The I/O end register will be changed automatically when the I/O leading register is changed.

After changing the register number, save the definition data by selecting **Online – Save to Flash** from the main menu.

- When changing a register number, make sure that the new register number is not already allocated. If a register number that is already allocated is used, the text will turn red. If this occurs, change the register number.

## LIO-01/LIO-02 Module

This chapter describes the LIO-01/LIO-02 Module in detail.

|                                                                         |      |
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## 2.1 Outline of LIO-01/LIO-02 Modules

### 2.1.1 Outline of Functions

The LIO-01 and LIO-02 Modules are I/O Modules having digital I/O and pulse counter functions. There are 16 digital inputs (DI) and 16 digital outputs (DO) (LIO-01: sink mode outputs, LIO-02: source mode outputs) for the digital I/O function. There is also 1 pulse input (PI) channel for the pulse counter function.

Digital I/O and pulse input are made at a periodical cycle for each high-speed scan or low-speed scan of the MP2000 Series Machine Controller. The following diagram outlines the functions of the LIO-01 and LIO-02 Module.

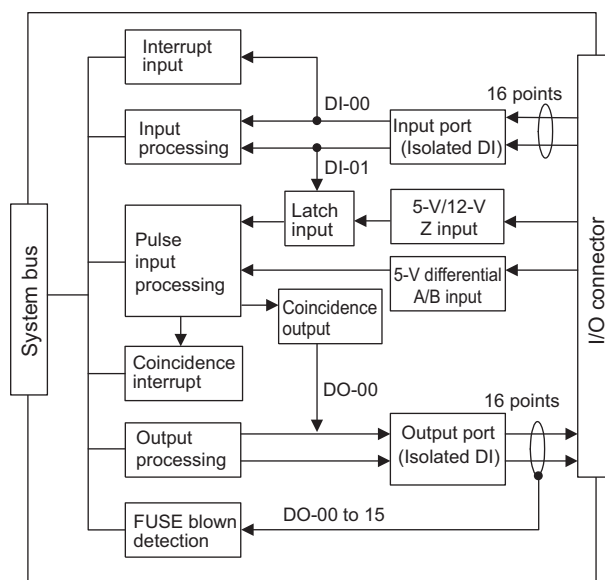
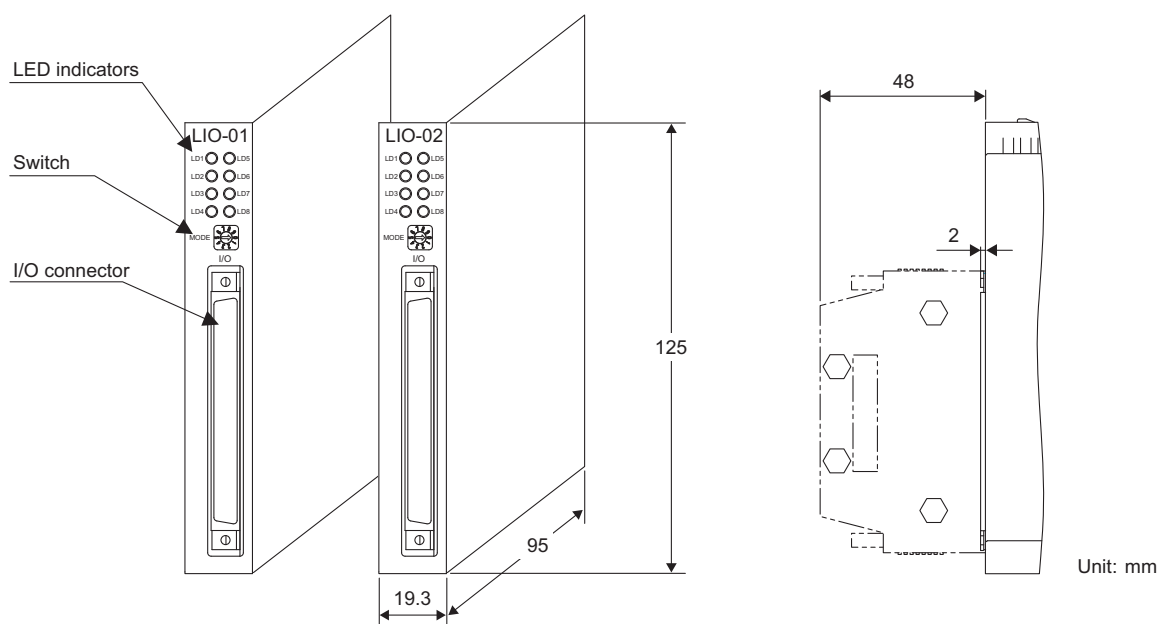


Fig. 2.1 Outline of LIO-01/LIO-02 Module Functions

### 2.1.2 LIO-01/LIO-02 Module Appearance and Connector External Dimensions

The following figure shows the appearance of the LIO-01/LIO-02 Modules and their connector external dimensions.



- ♦ LIO-01 and LIO-02 Modules have the same external dimensions for the connector.

## 2.1.3 Specifications

The following shows the specifications of the LIO-01/LIO-02 Modules.

### ( 1 ) Hardware Specifications

| Item                | Specifications                                                                                                                                                                          |                                                                                                                          |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Classification      | I/O Module                                                                                                                                                                              |                                                                                                                          |
| Name                | LIO-01                                                                                                                                                                                  | LIO-02                                                                                                                   |
| Model               | JAPMC-IO2300 (-E)                                                                                                                                                                       | JAPMC-IO2301 (-E)                                                                                                        |
| Digital Input       | 16 inputs<br>24 VDC, 4.1 mA, combined sink mode/source mode inputs<br>(DI_00 also used for interrupts, DI-01 also used for pulse latch inputs)                                          |                                                                                                                          |
| Digital Output      | 16 outputs<br>24 VDC transistor open-collector outputs, sink mode outputs<br>(DO_00 also used for coincidence outputs)                                                                  | 16 outputs<br>24 VDC transistor open-collector outputs, source mode outputs<br>(DO_00 also used for coincidence outputs) |
| Pulse Input         | Phase A/B/Z inputs<br>Phase AB: 5-V differential input, not isolated, max. frequency: 4 MHz<br>Phase Z: 5-V/12-V photocoupler input<br>Latch input<br>Pulse latch for phase Z or DI_01. |                                                                                                                          |
| Connector           | I/O: I/O connector                                                                                                                                                                      |                                                                                                                          |
| LED Indicators      | LD1 (green)<br>LD2 (green)<br>LD3 (green)<br>LD4 (green)<br>LD5 (green)<br>LD6 (green)<br>LD7 (green)<br>LD8 (green)                                                                    |                                                                                                                          |
| Switch              | Rotary switch (SW1)                                                                                                                                                                     |                                                                                                                          |
| Current Consumption | 500 mA max.                                                                                                                                                                             |                                                                                                                          |
| Dimensions (mm)     | 125 × 95 (H × D)                                                                                                                                                                        |                                                                                                                          |
| Mass                | 80 g                                                                                                                                                                                    |                                                                                                                          |

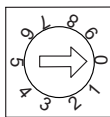
## ( 2 ) Environmental Conditions

| Item                            |                               | Specifications                                                                                                                                                                                                                                                                    |
|---------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions        | Ambient Operating Temperature | 0 to 55°C                                                                                                                                                                                                                                                                         |
|                                 | Ambient Storage Temperature   | -25 to 85°C                                                                                                                                                                                                                                                                       |
|                                 | Ambient Operating Humidity    | 30% to 95% (with no condensation)                                                                                                                                                                                                                                                 |
|                                 | Ambient Storage Humidity      | 5% to 95% (with no condensation)                                                                                                                                                                                                                                                  |
|                                 | Pollution Level               | Pollution level 2 (conforming to JIS B 3502)                                                                                                                                                                                                                                      |
|                                 | Corrosive Gas                 | There must be no combustible or corrosive gas.                                                                                                                                                                                                                                    |
|                                 | Operating Altitude            | 2,000 m above sea level or lower                                                                                                                                                                                                                                                  |
| Mechanical Operating Conditions | Vibration Resistance          | Conforming to JIS B 3502: <ul style="list-style-type: none"> <li>• 10 to 57 Hz with single-amplitude of 0.075 mm</li> <li>• 57 to 150 Hz with fixed acceleration of 9.8 m/s<sup>2</sup></li> <li>• 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)</li> </ul> |
|                                 | Shock Resistance              | Conforming to JIS B 3502:<br>Peak acceleration of 147 m/s <sup>2</sup> twice for 11 ms each in the X, Y, and Z directions                                                                                                                                                         |
| Electrical Operating Conditions | Noise Resistance              | Conforming to EN 61000-6-2, EN 61000-6-4, EN 55011 (Group 1 Class A)                                                                                                                                                                                                              |
| Installation Requirements       | Ground                        | Ground to 100 Ω max.                                                                                                                                                                                                                                                              |
|                                 | Cooling Method                | Natural cooling                                                                                                                                                                                                                                                                   |

## 2.1.4 LED Indicators and Switch Settings

LD1 ○ ○ LD5  
LD2 ○ ○ LD6  
LD3 ○ ○ LD7  
LD4 ○ ○ LD8

Indicators



SW1

The LIO-01 and LIO-02 Module status display LED indicators (LD1 to LD8) change based on the SW1 rotary switch settings (setting range: 0 to 5). The following table shows the indicator display for DI and DO status according to the SW1 setting.

| SW1 (Rotary Switch)<br>Set Value | LD No. | Status When Lit (Green)                  | LD No. | Status When Lit (Green)                  |
|----------------------------------|--------|------------------------------------------|--------|------------------------------------------|
| 0<br>(Board Status Indicator)    | LD1    | Normal (Error when not lit)              | LD5    | Normal (Error when not lit)              |
|                                  | LD2    | One of the inputs DI_00 to DI_07 is ON.  | LD6    | One of the inputs DI_08 to DI_15 is ON.  |
|                                  | LD3    | One of the outputs DO_00 to DO_07 is ON. | LD7    | One of the outputs DO_08 to DO_15 is ON. |
|                                  | LD4    | Pulse A/B input. The Phase A/B is ON.    | LD8    | Pulse Z input. The Phase Z is ON.        |
| 1<br>(DI Input Indicator 1)      | LD1    | DI_00 is ON.                             | LD5    | DI_04 is ON.                             |
|                                  | LD2    | DI_01 is ON.                             | LD6    | DI_05 is ON.                             |
|                                  | LD3    | DI_02 is ON.                             | LD7    | DI_06 is ON.                             |
|                                  | LD4    | DI_03 is ON.                             | LD8    | DI_07 is ON.                             |
| 2<br>(DI Input Indicator 2)      | LD1    | DI_08 is ON.                             | LD5    | DI_12 is ON.                             |
|                                  | LD2    | DI_09 is ON.                             | LD6    | DI_13 is ON.                             |
|                                  | LD3    | DI_10 is ON.                             | LD7    | DI_14 is ON.                             |
|                                  | LD4    | DI_11 is ON.                             | LD8    | DI_15 is ON.                             |
| 3<br>(DO Output Indicator 1)     | LD1    | DO_00 is ON.                             | LD5    | DO_04 is ON.                             |
|                                  | LD2    | DO_01 is ON.                             | LD6    | DO_05 is ON.                             |
|                                  | LD3    | DO_02 is ON.                             | LD7    | DO_06 is ON.                             |
|                                  | LD4    | DO_03 is ON.                             | LD8    | DO_07 is ON.                             |
| 4<br>(DO Output Indicator 2)     | LD1    | DO_08 is ON.                             | LD5    | DO_12 is ON.                             |
|                                  | LD2    | DO_09 is ON.                             | LD6    | DO_13 is ON.                             |
|                                  | LD3    | DO_10 is ON.                             | LD7    | DO_14 is ON.                             |
|                                  | LD4    | DO_11 is ON.                             | LD8    | DO_15 is ON.                             |
| 5<br>(PI Input Indicator)        | LD1    | Pulse A input                            | LD5    | Coincidence detection                    |
|                                  | LD2    | Pulse B input                            | LD6    | Phase-Z latch                            |
|                                  | LD3    | Pulse Z input                            | LD7    | DI latch                                 |
|                                  | LD4    | —                                        | LD8    | —                                        |

## 2.2 Specifications of LIO-01/LIO-02 Module Connections

### 2.2.1 Connector Specifications

The LIO-01/LIO-02 Module connector connects the external I/O signals or pulse input signal. (External input: 16 points, external output: 16 points, pulse input: 1 channel)

The following tables provide the specifications of the LIO-01/LIO-02 Module connector.

#### ( 1 ) Connector Model

| Name          | Connector Name | No. of Pins | Connector Model |                                          |                           |
|---------------|----------------|-------------|-----------------|------------------------------------------|---------------------------|
|               |                |             | Module Side     | Cable Side                               | Manufacturer              |
| I/O Connector | I/O            | 48          | FCN-365P048-AU  | FCN-360C048-E (cover),<br>FCN-361J048-AU | Fujitsu Component Limited |
|               |                |             | N365P048AU      | N360C048E (cover),<br>N361J048AU         | OTAX Corporation          |

#### ( 2 ) Connector Pin Arrangement

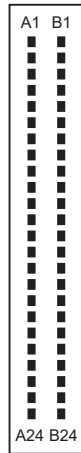
The following table shows the connector pin arrangement for LIO-01/LIO-02 Modules viewed from the wiring side and the details of the pins.

##### [ a ] LIO-01 Module Connector

| Pin No. | Signal Name | I/O | Remarks            | Pin No. | Signal Name | I/O | Remarks                     |
|---------|-------------|-----|--------------------|---------|-------------|-----|-----------------------------|
| A1      | PA          | I   | Phase-A pulse (+)  | B1      | PAL         | I   | Phase-A pulse (–)           |
| A2      | PB          | I   | Phase-B pulse (+)  | B2      | PBL         | I   | Phase-B pulse (–)           |
| A3      | PC          | I   | Phase-Z pulse (+)  | B3      | PCL5        | I   | Phase-Z pulse (–5-V input)  |
| A4      | GND         | I   | Pulse input ground | B4      | PCL12       | I   | Phase-Z pulse (–12-V input) |
| A5      | 0V          | P   | Common ground      | B5      | 0V          | P   | Common ground               |
| A6      | +24V        | P   | 24-V power supply  | B6      | +24V        | P   | 24-V power supply           |
| A7      | DO_15       | O   | Output 15          | B7      | DO_14       | O   | Output 14                   |
| A8      | DO_13       | O   | Output 13          | B8      | DO_12       | O   | Output 12                   |
| A9      | DO_11       | O   | Output 11          | B9      | DO_10       | O   | Output 10                   |
| A10     | DO_09       | O   | Output 9           | B10     | DO_08       | O   | Output 8                    |
| A11     | DO_07       | O   | Output 7           | B11     | DO_06       | O   | Output 6                    |
| A12     | DO_05       | O   | Output 5           | B12     | DO_04       | O   | Output 4                    |
| A13     | DO_03       | O   | Output 3           | B13     | DO_02       | O   | Output 2                    |
| A14     | DO_01       | O   | Output 1           | B14     | DO_00       | O   | Output 0                    |
| A15     | DI_15       | I   | Input 15           | B15     | DI_14       | I   | Input 14                    |
| A16     | DI_13       | I   | Input 13           | B16     | DI_12       | I   | Input 12                    |
| A17     | DI_11       | I   | Input 11           | B17     | DI_10       | I   | Input 10                    |
| A18     | DI_09       | I   | Input 9            | B18     | DI_08       | I   | Input 8                     |
| A19     | DI_07       | I   | Input 7            | B19     | DI_06       | I   | Input 6                     |
| A20     | DI_05       | I   | Input 5            | B20     | DI_04       | I   | Input 4                     |
| A21     | DI_03       | I   | Input 3            | B21     | DI_02       | I   | Input 2                     |
| A22     | DI_01       | I   | Input 1            | B22     | DI_00       | I   | Input 0                     |
| A23     | DI_COM0     | P   | Input common 0     | B23     | DI_COM1     | P   | Input common 1              |
| A24     | FG          |     | Frame ground       | B24     | FG          |     | Frame ground                |

♦ P: Power supply input; I: Input signal; O: Output signal

## [ b ] LIO-02 Module Connector



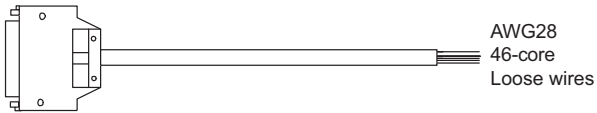
| Pin No. | Signal Name | I/O | Remarks            | Pin No. | Signal Name | I/O | Remarks                     |
|---------|-------------|-----|--------------------|---------|-------------|-----|-----------------------------|
| A1      | PA          | I   | Phase-A pulse (+)  | B1      | PAL         | I   | Phase-A pulse (–)           |
| A2      | PB          | I   | Phase-B pulse (+)  | B2      | PBL         | I   | Phase-B pulse (–)           |
| A3      | PC          | I   | Phase-Z pulse (+)  | B3      | PCL5        | I   | Phase-Z pulse (–5-V input)  |
| A4      | GND         | I   | Pulse input ground | B4      | PCL12       | I   | Phase-Z pulse (–12-V input) |
| A5      | 0V          | P   | 0-V power supply   | B5      | 0V          | P   | 0-V power supply            |
| A6      | +24V        | P   | Common 24V         | B6      | +24V        | P   | Common 24V                  |
| A7      | DO_15       | O   | Output 15          | B7      | DO_14       | O   | Output 14                   |
| A8      | DO_13       | O   | Output 13          | B8      | DO_12       | O   | Output 12                   |
| A9      | DO_11       | O   | Output 11          | B9      | DO_10       | O   | Output 10                   |
| A10     | DO_09       | O   | Output 9           | B10     | DO_08       | O   | Output 8                    |
| A11     | DO_07       | O   | Output 7           | B11     | DO_06       | O   | Output 6                    |
| A12     | DO_05       | O   | Output 5           | B12     | DO_04       | O   | Output 4                    |
| A13     | DO_03       | O   | Output 3           | B13     | DO_02       | O   | Output 2                    |
| A14     | DO_01       | O   | Output 1           | B14     | DO_00       | O   | Output 0                    |
| A15     | DI_15       | I   | Input 15           | B15     | DI_14       | I   | Input 14                    |
| A16     | DI_13       | I   | Input 13           | B16     | DI_12       | I   | Input 12                    |
| A17     | DI_11       | I   | Input 11           | B17     | DI_10       | I   | Input 10                    |
| A18     | DI_09       | I   | Input 9            | B18     | DI_08       | I   | Input 8                     |
| A19     | DI_07       | I   | Input 7            | B19     | DI_06       | I   | Input 6                     |
| A20     | DI_05       | I   | Input 5            | B20     | DI_04       | I   | Input 4                     |
| A21     | DI_03       | I   | Input 3            | B21     | DI_02       | I   | Input 2                     |
| A22     | DI_01       | I   | Input 1            | B22     | DI_00       | I   | Input 0                     |
| A23     | DI_COM0     | P   | Input common 0     | B23     | DI_COM1     | P   | Input common 1              |
| A24     | FG          |     | Frame ground       | B24     | FG          |     | Frame ground                |

♦ P: Power supply input; I: Input signal; O: Output signal

## 2.2.2 Cable Specifications

The following shows the specifications of the LIO-01/LIO-02 Module standard cables.

### ( 1 ) Standard Cable Model List

| Name                                               | Model            | Length | External Appearance (JEPMC-W2061-□□-E)                                             |
|----------------------------------------------------|------------------|--------|------------------------------------------------------------------------------------|
| Cable for LIO-01/02 Modules<br>(Single loose wire) | JEPMC-W2061-A5-E | 0.5 m  |  |
|                                                    | JEPMC-W2061-01-E | 1 m    |                                                                                    |
|                                                    | JEPMC-W2061-03-E | 3 m    |                                                                                    |

### ( 2 ) Standard Cable Wiring Table

The wiring table for the standard cable JEPMC-W2061-□□-E is shown below.

| 48-pin<br>Connector<br>Terminal No. | Marking |                     | Wire Color | Marking |                     | 48-pin<br>Connector<br>Terminal No. |
|-------------------------------------|---------|---------------------|------------|---------|---------------------|-------------------------------------|
|                                     | Color   | Marking             |            | Color   | Marks               |                                     |
| A1                                  | Red     | —                   | Orange     | Black   | —                   | B1                                  |
| A2                                  | Red     | —                   | Gray       | Black   | —                   | B2                                  |
| A3                                  | Red     | —                   | White      | Black   | —                   | B3                                  |
| A4                                  | Red     | —                   | Yellow     | Black   | —                   | B4                                  |
| A5                                  | Red     | —                   | Pink       | Black   | —                   | B5                                  |
| A6                                  | Red     | --                  | Orange     | Black   | --                  | B6                                  |
| A7                                  | Red     | --                  | Gray       | Black   | --                  | B7                                  |
| A8                                  | Red     | --                  | White      | Black   | --                  | B8                                  |
| A9                                  | Red     | --                  | Yellow     | Black   | --                  | B9                                  |
| A10                                 | Red     | --                  | Pink       | Black   | --                  | B10                                 |
| A11                                 | Red     | ----                | Orange     | Black   | ----                | B11                                 |
| A12                                 | Red     | ----                | Gray       | Black   | ----                | B12                                 |
| A13                                 | Red     | ----                | White      | Black   | ----                | B13                                 |
| A14                                 | Red     | ----                | Yellow     | Black   | ----                | B14                                 |
| A15                                 | Red     | ----                | Pink       | Black   | ----                | B15                                 |
| A16                                 | Red     | -----               | Orange     | Black   | -----               | B16                                 |
| A17                                 | Red     | -----               | Gray       | Black   | -----               | B17                                 |
| A18                                 | Red     | -----               | White      | Black   | -----               | B18                                 |
| A19                                 | Red     | -----               | Yellow     | Black   | -----               | B19                                 |
| A20                                 | Red     | -----               | Pink       | Black   | -----               | B20                                 |
| A21                                 | Red     | -----<br>Continuous | Orange     | Black   | -----<br>Continuous | B21                                 |
| A22                                 | Red     | -----<br>Continuous | Gray       | Black   | -----<br>Continuous | B22                                 |
| A23                                 | Red     | -----<br>Continuous | White      | Black   | -----<br>Continuous | B23                                 |
| A24                                 | Shield  |                     |            |         |                     | B24                                 |

### 2.2.3 Input Circuits

The following table shows the LIO-01/LIO-02 Module input circuit specifications.

| Item                | Specifications                                                                                                                                                                                                                                                                                                                                          |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inputs              | 16 points                                                                                                                                                                                                                                                                                                                                               |
| Input Format        | Sink mode/source mode input                                                                                                                                                                                                                                                                                                                             |
| Isolation Method    | Photocoupler                                                                                                                                                                                                                                                                                                                                            |
| Input Voltage       | 24 VDC, $\pm 20\%$ (+19.2 to +28.8 V)                                                                                                                                                                                                                                                                                                                   |
| Input Current       | 4.1 mA (typ.)                                                                                                                                                                                                                                                                                                                                           |
| ON Voltage/Current  | 15 V min./2.0 mA min.                                                                                                                                                                                                                                                                                                                                   |
| OFF Voltage/Current | 5 V max./1.0 mA max.                                                                                                                                                                                                                                                                                                                                    |
| ON Time/OFF Time    | ON: 0.5 ms max.<br>OFF: 0.5 ms max.                                                                                                                                                                                                                                                                                                                     |
| Number of Commons   | 2 (8 points/common)                                                                                                                                                                                                                                                                                                                                     |
| Other Functions     | <ul style="list-style-type: none"> <li>DI_00 is shared with an interrupt input. If DI_00 is turned ON while interrupts are enabled, the interrupt processing drawing (program) is executed.</li> <li>DI_01 is shared with pulse latch inputs. If DI-01 is turned ON while pulse latch inputs are enabled, the pulse counter will be latched.</li> </ul> |

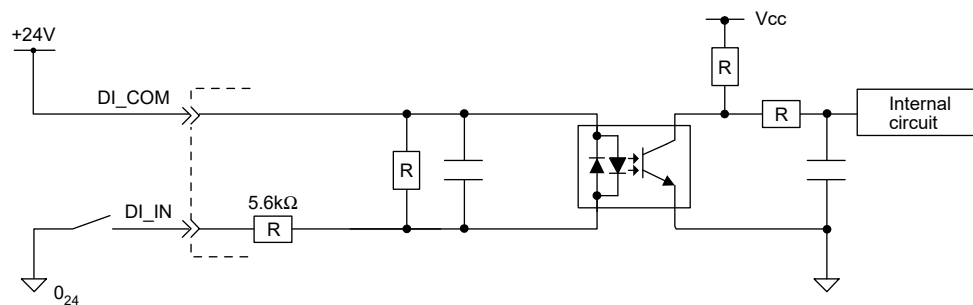


Fig. 2.2 Digital Input Circuit (Source Mode Input)

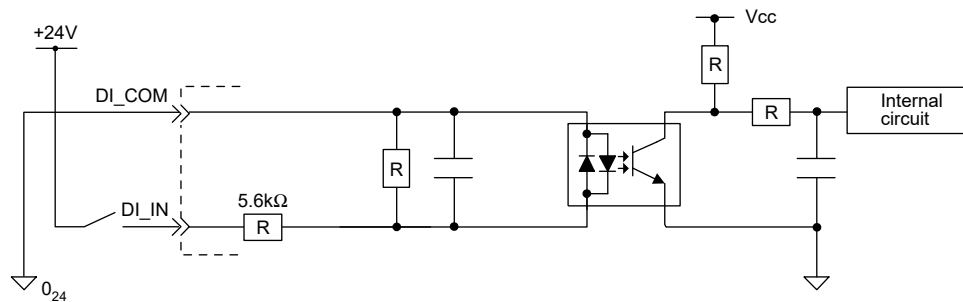


Fig. 2.3 Digital Input Circuit (Sink Mode Input)

## 2.2.4 Output Circuit

The following table shows the LIO-01/LIO-02 Module output circuit specifications.

| Item                     | Specifications                                                                                                                                                                           |                                               |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Outputs                  | 16 points                                                                                                                                                                                |                                               |
| Output Format            | LIO-01                                                                                                                                                                                   | Transistor, open collector sink mode output   |
|                          | LIO-02                                                                                                                                                                                   | Transistor, open collector source mode output |
| Isolation Method         | Photocoupler                                                                                                                                                                             |                                               |
| Output Voltage           | +24 VDC, $\pm 20\%$                                                                                                                                                                      |                                               |
| Output Current           | 100 mA max.                                                                                                                                                                              |                                               |
| Leakage Current When OFF | 0.1 mA max.                                                                                                                                                                              |                                               |
| ON Time/OFF Time         | ON: 1 ms max.<br>OFF: 1 ms max.                                                                                                                                                          |                                               |
| Number of Commons        | 1 (16 points/common)                                                                                                                                                                     |                                               |
| Protection Circuit       | Fuse<br>The fuse is not, however, for circuit protection. It is for protecting against fire at output shorts. Attach a fuse externally to each output if circuit protection is required. |                                               |
| Error Detection          | Fuse blown detection<br>Replace the Module when fuse blown is detected.                                                                                                                  |                                               |
| Other Functions          | DO_00 is shared with counter coincidence output.                                                                                                                                         |                                               |

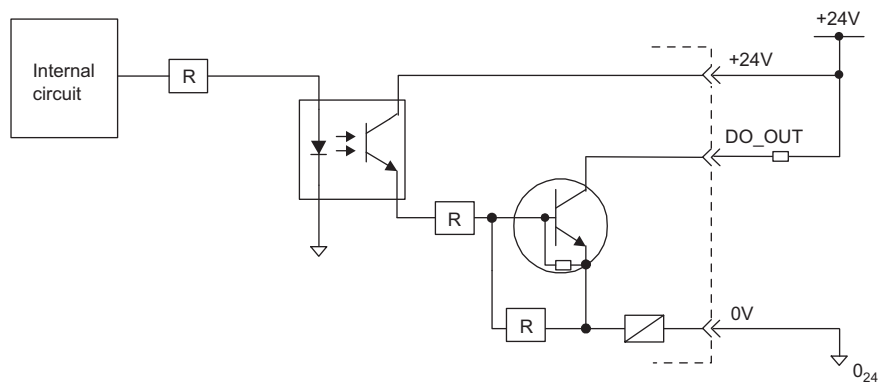


Fig. 2.4 LIO-01 Digital Output Circuit (Sink Mode Output)

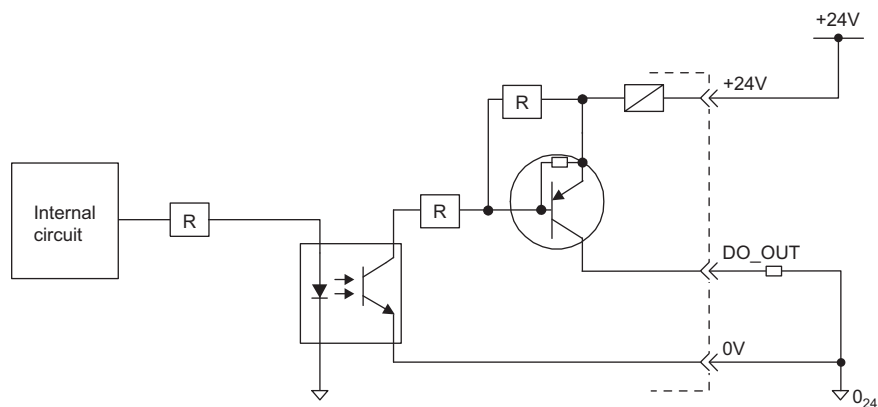


Fig. 2.5 LIO-02 Digital Output Circuit (Source Mode Output)

## 2.2.5 Pulse Input Circuit

The following table shows the LIO-01/LIO-02 Module pulse input circuit specifications.

| Item               | Specifications                                                                                                                                                                         |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of Channels | 1 channel (Phase-A/B/Z input)                                                                                                                                                          |
| Input Circuit      | Phase-AB: 5-V differential input, not isolated, max. frequency: 4 MHz<br>Phase-Z: 5-V/12-V photocoupler input                                                                          |
| Input Mode         | Phase-A/B, signed, incremental/decremental                                                                                                                                             |
| Latch Input        | Pulse latch on phase-Z or DI_01.<br>Response time at phase-Z input<br>ON: 1 $\mu$ s max.<br>OFF: 1 $\mu$ s max.<br>Response time at DI_01 input<br>ON: 0.5 ms max.<br>OFF: 0.5 ms max. |
| Other Functions    | Coincidence detection, counter preset                                                                                                                                                  |

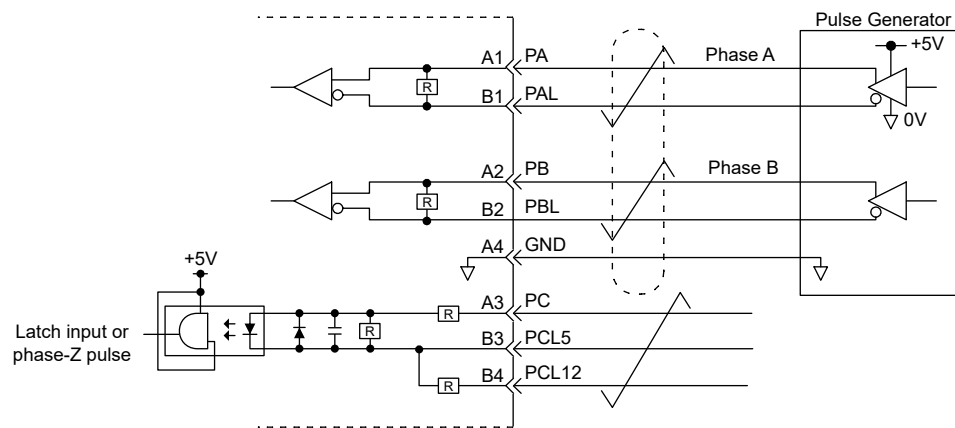
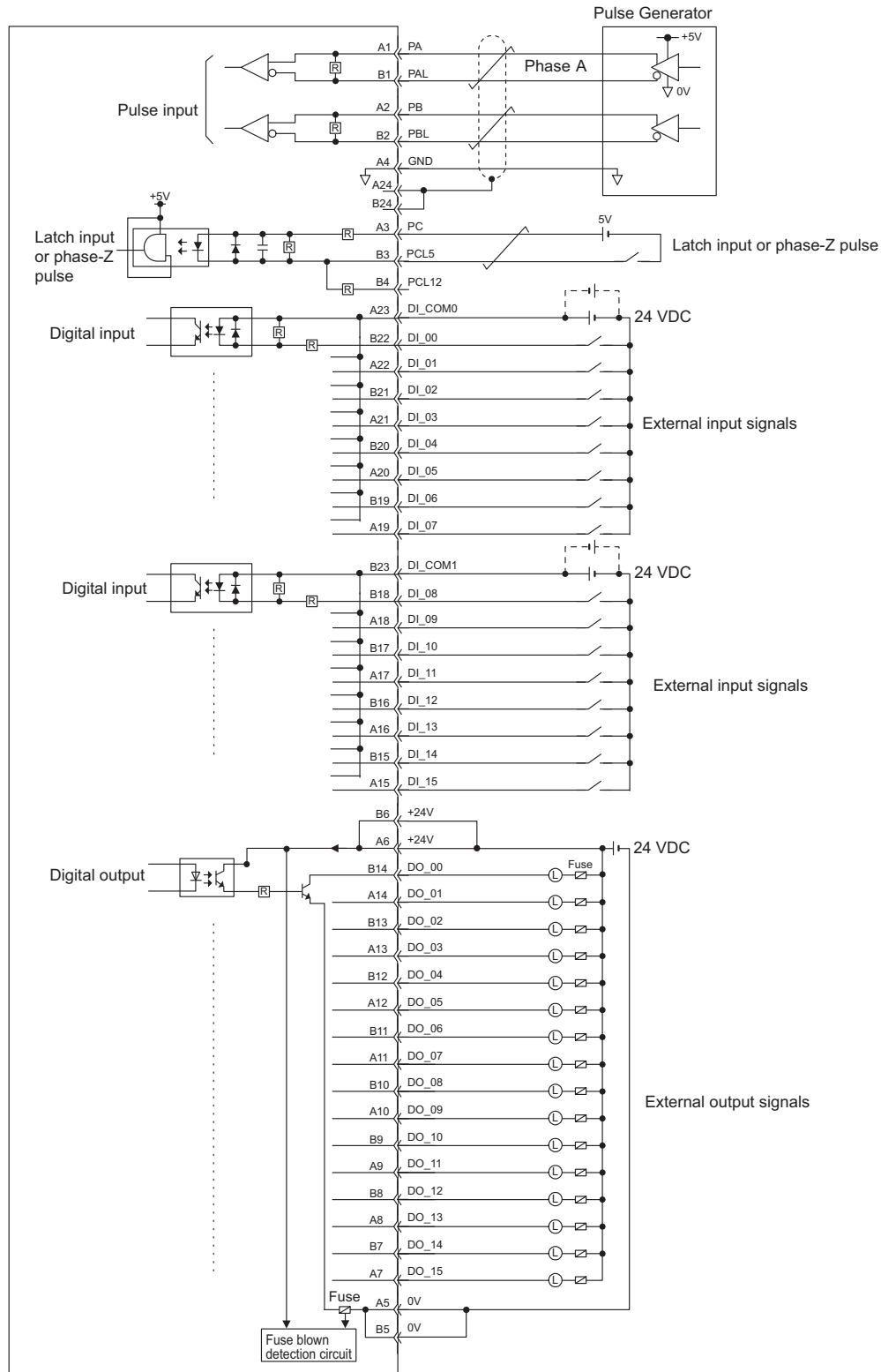


Fig. 2.6 Pulse Input Circuit

## 2.2.6 LIO-01/LIO-02 Module Connections

The following diagrams show connection examples for LIO-01/LIO-02 Module connectors.

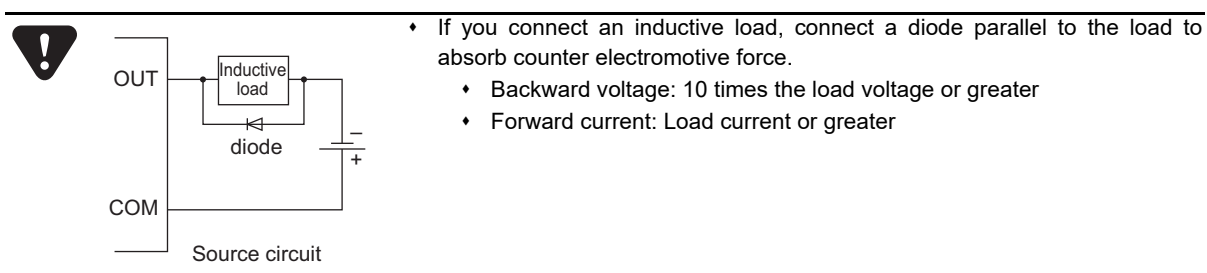
### ( 1 ) LIO-01 Module Connectors



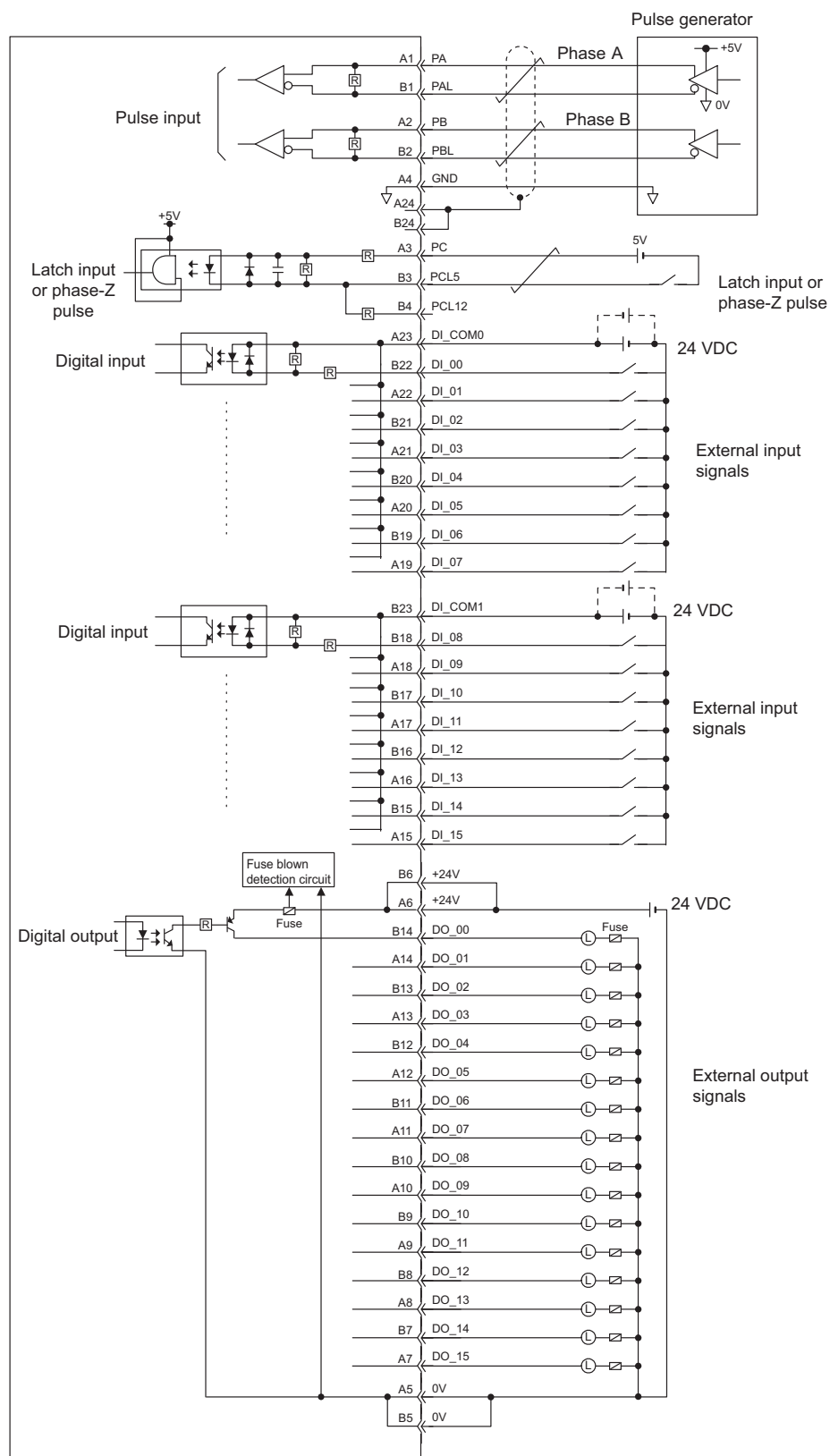
- ♦ The pins No. A5 and B5, and the pins No. A6 and B6 are internally connected. Connect them externally as well.



- ♦ A fuse is inserted in the output common line of the LIO-01 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.



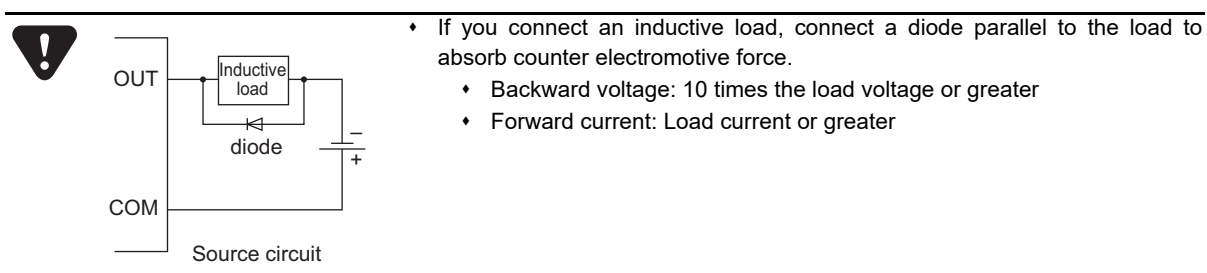
## ( 2 ) LIO-02 Module Connectors



- The pins No. A5 and B5, and the pins No. A6 and B6 are internally connected. Connect them externally as well.



- A fuse is inserted in the output common line of the LIO-02 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.



## 2.3 LIO-01/LIO-02 Module Details

LIO-01/LIO-02 Module details, such as the local I/O and Counter Module functions, can be set in the **Local I/O** Window or the **Counter Module** Window. These window can be displayed from the **Module Configuration** Window.

### 2.3.1 Local I/O Configuration

#### ( 1 ) Displaying the Local I/O Window

Double-click **LIO** in the **Function Module/Slave** Column of the **Module Configuration** Window.

| Module                    | Function Module/Slave | Status | Circuit No/AxisAddress |               | Motion Register | Register(Input/Output)                                            |                |      |      | Comment |
|---------------------------|-----------------------|--------|------------------------|---------------|-----------------|-------------------------------------------------------------------|----------------|------|------|---------|
|                           |                       |        | Start                  | Occupied circ |                 | Disabled                                                          | Start - End    | Size | Scan |         |
| 01 [MP2300] : ---         | 01 CPU                | ----   | ---                    | ---           | ---             | ----                                                              | ---            | ---  | ---  |         |
| 00 [MP2300] : ----        | 02 IO                 | ----   | ---                    | 1             | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0000 - 0001[H] | 2    | ---  |         |
|                           | 03 SVB                | ----   | Circuit No1            | 1             | 8000 - 87FF[H]  | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0010 - 040F[H] | 1024 | ---  |         |
|                           | 04 SVR                | ----   | Circuit No2            | 1             | 8800 - 8FFF[H]  | ----                                                              | ---            | ---  | ---  |         |
|                           | 01 217IF              | ----   | Circuit No1            | 1             | ---             | ----                                                              | ---            | ---  | ---  |         |
| 01 [218IF-01] : ----      | 02 218IF              | ----   | Circuit No1            | 1             | ---             | ----                                                              | ---            | ---  | ---  |         |
| 02 [LIO-01] : ----        | 01 LIO                | ----   | ---                    | 1             | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0410 - 0411[H] | 2    | ---  |         |
|                           | 02 CNTR               | ----   | ---                    | 1             | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0420 - 043F[H] | 32   | ---  |         |
| 03 -- UNDEFINED -- : ---- |                       | ----   |                        |               |                 |                                                                   |                |      |      |         |

A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **Local I/O** Window will be displayed.

- Refer to 1.4.1 *Displaying the Module Configuration Window* on page 1-15 for information on displaying the **Module Configuration** Window.

## ( 2 ) Local I/O Configuration Details

The following items are displayed in the **Local I/O** Window. The discrete inputs, discrete outputs, and interrupt inputs can be set.

| No | Item         | D                                   | REG      | Word  | SCAN | Current Value | HEX |
|----|--------------|-------------------------------------|----------|-------|------|---------------|-----|
| 1  | Local Input  | <input type="checkbox"/>            | IW00410  | 1     | HIGH |               |     |
| 2  | Local Output | <input type="checkbox"/>            | OW00411  | 1     | HIGH |               |     |
| 3  | IRQ Input    | <input checked="" type="checkbox"/> | IB004100 | ----- | -    |               |     |

D : Enable or disable each item by clicking on the cell.

☐ : Enabled, ☒ : Disabled

REG : The register length is fixed at one word, i.e., 16 points are set for each input or output register.

Word : Displays the word size of the register data. It cannot be changed.

SCAN : Select the speed from **HIGH**, **LOW**, or **NA** (none specified), for the scan that processes the inputs

or outputs.

Current Value : The current value of the register will be displayed in binary when online. It will not be displayed when offline.

The outputs to external devices can be set by changing the current value of the discrete outputs.

When the set value is confirmed, it is immediately saved in the register.

Other current values cannot be changed.

HEX : The current value of the register will be displayed in hexadecimal when online. It will not be displayed when offline.

After changing the local I/O configuration, save the definition data by selecting **Online – Save to Flash** from the main menu.

## 2.3.2 Counter Module Configuration

### ( 1 ) Displaying the Counter Module Window

Double-click **CNTR** in the **Function Module/Slave** Column of the **Module Configuration** Window.

| Module               | Function Module/Slave | Status | Circuit No/AxisAddress |             | Motion Register | Register(Input/Output)                                            |                |      |      | Comment |
|----------------------|-----------------------|--------|------------------------|-------------|-----------------|-------------------------------------------------------------------|----------------|------|------|---------|
|                      |                       |        | Start                  | cupied circ |                 | Disabled                                                          | Start - End    | Size | Scan |         |
| 01 [MP2300] : ---    |                       |        |                        |             |                 |                                                                   |                |      |      |         |
| 00 [MP2300] : ---    | 01 CPU                | ---    | ---                    | ---         | ---             |                                                                   | ---            | ---  | ---  |         |
|                      | 02 IO                 | ---    | ---                    | 1           | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0000 - 0001[H] | 2    | ---  |         |
|                      | 03 [SVB]              | ---    | Circuit No1            | 1           | 8000 - 87FF[H]  | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0010 - 040F[H] | 1024 | ---  |         |
|                      | 04 [SVR]              | ---    | Circuit No2            | 1           | 8800 - 8FFF[H]  |                                                                   | ---            | ---  | ---  |         |
| 01 [218IF-01] : ---  | 01 217IF              | ---    | Circuit No1            | 1           | ---             |                                                                   | ---            | ---  | ---  |         |
|                      | 02 218IF              | ---    | Circuit No1            | 1           | ---             |                                                                   | ---            | ---  | ---  |         |
| 02 [LIO-01] : ---    | 01 LIO                | ---    | ---                    | 1           | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0410 - 0411[H] | 2    | ---  |         |
|                      | 02 CNTR               | ---    | ---                    | 1           | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0420 - 043F[H] | 32   | ---  |         |
| 03 [UNDEFINED] : --- |                       |        |                        |             |                 |                                                                   |                |      |      |         |

A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **Counter Module** Window will be displayed.

- Refer to 1.4.1 *Displaying the Module Configuration Window* on page 1-15 for information on displaying the **Module Configuration** Window.
- If the counter function is not used with LIO-01 nor LIO-02, select **UNDEFINED** instead of **CNTR**.

## ( 2 ) Counter Module Window

In the **Counter Module** Window, there are two tab pages, **Fix Parameter Set** and **I/O Data Set**. Fixed parameters and I/O data can be set from these tab pages.

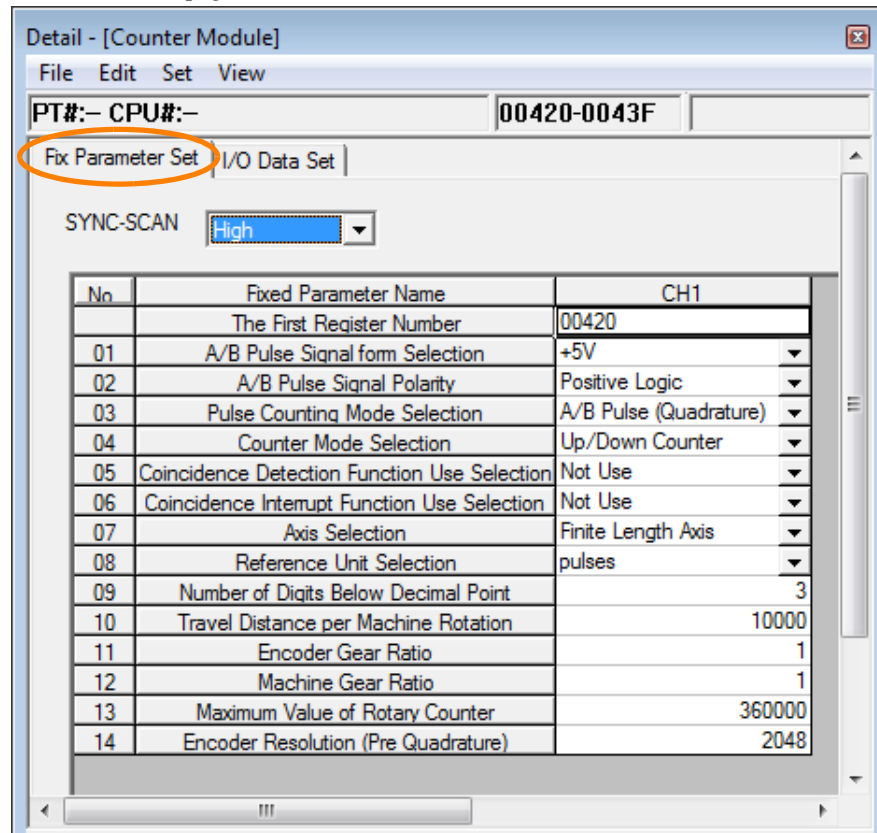


Fig. 2.7 Counter Module **Fix Parameter Set** Tab Page

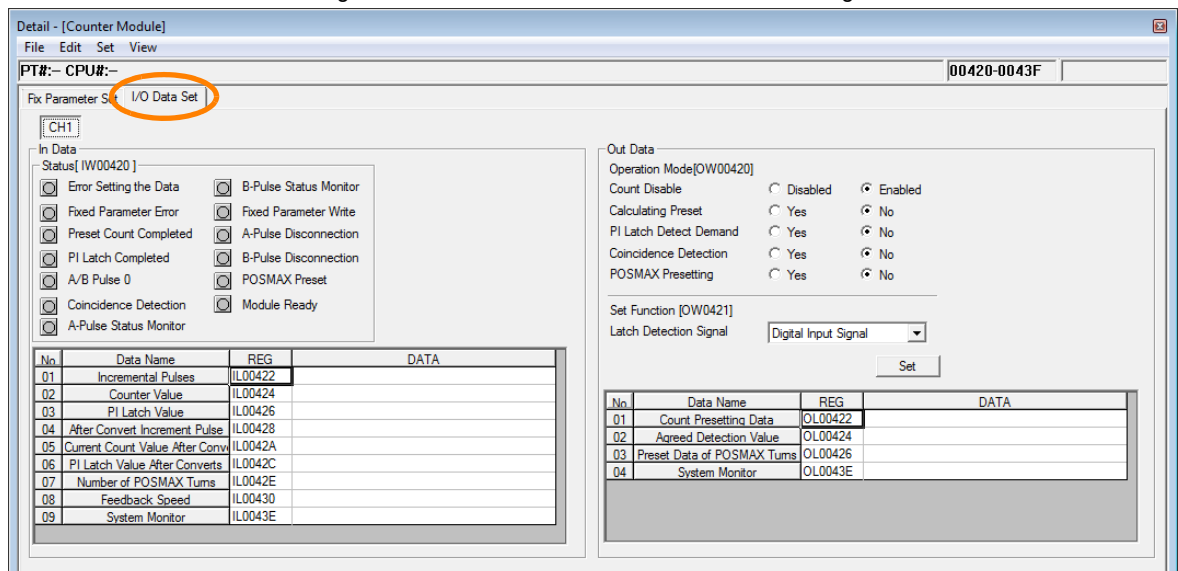


Fig. 2.8 Counter Module **I/O Data Set** Tab Page

### ( 3 ) Setting the Fixed Parameters

Set the following fixed parameters in the **Fix Parameter Set** tab page in the **Counter Module Window**.

#### ■ Counter Fixed Parameters

| No. | Name                                                                                         | Description                                                                                                                                                                                                                                                                                                                            | Size    | Default                              |
|-----|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------------------------|
|     | SYNC-SCAN<br>(Synchronous Scan Selection)                                                    | Select a scan cycle of the MP2000 Series Machine Controller to update the I/O data of counter function: High-speed scan or Low-speed scan.                                                                                                                                                                                             |         | High                                 |
|     | The First Register Number<br>(Leading Register Number)                                       | Displays the leading register number that corresponds to the parameter. This setting is disabled.                                                                                                                                                                                                                                      | 1 word  |                                      |
| 01  | A/B Pulse Signal Form Selection                                                              | Signal form of phases A and B. The signal form is fixed to a +5V differential input.                                                                                                                                                                                                                                                   | 1 word  | Fixed to +5V<br>(differential input) |
| 02  | A/B Pulse Signal Polarity Selection <sup>*1</sup>                                            | Select either positive or negative logic for the signal polarity of phases A and B.                                                                                                                                                                                                                                                    | 1 word  | Positive logic                       |
| 03  | Pulse Counting Mode Selection <sup>*1</sup>                                                  | Specify the pulse counting mode <sup>*1</sup> among the following 7 equations.<br><ul style="list-style-type: none"> <li>• Pulse and Direction</li> <li>• Pulse and Direction * 2</li> <li>• Up/Down Counter</li> <li>• Up/Down Counter * 2</li> <li>• A/B Pulse</li> <li>• A/B Pulse * 2</li> <li>• A/B Pulse (Quadrature)</li> </ul> | 1 word  | A/B Pulse<br>(Quadrature)            |
| 04  | Counter Mode Selection                                                                       | The counter mode is fixed to Up/Down Counter.                                                                                                                                                                                                                                                                                          | 1 word  | Fixed to Up/Down Counter             |
| 05  | Coincidence Detection Function Use Selection                                                 | Set whether or not the coincidence detection <sup>*2</sup> is to be used.                                                                                                                                                                                                                                                              | 1 word  | Not use                              |
| 06  | Coincidence Interrupt Function Use Selection                                                 | Set whether or not the coincidence interrupt function <sup>*2</sup> is to be used.<br>(Valid only when the coincidence detection function is set.)                                                                                                                                                                                     | 1 word  | Not use                              |
| 07  | Axis Selection                                                                               | Set the axis type <sup>*3</sup> : Finite or infinite length axis.                                                                                                                                                                                                                                                                      | 1 word  | Finite length axis                   |
| 08  | Reference Unit Selection                                                                     | Specify the reference unit.<br><ul style="list-style-type: none"> <li>• pulse</li> <li>• mm</li> <li>• deg</li> <li>• inch</li> </ul> If pulse is selected, an electronic gear is not to be used; If a unit other than pulse is selected, an electronic gear is to be used.                                                            | 1 word  | pulse                                |
| 09  | Number of Digits Below Decimal Point                                                         | Set the number of digits 0 to 5 below the decimal point <sup>*4</sup> for the minimum reference unit.<br><i>Example:</i><br>If the minimum reference unit is 1 $\mu\text{m}$ ( $10^{-3}\text{mm}$ ):<br>Reference unit selection : mm, and<br>Number of digits below decimal point: 3                                                  | 1 word  | 3                                    |
| 10  | Travel Distance per Machine Rotation <sup>*4, *5</sup>                                       | Set the load moving amount per load axis rotation.<br>Setting range: 1 to 2147483647 (reference unit)                                                                                                                                                                                                                                  | 2 words | 10000                                |
| 11  | Encoder Gear Ratio <sup>*4, *5</sup>                                                         | Set the value m so that the encoder axis rotates m times when the load axis rotates n times.<br>Setting range: 1 to 65535                                                                                                                                                                                                              | 1 word  | 1                                    |
| 12  | Machine Gear Ratio (Load) <sup>*4, *5</sup>                                                  | Set the value n so that the encoder axis rotates m times when the load axis rotates n times.<br>Setting range: 1 to 65535                                                                                                                                                                                                              | 1 word  | 1                                    |
| 13  | Maximum Value of Rotary Counter (Infinite Length Axis Reset Position (POSMAX)) <sup>*3</sup> | If the Infinite Length Axis was selected for fixed parameter No.07, specify the number of rotations (1 to 2147483647 reference units) after which the axis will be reset.                                                                                                                                                              | 2 words | 360000                               |

(cont'd)

| No. | Name                                                                                                            | Description                                                                                        | Size    | Default |
|-----|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------|---------|
| 14  | Encoder Resolution<br>(Pre Quadrature)<br>(Number of Pulses Per<br>Encoder Rotation<br>(before Multiplication)) | Set the number of input pulses per encoder rotation.<br>Setting range: 1 to 2147483647 (pulse/rev) | 2 words | 2048    |

- \* 1. For details, refer to 2.4.1 *Pulse Counting Modes* on page 2-26.
- \* 2. For details, refer to 2.4.3 *Coincidence Output and Coincidence Interrupt Functions* on page 2-29.
- \* 3. For details, refer to 2.4.5 *Axis Type Selection* on page 2-31.
- \* 4. For details, refer to 2.5 *Electronic Gear Function* on page 2-32.
- \* 5. If pulse is selected for the parameter No. 08, parameters No. 10 to 12 are ignored.

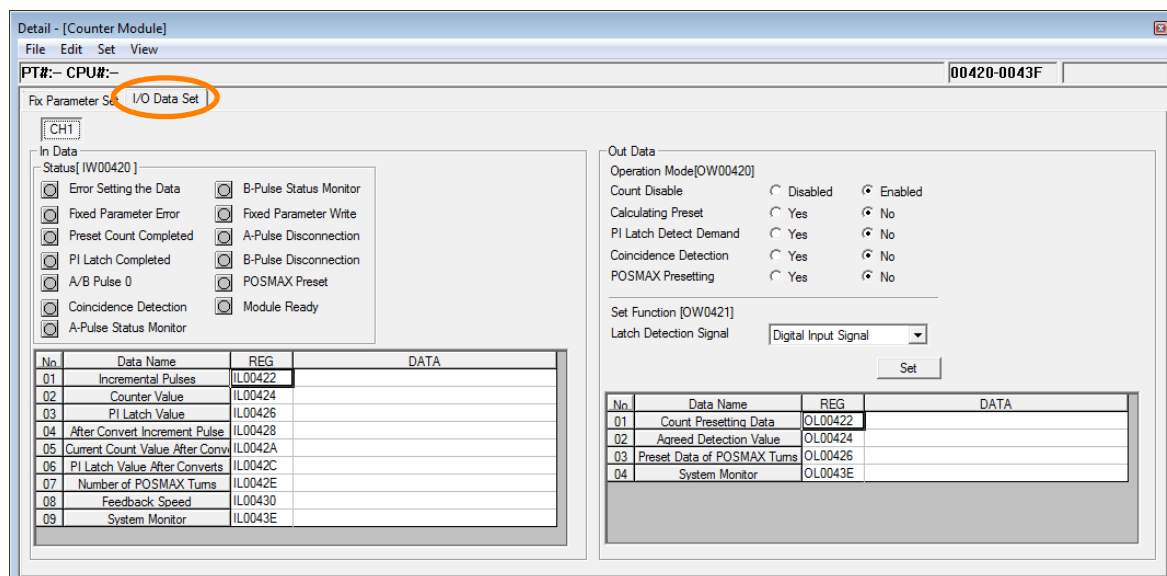


- If SYNC-SCAN (Synchronous Scan Selection) or Scan Time Setting is changed, be sure to save the data in the flash memory and restart the controller.

## ( 4 ) I/O Data Settings

## [ a ] I/O Data Setting Tab Page

Set the I/O data in the **I/O Data Set** Tab Page in the **Counter Module** Window.



- The channel number is fixed to CH1.

The details on the status and I/O data that can be monitored in the **I/O Data Set** Tab Page are described below.

## [ b ] In (Input) Data Details

The following table provides details of the **In Data** Area.

- Abbreviated names are given in square brackets in the Name column.

| No. | Register No. | Name                        | Contents                                                                                                                                                          | Range | Unit | Size   |
|-----|--------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|--------|
| —   | IW□□00<br>*1 | Status<br>(Run<br>[RUNSTS]) | <p>The run status of the Counter Module is indicated for each bit.</p> <p>When online:</p> <p>● : ON ( = 1 ),</p> <p>○ : OFF ( = 0 ),</p> <p>When off line: ●</p> | —     | —    | 1 word |
|     |              | Bit 0                       | Error Setting the Data<br>(Data setting error)                                                                                                                    | —     | —    |        |
|     |              | Bit 1                       | Fixed Parameter Error                                                                                                                                             | —     | —    |        |
|     |              | Bit 2                       | Preset Count Completed                                                                                                                                            | —     | —    |        |
|     |              | Bit 3                       | PI Latch Completed                                                                                                                                                | —     | —    |        |
|     |              | Bit 4                       | A/B Pulse 0<br>(Feedback pulse is ±1 or less)                                                                                                                     | —     | —    |        |
|     |              | Bit 5                       | Coincidence Detection                                                                                                                                             | —     | —    |        |
|     |              | Bit 6                       | A-Pulse Status Monitor                                                                                                                                            | —     | —    |        |
|     |              | Bit 7                       | B-Pulse Status Monitor                                                                                                                                            | —     | —    |        |
|     |              | Bit 9                       | Fixed Parameter Write                                                                                                                                             | —     | —    |        |
|     |              | Bit A                       | A-Pulse Disconnection                                                                                                                                             | —     | —    |        |
|     |              | Bit B                       | B-Pulse Disconnection                                                                                                                                             | —     | —    |        |
|     |              | Bit C                       | POSMAX Preset<br>(POSMAX turns presetting completed)                                                                                                              | —     | —    |        |
|     |              | Bit F                       | Module Ready                                                                                                                                                      | —     | —    |        |

(cont'd)

| No. | Register No. | Name                                      | Contents                                                                                                                                                                                                                                                                   | Range                     | Unit           | Size    |
|-----|--------------|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------|---------|
| 01  | IL□□02       | Incremental Pulses [PDV]                  | Indicates the difference between the pulse count value at previous scan and that at present scan.                                                                                                                                                                          | -2147483648 to 2147483647 | pulse          | 2 words |
| 02  | IL□□04       | Counter Value [PFB]                       | Indicates the pulse count value of each scan.                                                                                                                                                                                                                              | -2147483648 to 2147483647 | pulse          | 2 words |
| 03  | IL□□06       | PI Latch Value [FREQ]                     | Indicates the current value of the counter when an external signal is input.                                                                                                                                                                                               | -2147483648 to 2147483647 | pulse          | 2 words |
| 04  | IL□□08       | After Increment Convert Pulse [PDVG]      | Indicates the number of incremental pulses converted to a value in the reference unit. Indicates the same value as the number of incremental pulses if pulse is selected for the fixed parameter No. 08 "Reference Unit Selection" (when the electronic gear is not used). | -2147483648 to 2147483647 | Reference unit | 2 words |
| 05  | IL□□0A       | Current Count Value After Converts [PFBG] | Indicates the current value of the counter converted to a value in the reference unit. Indicates the same value as the counter current value when pulse is selected for the fixed parameter No. 08 "Reference Unit Selection" (when the electronic gear is not used).      | -2147483648 to 2147483647 | Reference unit | 2 words |
| 06  | IL□□0C       | PI Latch Value After Converts [FREQG]     | Indicates the PI latch data converted to a value in the reference unit. Indicates the same value as the PI latch data when pulse is selected for the fixed parameter No. 08 "Reference Unit Selection" (when the electronic gear is not used).                             | -2147483648 to 2147483647 | Reference unit | 2 words |
| 07  | IL□□0E       | Number of POSMAX Turns                    | Indicates the number of rotations that have been made when Infinite Length Axis is selected for the fixed parameter No. 07 "Axis Selection."                                                                                                                               | -2147483648 to 2147483647 | Rotation       | 2 words |
| 08  | IL□□10       | Feedback Speed*2                          | If the electronic gear *3 is not used, the unit is pulse/s.                                                                                                                                                                                                                | -2147483648 to 2147483647 | Reference unit | 2 words |
| 09  | IL□□1E       | System Monitor                            | For system use                                                                                                                                                                                                                                                             | -2147483648 to 2147483647 | —              | 2 words |

\* 1. IW□□00 gives the register number that is displayed in **The First Register Number** cell on the **Fix Parameter Set** Tab Page + 00.

\* 2. The Feedback Speed is the moving average of the results of the following calculation for 32 scans.

- ♦ Without Electronic Gear (Reference unit: Pulse)  
Feedback Speed (pulse/s) = No. of incremental pulses × 1000/Ts
- ♦ With Electronic Gear (Reference unit: Unit other than pulse)  
Feedback Speed (reference unit/s) = No. of incremental pulses after conversion × 1000/Ts  
TS: Scan time (ms) for counter synchronized scan.

\* 3. Refer to 2.5 *Electronic Gear Function* on page 2-32.

## [ c ] Out (Output) Data Details

The following table shows details of the **Out Data** Area.

- ♦ Abbreviated names are given in square brackets in the Name column.

| No. | Register No. | Name                                                               | Contents                                                                                                                                                                                                                                                       | Range                     | Unit            | Size    |
|-----|--------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------|---------|
| –   | OW□□00<br>*1 | Operation Mode (RUN Mode) [RUNMOD]                                 | <div>Bit 0</div> Count Disable<br>ON (=1): Counting prohibited<br>OFF (=0): Counting enabled (Default)<br>Prohibits counting while the bit is ON (=1).                                                                                                         |                           | –               | 1 word  |
|     |              |                                                                    | <div>Bit 1</div> Calculating Preset (Count Preset Request)<br>ON (=1): Request preset<br>OFF (=0): Not requested (Default)<br>Resets the count to its preset value when the bit is turned ON (=1).                                                             |                           | –               |         |
|     |              |                                                                    | <div>Bit 2</div> PI Latch Detect Demand*2<br>ON (=1): Request latch detection<br>OFF (=0): Not requested (Default)<br>Stores the counter value at the moment an external signal is input while the bit is ON (=1).                                             |                           | –               |         |
|     |              |                                                                    | <div>Bit 3</div> Coincidence Detection*3<br>ON (=1): Request coincidence detection<br>OFF (=0): Not requested (Default)<br>Sends a coincidence signal if the values of the counter and the coincidence detection setting match when the bit is turned ON (=1). |                           | –               |         |
|     |              |                                                                    | <div>Bit 4</div> POSMAX Presetting (POSMAX Turns Presetting Request)<br>ON (=1): Requests preset<br>OFF (=0): Not requested (Default)<br>Resets the number of POSMAX turns to its preset value when the bit turns ON (=1).                                     |                           | –               |         |
| –   | OW□□01       | Set Function/ Latch Detection Signal                               | Select the external signal to be used for the PI latch signal. <ul style="list-style-type: none"> <li>• 0000H: DI latch (discrete input)</li> <li>• 0002H: Z latch (phase-Z input)</li> </ul>                                                                  | 0000H to 0002H            | –               | 1 word  |
| 01  | OL□□02       | Count Presetting Data [PRSDAT]                                     | The current value of the counter is reset to this value when a Count Preset Request is output.                                                                                                                                                                 | -2147483648 to 2147483647 | Reference units | 2 words |
| 02  | OL□□04       | Agreed Detection Value (Coincidence Detection Set Value) [COINDAT] | A coincidence detection signal and an interrupt signal to the MP2000 Series Machine Controller are output if the current value of the counter equals the value set in this parameter when the Coincidence Detection Request is output.                         | -2147483648 to 2147483647 | Reference units | 2 words |
| 03  | OL□□06       | Preset Data of POSMAX Turns                                        | The number of POSMAX turns is reset to the value set in this parameter when a POSMAX Turn Number Presetting Request is output.                                                                                                                                 | -2147483648 to 2147483647 | Rotations       | 2 words |
| 04  | OL□□1E       | System Monitor                                                     | For system use.                                                                                                                                                                                                                                                |                           | –               |         |

\* 1. OW□□00 gives the register number that is displayed in **The First Register Number** cell on the **Fix Parameter Set** Tab Page + 00.

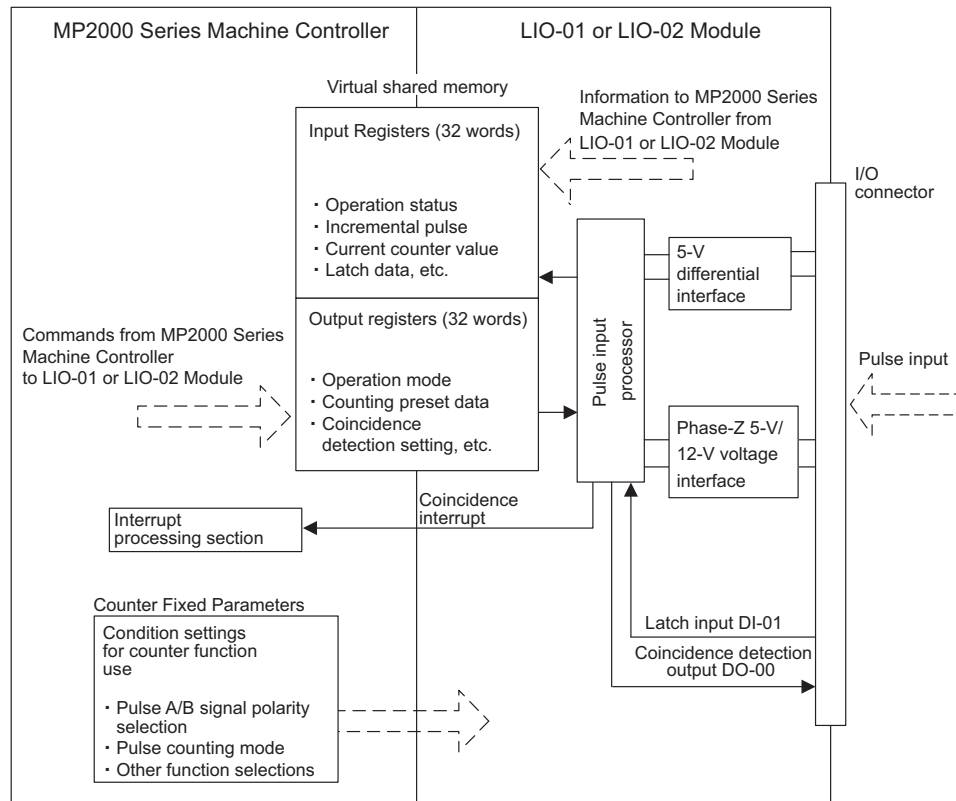
\* 2. Refer to 2.4.4 PI Latch Function on page 2-30.

\* 3. Refer to 2.4.3 Coincidence Output and Coincidence Interrupt Functions on page 2-29.

## 2.4 Details of Counter Functions

For the counter function, the command is determined according to the settings of the counter fixed parameters and output registers, and the status and counter value are stored in input registers.

The following diagram shows the data flow for the counter function.

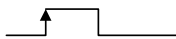
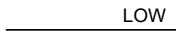
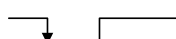
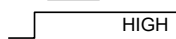
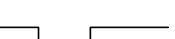
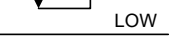
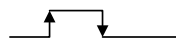
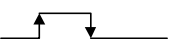
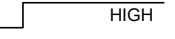
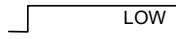
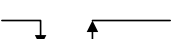
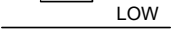
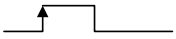
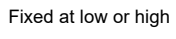
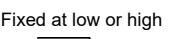
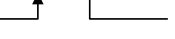
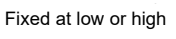
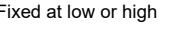
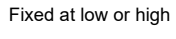
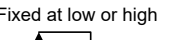
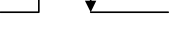
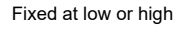
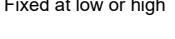
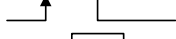
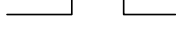
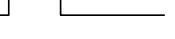
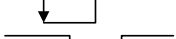
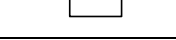
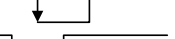
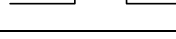
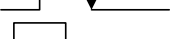
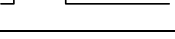
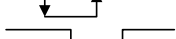
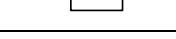
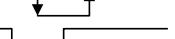
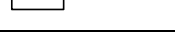
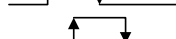
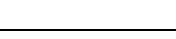
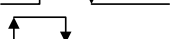
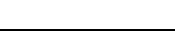
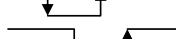
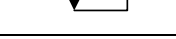
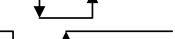


- ♦ In this section, the *fixed parameters* mean the *counter fixed parameters* if not otherwise mentioned.
- ♦ Refer to 1.3 *Self-configuration* on page 1-12 to execute self-configuration of the Machine Controller before setting the fixed parameters.

The following describes the details of pulse counting modes, pulse count function, coincidence output and coincidence interrupt functions, and PI latch function among the counter functions of the LIO-01 or LIO-02 Modules.

## 2.4.1 Pulse Counting Modes

The following pulse counting modes can be selected by setting the counter fixed parameter No. 3 (Pulse Counting Mode Selection) and No.2 “A/B Pulse Signal Polarity Selection.”.

| Pulse Counting Mode |     | Polarity       | Up Count (Forward)                                                                                                                                                                                              | Down Count (Reverse)                                                                                                                                                                                                |
|---------------------|-----|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pulse and Direction | × 1 | Positive logic | Pulse A <br>Pulse B  LOW                      | Pulse A <br>Pulse B  HIGH                     |
|                     |     | Negative logic | Pulse A <br>Pulse B  HIGH                     | Pulse A <br>Pulse B  LOW                      |
|                     | × 2 | Positive logic | Pulse A <br>Pulse B  LOW                      | Pulse A <br>Pulse B  HIGH                     |
|                     |     | Negative logic | Pulse A <br>Pulse B  LOW                      | Pulse A <br>Pulse B  LOW                      |
| UP/DOWN Counter     | × 1 | Positive logic | Pulse A <br>Pulse B  Fixed at low or high     | Pulse A <br>Pulse B  Fixed at low or high     |
|                     |     | Negative logic | Pulse A <br>Pulse B  Fixed at low or high  | Pulse A <br>Pulse B  Fixed at low or high  |
|                     | × 2 | Positive logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
|                     |     | Negative logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
| A/B Pulse           | × 1 | Positive logic | Pulse A <br>Pulse B                       | Pulse A <br>Pulse B                       |
|                     |     | Negative logic | Pulse A <br>Pulse B                       | Pulse A <br>Pulse B                       |
|                     | × 2 | Positive logic | Pulse A <br>Pulse B                       | Pulse A <br>Pulse B                       |
|                     |     | Negative logic | Pulse A <br>Pulse B                       | Pulse A <br>Pulse B                       |
|                     | × 4 | Positive logic | Pulse A <br>Pulse B                       | Pulse A <br>Pulse B                       |
|                     |     | Negative logic | Pulse A <br>Pulse B                       | Pulse A <br>Pulse B                       |



- If connecting the I/O module to a Yaskawa SERVOPACK, set either the fixed parameter or the SERVOPACK parameter as follows.
  - Fixed parameter No.2 (A/B Pulse Signal Polarity Selection): 1 (Negative logic)
  - SERVOPACK parameter 1st digit of Pn000: 1 (CW for reverse rotation: reverse rotation mode)



■ Count Preset Completion Timing

The following diagram shows the count preset completion timing of the LIO-01 or LIO-02 Modules, which differs from the completion timing of the CNTR-01 Module (Counter Module). (Refer to Fig. 2.10 Count Preset Completion Timing of CNTR-01 Module.)

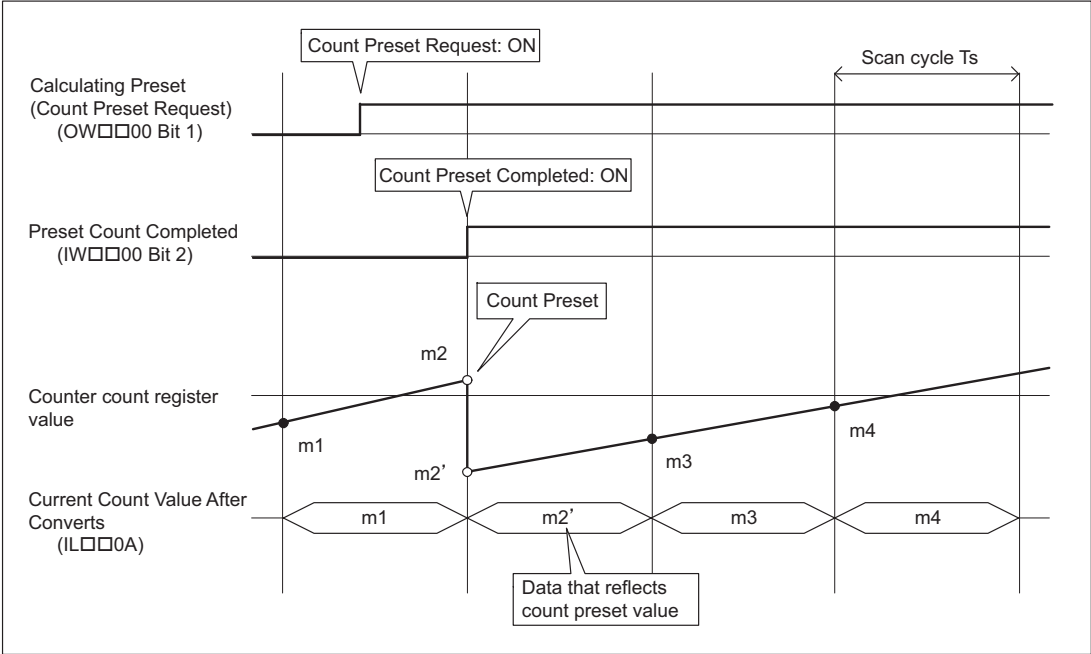


Fig. 2.9 Count Preset Completion Timing of LIO-01 or LIO-02 Module

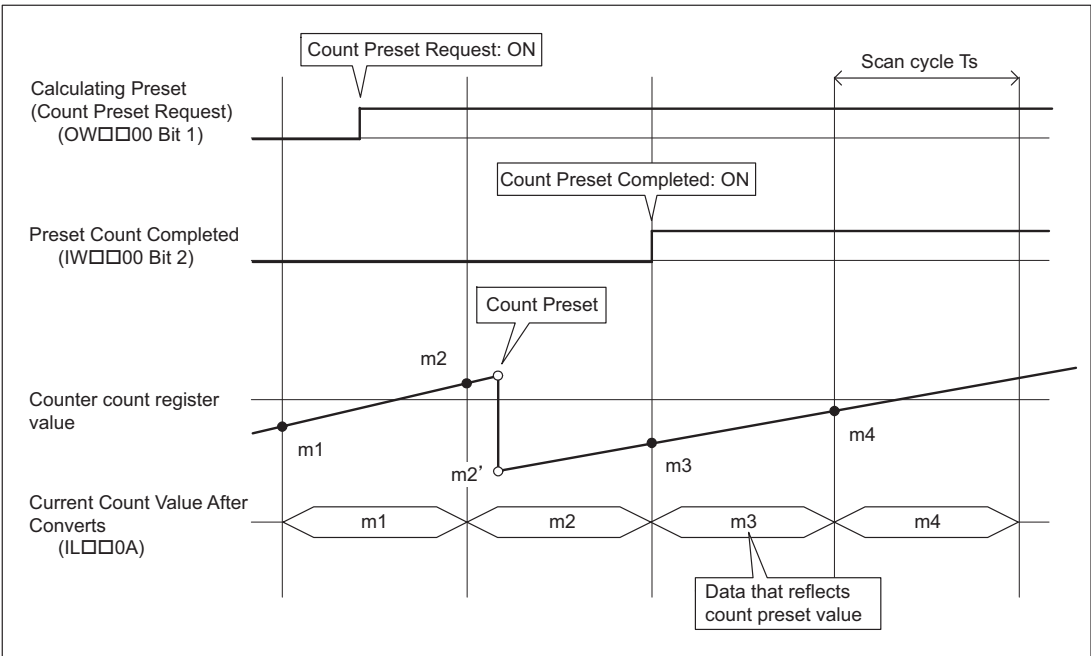


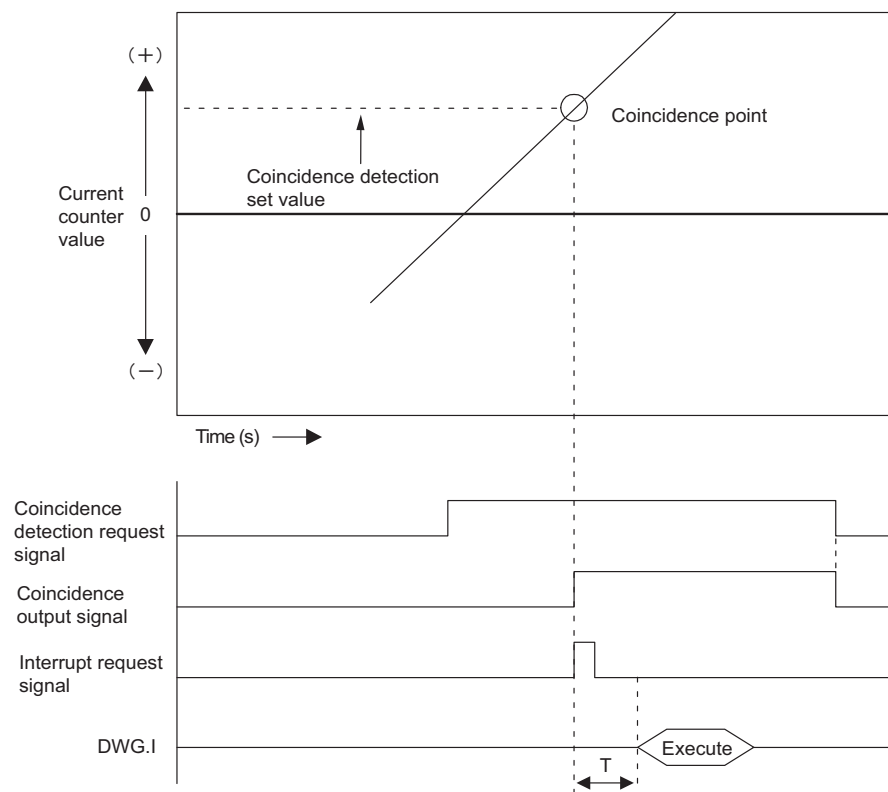
Fig. 2.10 Count Preset Completion Timing of CNTR-01 Module

## 2.4.3 Coincidence Output and Coincidence Interrupt Functions

The Coincidence Output and Coincidence Interrupt Functions output an external output signal (coincidence detection signal) and output an interrupt signal to the MP2000 Series Machine Controller when the current counter value and a preset output register value (Coincidence Detection Setting:  $OL\Box\Box\Box+4$ ) match.

- The Coincidence Output Request is enabled when “Use” is set to the counter fixed parameter No. 5 (Coincidence Detection Function Use Selection).
- The Coincidence Interrupt Request is enabled if “Use” is set to the counter fixed parameter No. 6 (Coincidence Interrupt Function Use Selection).

The following graph shows the number of occurrences from when coincidence detection request signal is output to when the coincidence point is detected and DWG.I (interrupt drawing) starts execution.



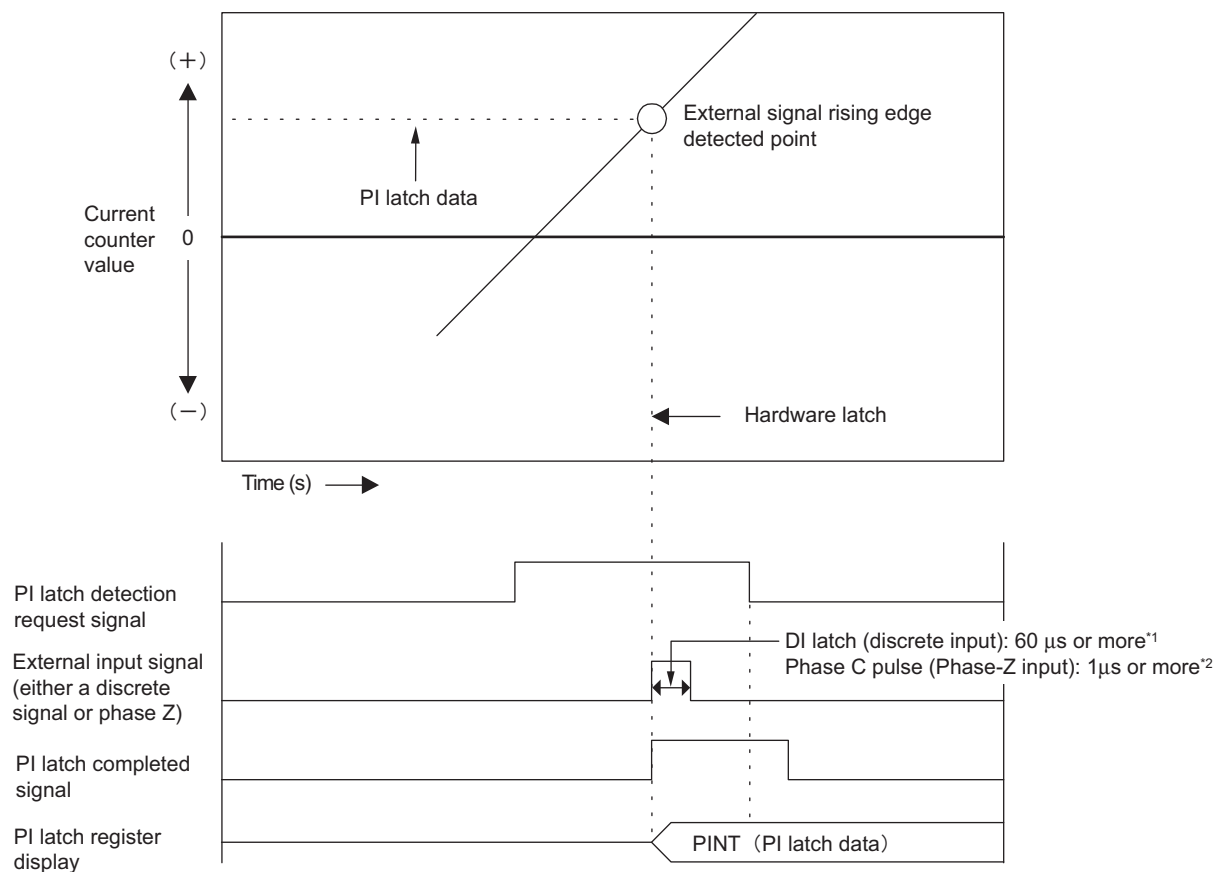
- \* T: Time when the coincidence point is detected to when DWG.I (interrupt drawing) starts execution (approx. 60 to 440  $\mu$ s)
- ♦ DO-00 is used as a coincidence output signal.  
When the counter fixed parameter No. 05 (Coincidence Detection Function Use Selection) is set to “Use,” DO\_00 will be masked. So, when setting a register, which is allocated to DO\_00, using a ladder program to ON or OFF, the setting of this register will not be valid because the other setting has priority.
- ♦ To monitor the coincidence detection signal, use Coincidence Detection in the Status (Run Status).
- ♦ Disable coincidence detection request when using the Count Preset. If the Count Preset is being used with the coincidence detection request enabled, coincidence point may be detected at the incorrect point because the matching point before the coordinate system has been rebuilt will be used.

## 2.4.4 PI Latch Function

The PI latch function saves (latches) the current value to a memory register (IL□□06) on the rising edge of an external signal.

Select either a discrete input (DI latch) or phase-Z (Z latch) as the external signal.

The following graph shows the number of occurrences from when PI latch signal is output to when the rising edge of an external signal is detected and PI latch data is displayed.



- \* 1. When discrete input is changed from ON to OFF, the next ON signal cannot be received unless at least 500 μs passes after the change.
- \* 2. When phase-Z input is changed from ON to OFF, the next ON signal cannot be received unless at least 1 μs passes after the change.

## 2.4.5 Axis Type Selection

There are two types of axis: An infinite length axis that resets the current value with a specified value, and a finite length axis that does not reset the current value.

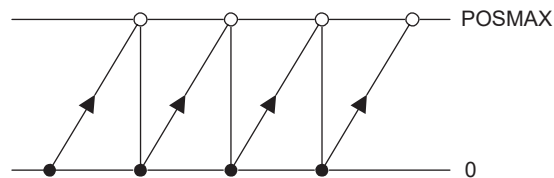
The finite length axis is used for rotation in one direction only, where the current value data does not need to be reset after rotation, and for return and other operations are performed only within a specified range.

The infinite length axis is used for applications such as resetting the current value data for a conveyor belt or other device to 0 after one rotation.

The type of the axis to be used is selected by fixed parameter No. 07 (Axis Selection).

If infinite length axis is set, the current counter value after conversion and the PI latch data after conversion is stored in the range 0 to infinite length axis reset position – 1.

Set the reset position in the counter fixed parameter No. 13 (Maximum Value of Rotary Counter) (Infinite Length Axis Reset Position) (POSMAX).



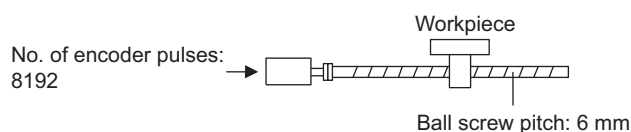
## 2.5 Electronic Gear Function

The Electronic Gear Function can be used when other than pulse is set to the counter fixed parameter No. 08 (Reference Unit Selection).

### 2.5.1 Outline

The Electronic Gear Function is used to set the workpiece travel distance per pulse input to the LIO Module counter to any value.

The following example describes differences in operations to move a workpiece 10 mm using the equipment shown below with and without electronic gear function. When using the electronic gear function, simply input the reference value calculated for the travel distance regardless of the number of pulses to move a workpiece for a specified travel distance.



#### When the Electronic Gear is Not Used

To move a workpiece 10 mm:  
 1 revolution is 6 mm. Therefore,  
 $10 \div 6 = 1.666$  revolutions  
 $2048 \times 4$  pulses is 1 revolution. Therefore,  
 $1.666 \times 8092 = 13653$  pulses  
 13653 pulses are input as reference pulses. The equation must be calculated at the host controller.

#### When the Electronic Gear is Used

To move a workpiece 10 mm:  
 Mechanical conditions and minimum reference unit are defined with electronic gear.  
 To move a workpiece 10 mm, the minimum reference unit is set to 1  $\mu\text{m}$ . Therefore,  
 $10 (\text{mm}) \div 1 (\mu\text{m}) = 10000$   
 10000 is input as reference value.

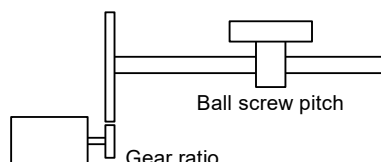
### 2.5.2 Settings

Use steps 1 to 5 in the following procedure to make the settings.

#### 1. Confirm the machine specifications.

##### Elements relating to the Electronic Gear

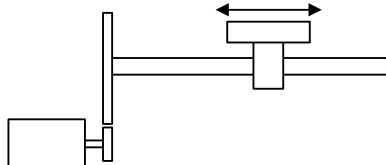
- Gear ratio
- Ball screw pitch
- Pulley diameter, etc.



2. Check the number of encoder pulses displayed in Counter Value, and set this value to the counter fixed parameter No. 14 (Encoder Resolution (Pre Quadrature)) (Number of Pulses Per Encoder Rotation).
3. Set the reference unit (the smallest reference unit for the reference data to move a load) according to the settings in the counter fixed parameters No. 08 (Reference Unit Selection) and No. 09 (Number of Digits Below Decimal Point).

Reference to move a table in units of 0.001 mm.

Reference unit: 0.001 mm



Consider the machine specifications and positioning precision when setting the reference unit.

- When reference unit is 1  $\mu\text{m}$ :  
When 50,000 reference pulses are input, the workpiece will be moved by  $50,000 \times 1 \mu\text{m} = 50 \text{ mm}$ .

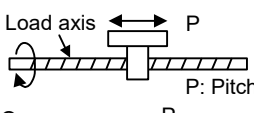
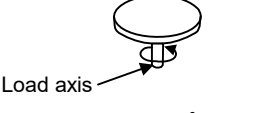
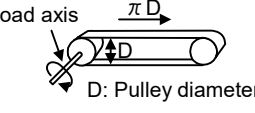
- Find the load travel distance for each rotation of the load axis using the reference unit and set this distance to the counter fixed parameter No. 10 (Travel Distance per Machine Rotation).

$$\text{Load travel distance per rotation of load axis (reference unit)} = \frac{\text{Load travel distance per load axis rotation}}{\text{Reference unit}}$$

Calculation Examples

- For a ball screw pitch of 5 mm and a reference unit of 0.001 mm:

$$\frac{5}{0.001} = 5000 \text{ (Reference unit)}$$

| Ball screw                                                                                                                                           | Rotary table                                                                                                                                                 | Belt + pulley                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>One rotation = <math>\frac{P}{\text{Reference unit}}</math></p> |  <p>One rotation = <math>\frac{360^\circ}{\text{Reference unit}}</math></p> |  <p>One rotation = <math>\frac{\pi D}{\text{Reference unit}}</math></p> |

- Set the Encoder Gear Ratio and the Machine Gear Ratio in the counter fixed parameters No. 11 and No.12.

When the encoder axis has rotated m times and the mechanical configuration allows the load axis to rotate n times, set the following values:

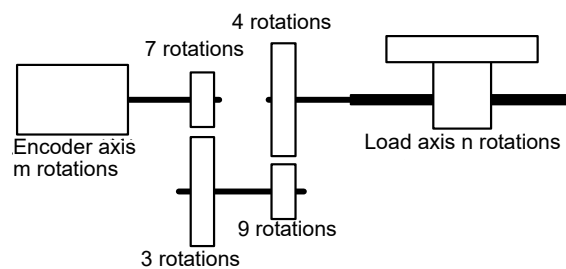
No. 11 (Encoder Gear Ratio) = m rotations

No. 12 (Machine Gear Ratio) = n rotations

Setting range: 1 to 65,535 [rotations]

<Setting Example>

For the configuration shown in the diagram:



$$\text{Gear ratio} = n/m = (3/7) \times (4/9) = 4/21$$

Therefore, set the following values:

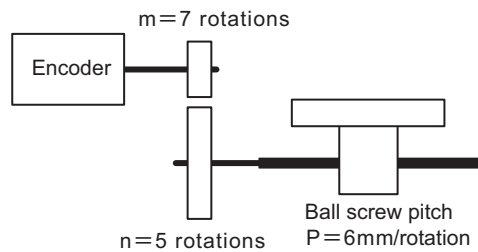
No.11 (Encoder Gear Ratio) = 4 (rotations)

No.12 (Machine Gear Ratio) = 21 (rotations)

### 2.5.3 Electronic Gear Setting Examples

The following is setting examples for each kind of load mechanical configuration.

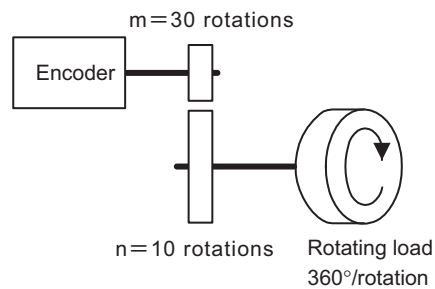
#### ( 1 ) Example A: Ball Screw



In the above machine system, if the reference unit = 0.001 mm, the setting of each parameter will be as follows:

- Moving Amount Per Machine Rotation =  $6\text{ mm}/0.001\text{ mm} = 6000$
- Counter fixed parameter No. 11 (Encoder Gear Ratio) = 7 (rotations)
- Counter fixed parameter No. 12 (Machine Gear Ratio) = 5 (rotations)

#### ( 2 ) Example B: Rotating Load



In the above machine system, if the reference unit =  $0.1^\circ$ , the setting of each parameter will be as follows:

- Moving Amount Per Machine Rotation =  $360^\circ/0.1^\circ = 3600$
- Counter fixed parameter No. 11 (Encoder Gear Ratio) = 3 (rotations)
- Counter fixed parameter No. 12 (Machine Gear Ratio) = 1 (rotation)

## 2.5.4 Precautions When Using Electronic Gears

When using electronic gears, make sure that the After Convert Incremental Pulse (Number of Incremental Pulses After Conversion) (IL□□08) is not outside the range for double integers (-2147483648 to 2147483647). If it is outside this range, counter parameters after conversion, such as the After Convert Incremental Pulse (IL□□08), Current Count Value after Conversion (IL□□0A), and PI Latch Value (IL□□0C), may not be correctly reported.

### ■ Conditions to Fit within Range

The following is the conditional expression for the After Convert Incremental Pulse (IL□□08) to fit within the range for double integers.

$$\text{Maximum frequency of input pulse (Hz)} \times \frac{T_s^* (\text{ms})}{1000(\text{ms})} \times \text{Workpiece travel distance per pulse (reference units/pulse)} \leq 2147483647$$

\*  $T_s$ : Scan time setting

The workpiece travel distance per pulse can be found using the following formula.

$$\begin{aligned} & \text{Workpiece travel distance per pulse (reference units/pulse)} \\ = & \frac{\text{No.10}^{*1} \text{ Travel Distance Per Machine Rotation}}{\text{No.14}^{*1} \text{ Encoder Resolution (Pre Quadrature)} \times \text{Multiplication}^{*2}} \times \frac{\text{No.12}^{*1} \text{ Machine Gear Ratio}}{\text{No.11}^{*1} \text{ Encoder Gear Ratio}} \end{aligned}$$

\* 1. No.10, No.11, No.12, and No.14 are fixed parameters.

\* 2. Multiplication value of fixed parameter No. 3, Pulse Counting Mode Selection. (For example, for A/B Pulse (Quadrature), the multiplication value is 4.)

## LIO-04/LIO-05 Module

This chapter describes the LIO-04/LIO-05 Module in detail.

|                                                                         |      |
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## 3.1 Outline of LIO-04/LIO-05 Modules

### 3.1.1 Outline of Functions

The LIO-04/LIO-05 Module is equipped with the following digital I/O functions.

LIO-04: 32 digital inputs (DI) and 32 digital outputs (DO) (sink mode output)

LIO-05: 32 digital inputs (DI) and 32 digital outputs (DO) (source mode output)

Digital I/O is made at a periodical cycle for each high-speed scan or low-speed scan of the MP2000 Series Machine Controller.

The following diagram outlines the functions of the LIO-04/LIO-05 Module.

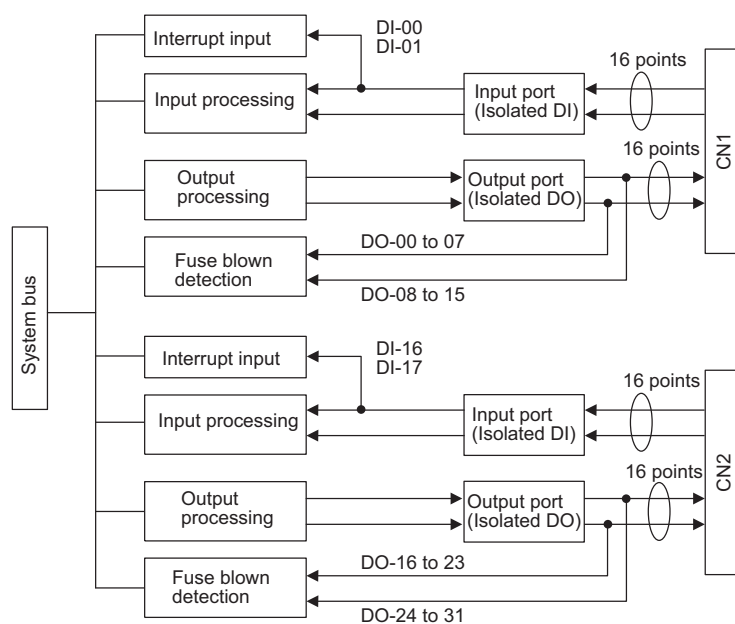
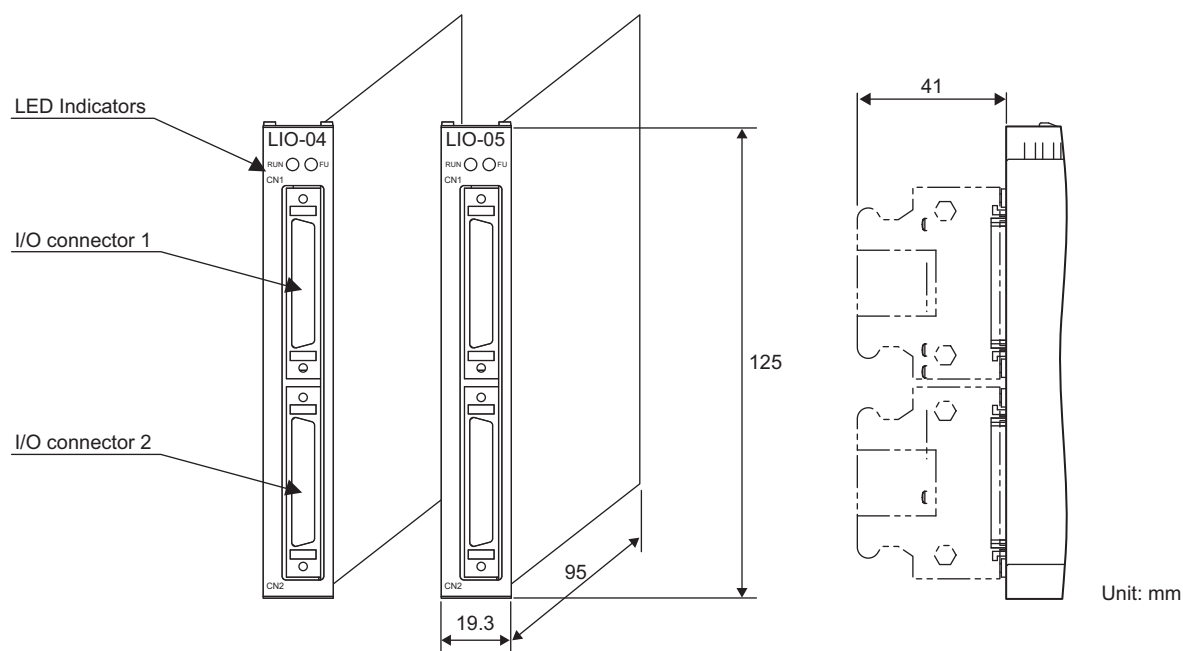


Fig. 3.1 Outline of LIO-04/LIO-05 Module Functions

### 3.1.2 LIO-04/LIO-05 Module Appearance and Connector External Dimensions

The following figure shows the appearance of the LIO-04/LIO-05 Modules and the connector external dimensions.



- ♦ LIO-04 and LIO-05 Modules have the same external dimensions for the connectors.

### 3.1.3 Specifications

The following shows the specifications of the LIO-04/LIO-05 Modules.

#### ( 1 ) Hardware Specifications

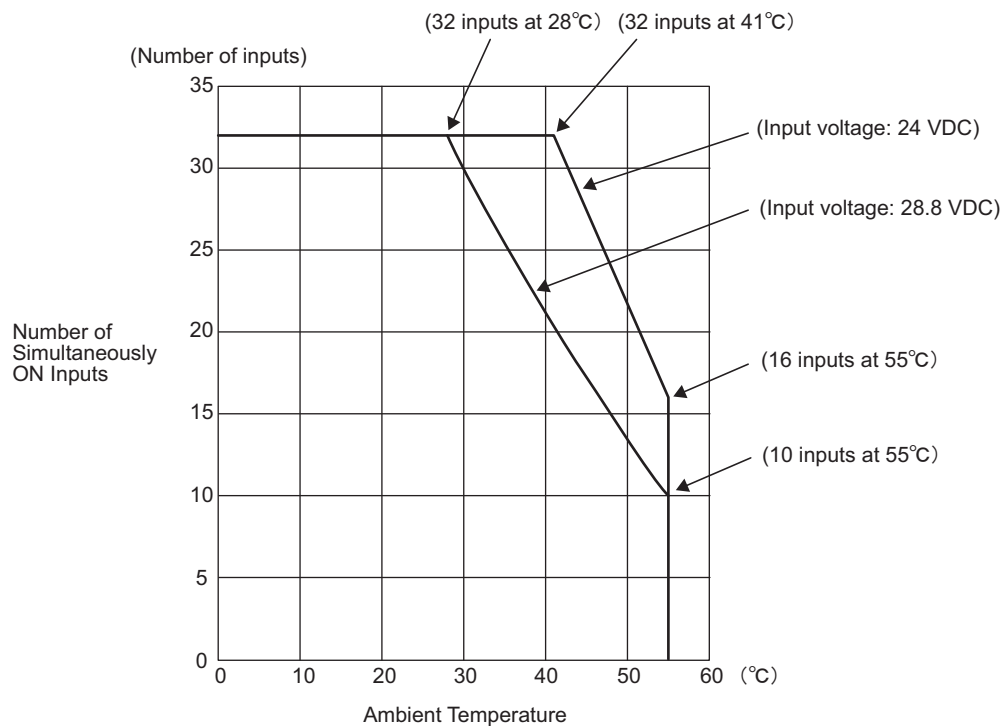
| Item                | Specifications                                                                                                                                                                                                                                                                                         |                                                                                                                 |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Classification      | I/O Module                                                                                                                                                                                                                                                                                             |                                                                                                                 |
| Name                | LIO-04                                                                                                                                                                                                                                                                                                 | LIO-05                                                                                                          |
| Model               | JAPMC-IO2303 (-E)                                                                                                                                                                                                                                                                                      | JAPMC-IO2304 (-E)                                                                                               |
| Digital Input       | 32 inputs<br>24 VDC $\pm$ 20% (+19.2 V to +28.8 V), 4.1 mA (TYP),<br>combined sink mode/source mode inputs (DI-00, -01, -16, and -17 also used for interrupts)<br>Number of simultaneously ON inputs: 16 (8/connector with 24 VDC),<br>10 (5/connector with 28.8 VDC)<br>*For details, refer to ( 3 ). |                                                                                                                 |
| Digital Output      | 32 outputs<br>24 VDC $\pm$ 20% (+19.2 V to +28.8 V),<br>100 mA max.,<br>transistor outputs, sink mode outputs                                                                                                                                                                                          | 32 outputs<br>24 VDC $\pm$ 20% (+19.2 V to +28.8 V),<br>100 mA max.,<br>transistor outputs, source mode outputs |
| LED Indicators      | RUN (green)<br>FUSE (red)                                                                                                                                                                                                                                                                              |                                                                                                                 |
| Connectors          | CN1: I/O connector<br>CN2: I/O connector                                                                                                                                                                                                                                                               |                                                                                                                 |
| Current Consumption | 500 mA max.                                                                                                                                                                                                                                                                                            |                                                                                                                 |
| Dimensions (mm)     | 125 × 95 (H×D)                                                                                                                                                                                                                                                                                         |                                                                                                                 |
| Mass                | 80 g                                                                                                                                                                                                                                                                                                   |                                                                                                                 |

#### ( 2 ) Environmental Conditions

| Item                            |                               | Specifications                                                                                                                                                                                                             |
|---------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions        | Ambient Operating Temperature | 0 to 55°C                                                                                                                                                                                                                  |
|                                 | Ambient Storage Temperature   | -25 to 85°C                                                                                                                                                                                                                |
|                                 | Ambient Operating Humidity    | 30% to 95% (with no condensation)                                                                                                                                                                                          |
|                                 | Ambient Storage Humidity      | 5% to 95% (with no condensation)                                                                                                                                                                                           |
|                                 | Pollution Level               | Pollution level 2 (conforming to JIS B 3502)                                                                                                                                                                               |
|                                 | Corrosive Gas                 | There must be no combustible or corrosive gas.                                                                                                                                                                             |
|                                 | Operating Altitude            | 2,000 m above sea level or lower                                                                                                                                                                                           |
| Mechanical Operating Conditions | Vibration Resistance          | Conforming to JIS B 3502:<br>• 10 to 57 Hz with single-amplitude of 0.075 mm<br>• 57 to 150 Hz with fixed acceleration of 9.8 m/s <sup>2</sup><br>• 10 sweeps each in X, Y, and Z directions<br>(sweep time: 1 octave/min) |
|                                 | Shock Resistance              | Conforming to JIS B 3502:<br>Peak acceleration of 147 m/s <sup>2</sup> twice for 11 ms each in the X, Y, and Z directions                                                                                                  |
| Electrical Operating Conditions | Noise Resistance              | Conforming to EN 61000-6-2, EN 61000-6-4, EN 55011 (Group 1 Class A)                                                                                                                                                       |
| Installation Requirements       | Ground                        | Ground to 100 $\Omega$ max.                                                                                                                                                                                                |
|                                 | Cooling Method                | Natural cooling                                                                                                                                                                                                            |

### ( 3 ) Number of Simultaneously ON Inputs - Ambient Temperature Characteristics

The following graph shows the number of inputs that can be simultaneously ON depending on the ambient temperature.



### 3.1.4 LED Indicators

The following table shows the LIO-04/LIO-05 Module status when each indicator lamp is lit or unlit.

RUN   FUSE

| Indicator | Color | When Lit                                                 | When Unlit                          |
|-----------|-------|----------------------------------------------------------|-------------------------------------|
| RUN       | Green | Normal operation                                         | Error occurrence                    |
| FUSE      | Red   | One or some of the output protection fuses is blown out. | Output protection fuses are normal. |

## 3.2 Specifications of LIO-04/LIO-05 Module Connections

### 3.2.1 Connector Specifications

The LIO-04/LIO-05 Module connector connects the external I/O signals. (External input: 32 points, external output: 32 points)

The following tables provide the specifications of the LIO-04/LIO-05 Module connector.

#### ( 1 ) Connector Model



| Name                   | Connector Name | No. of Pins | Connector Model                      |                                                                                                                                                                                    |                  |
|------------------------|----------------|-------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                        |                |             | Module Side                          | Cable Side                                                                                                                                                                         | Manufacturer     |
| External I/O Connector | CN1/CN2        | 50          | 10250-52A3PL<br>(Conforming to RoHS) | <ul style="list-style-type: none"><li>• Connector<br/>10150-3000PE</li><li>• Shell<br/>10350-52A0-008<br/>(screw locking), or<br/>10350-52F0-008<br/>(one-touch locking)</li></ul> | 3M Japan Limited |

## ( 2 ) LIO-04 Module Connector Pin Arrangement

The following table shows the LIO-04 Module connector (CN1 and CN2) pin arrangement viewed from the wiring side and the details of the pins.

## ■ CN1 Connector Pin Arrangement (Viewed from Wiring Side)



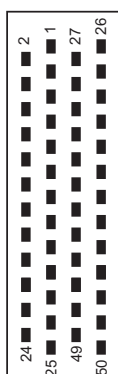
|    |         |    |         |    |       |    |       |
|----|---------|----|---------|----|-------|----|-------|
| 2  | DI_00   | 1  | DICOM_1 | 27 | DI_01 | 26 |       |
| 4  | DI_04   | 3  | DI_02   | 29 | DI_05 | 28 | DI_03 |
| 6  | DICOM_2 | 5  | DI_06   | 31 |       | 30 | DI_07 |
| 8  | DI_10   | 7  | DI_08   | 33 | DI_11 | 32 | DI_09 |
| 10 | DI_14   | 9  | DI_12   | 35 | DI_15 | 34 | DI_13 |
| 12 | DO_00   | 11 |         | 37 | DO_01 | 36 |       |
| 14 |         | 13 | DO_02   | 39 | 0V_1  | 38 | DO_03 |
| 16 | DO_04   | 15 | +24V_1  | 41 | DO_05 | 40 |       |
| 18 |         | 17 | DO_06   | 43 | 0V_1  | 42 | DO_07 |
| 20 | DO_10   | 19 | DO_08   | 45 | DO_11 | 44 | DO_09 |
| 22 | +24V_2  | 21 |         | 47 |       | 46 | 0V_2  |
| 24 | DO_14   | 23 | DO_12   | 49 | DO_15 | 48 | DO_13 |
|    |         | 25 |         |    |       | 50 | 0V_2  |

## ■ CN1 Connector Details

| Pin No. | Signal Name | I/O | Remarks                                       | Pin No. | Signal Name | I/O | Remarks                                       |
|---------|-------------|-----|-----------------------------------------------|---------|-------------|-----|-----------------------------------------------|
| 1       | DICOM_1     | P   | Input common 1                                | 26      |             |     |                                               |
| 2       | DI_00       | I   | Digital input 0 (shared with interrupt input) | 27      | DI_01       | I   | Digital input 1 (shared with interrupt input) |
| 3       | DI_02       | I   | Digital input 2                               | 28      | DI_03       | I   | Digital input 3                               |
| 4       | DI_04       | I   | Digital input 4                               | 29      | DI_05       | I   | Digital input 5                               |
| 5       | DI_06       | I   | Digital input 6                               | 30      | DI_07       | I   | Digital input 7                               |
| 6       | DICOM_2     | P   | Input common 2                                | 31      |             |     |                                               |
| 7       | DI_08       | I   | Digital input 8                               | 32      | DI_09       | I   | Digital input 9                               |
| 8       | DI_10       | I   | Digital input 10                              | 33      | DI_11       | I   | Digital input 11                              |
| 9       | DI_12       | I   | Digital input 12                              | 34      | DI_13       | I   | Digital input 13                              |
| 10      | DI_14       | I   | Digital input 14                              | 35      | DI_15       | I   | Digital input 15                              |
| 11      |             |     |                                               | 36      |             |     |                                               |
| 12      | DO_00       | O   | Digital output 0                              | 37      | DO_01       | O   | Digital output 1                              |
| 13      | DO_02       | O   | Digital output 2                              | 38      | DO_03       | O   | Digital output 3                              |
| 14      |             |     |                                               | 39      | 0V_1        | P   | Common ground 1                               |
| 15      | +24V_1      | P   | 24-V power supply 1                           | 40      |             |     |                                               |
| 16      | DO_04       | O   | Digital output 4                              | 41      | DO_05       | O   | Digital output 5                              |
| 17      | DO_06       | O   | Digital output 6                              | 42      | DO_07       | O   | Digital output 7                              |
| 18      |             |     |                                               | 43      | 0V_1        | P   | Common ground 1                               |
| 19      | DO_08       | O   | Digital output 8                              | 44      | DO_09       | O   | Digital output 9                              |
| 20      | DO_10       | O   | Digital output 10                             | 45      | DO_11       | O   | Digital output 11                             |
| 21      |             |     |                                               | 46      | 0V_2        | P   | Common ground 2                               |
| 22      | +24V_2      | P   | 24-V power supply 2                           | 47      |             |     |                                               |
| 23      | DO_12       | O   | Digital output 12                             | 48      | DO_13       | O   | Digital output 13                             |
| 24      | DO_14       | O   | Digital output 14                             | 49      | DO_15       | O   | Digital output 15                             |
| 25      |             |     |                                               | 50      | 0V_2        | P   | Common ground 2                               |

- P: Power supply input, I: Input signal, O: Output signal

### ■ CN2 Connector Pin Arrangement (Viewed from Wiring Side)



|    |         |    |         |    |       |    |       |
|----|---------|----|---------|----|-------|----|-------|
| 2  | DI_16   | 1  | DICOM_3 | 27 | DI_17 | 26 |       |
| 4  | DI_20   | 3  | DI_18   | 29 | DI_21 | 28 | DI_19 |
| 6  | DICOM_4 | 5  | DI_22   | 31 |       | 30 | DI_23 |
| 8  | DI_26   | 7  | DI_24   | 33 | DI_27 | 32 | DI_25 |
| 10 | DI_30   | 9  | DI_28   | 35 | DI_31 | 34 | DI_29 |
| 12 | DO_16   | 11 |         | 37 | DO_17 | 36 |       |
| 14 |         | 13 | DO_18   | 39 | 0V_3  | 38 | DO_19 |
| 16 | DO_20   | 15 | +24V_3  | 41 | DO_21 | 40 |       |
| 18 |         | 17 | DO_22   | 43 | 0V_3  | 42 | DO_23 |
| 20 | DO_26   | 19 | DO_24   | 45 | DO_27 | 44 | DO_25 |
| 22 | +24V_4  | 21 |         | 47 |       | 46 | 0V_4  |
| 24 | DO_30   | 23 | DO_28   | 49 | DO_31 | 48 | DO_29 |
|    |         | 25 |         |    |       | 50 | 0V_4  |

### ■ CN2 Connector Details

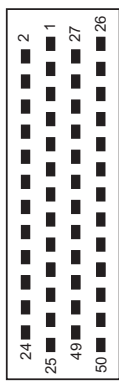
| Pin No. | Signal Name | I/O | Remarks                                        | Pin No. | Signal Name | I/O | Remarks                                        |
|---------|-------------|-----|------------------------------------------------|---------|-------------|-----|------------------------------------------------|
| 1       | DICOM_3     | P   | Input common 3                                 | 26      |             |     |                                                |
| 2       | DI_16       | I   | Digital input 16 (shared with interrupt input) | 27      | DI_17       | I   | Digital input 17 (shared with interrupt input) |
| 3       | DI_18       | I   | Digital input 18                               | 28      | DI_19       | I   | Digital input 19                               |
| 4       | DI_20       | I   | Digital input 20                               | 29      | DI_21       | I   | Digital input 21                               |
| 5       | DI_22       | I   | Digital input 22                               | 30      | DI_23       | I   | Digital input 23                               |
| 6       | DICOM_4     | P   | Input common 4                                 | 31      |             |     |                                                |
| 7       | DI_24       | I   | Digital input 24                               | 32      | DI_25       | I   | Digital input 25                               |
| 8       | DI_26       | I   | Digital input 26                               | 33      | DI_27       | I   | Digital input 27                               |
| 9       | DI_28       | I   | Digital input 28                               | 34      | DI_29       | I   | Digital input 29                               |
| 10      | DI_30       | I   | Digital input 30                               | 35      | DI_31       | I   | Digital input 31                               |
| 11      |             |     |                                                | 36      |             |     |                                                |
| 12      | DO_16       | O   | Digital output 16                              | 37      | DO_17       | O   | Digital output 17                              |
| 13      | DO_18       | O   | Digital output 18                              | 38      | DO_19       | O   | Digital output 19                              |
| 14      |             |     |                                                | 39      | 0V_3        | P   | Common ground 3                                |
| 15      | +24V_3      | P   | 24-V power supply 3                            | 40      |             |     |                                                |
| 16      | DO_20       | O   | Digital output 20                              | 41      | DO_21       | O   | Digital output 21                              |
| 17      | DO_22       | O   | Digital output 22                              | 42      | DO_23       | O   | Digital output 23                              |
| 18      |             |     |                                                | 43      | 0V_3        | P   | Common ground 3                                |
| 19      | DO_24       | O   | Digital output 24                              | 44      | DO_25       | O   | Digital output 25                              |
| 20      | DO_26       | O   | Digital output 26                              | 45      | DO_27       | O   | Digital output 27                              |
| 21      |             |     |                                                | 46      | 0V_4        | P   | Common ground 4                                |
| 22      | +24V_4      | P   | 24-V power supply 4                            | 47      |             |     |                                                |
| 23      | DO_28       | O   | Digital output 28                              | 48      | DO_29       | O   | Digital output 29                              |
| 24      | DO_30       | O   | Digital output 30                              | 49      | DO_31       | O   | Digital output 31                              |
| 25      |             |     |                                                | 50      | 0V_4        | P   | Common ground 4                                |

- P: Power supply input, I: Input signal, O: Output signal

## ( 3 ) LIO-05 Module Connector Pin Arrangement

The following table shows the LIO-05 Module connector (CN1 and CN2) pin arrangement viewed from the wiring side and the details of the pins.

## ■ CN1 Connector Pin Arrangement (Viewed from Wiring Side)



|    |         |    |         |    |        |    |        |
|----|---------|----|---------|----|--------|----|--------|
| 2  | DI_00   | 1  | DICOM_1 | 27 | DI_01  | 26 |        |
| 4  | DI_04   | 3  | DI_02   | 29 | DI_05  | 28 | DI_03  |
| 6  | DICOM_2 | 5  | DI_06   | 31 |        | 30 | DI_07  |
| 8  | DI_10   | 7  | DI_08   | 33 | DI_11  | 32 | DI_09  |
| 10 | DI_14   | 9  | DI_12   | 35 | DI_15  | 34 | DI_13  |
| 12 | DO_00   | 11 |         | 37 | DO_01  | 36 |        |
| 14 |         | 13 | DO_02   | 39 | 0V_1   | 38 | DO_03  |
| 16 | DO_04   | 15 | +24V_1  | 41 | DO_05  | 40 | +24V_1 |
| 18 |         | 17 | DO_06   | 43 |        | 42 | DO_07  |
| 20 | DO_10   | 19 | DO_08   | 45 | DO_11  | 44 | DO_09  |
| 22 | +24V_2  | 21 |         | 47 | +24V_2 | 46 | 0V_2   |
| 24 | DO_14   | 23 | DO_12   | 49 | DO_15  | 48 | DO_13  |
|    |         | 25 |         |    |        | 50 |        |

## ■ CN1 Connector Details

| Pin No. | Signal Name | I/O | Remarks                                       | Pin No. | Signal Name | I/O | Remarks                                       |
|---------|-------------|-----|-----------------------------------------------|---------|-------------|-----|-----------------------------------------------|
| 1       | DICOM_1     | P   | Input common 1                                | 26      |             |     |                                               |
| 2       | DI_00       | I   | Digital input 0 (shared with interrupt input) | 27      | DI_01       | I   | Digital input 1 (shared with interrupt input) |
| 3       | DI_02       | I   | Digital input 2                               | 28      | DI_03       | I   | Digital input 3                               |
| 4       | DI_04       | I   | Digital input 4                               | 29      | DI_05       | I   | Digital input 5                               |
| 5       | DI_06       | I   | Digital input 6                               | 30      | DI_07       | I   | Digital input 7                               |
| 6       | DICOM_2     | P   | Input common 2                                | 31      |             |     |                                               |
| 7       | DI_08       | I   | Digital input 8                               | 32      | DI_09       | I   | Digital input 9                               |
| 8       | DI_10       | I   | Digital input 10                              | 33      | DI_11       | I   | Digital input 11                              |
| 9       | DI_12       | I   | Digital input 12                              | 34      | DI_13       | I   | Digital input 13                              |
| 10      | DI_14       | I   | Digital input 14                              | 35      | DI_15       | I   | Digital input 15                              |
| 11      |             |     |                                               | 36      |             |     |                                               |
| 12      | DO_00       | O   | Digital output 0                              | 37      | DO_01       | O   | Digital output 1                              |
| 13      | DO_02       | O   | Digital output 2                              | 38      | DO_03       | O   | Digital output 3                              |
| 14      |             |     |                                               | 39      | 0V_1        | P   | 0-V power supply 1                            |
| 15      | +24V_1      | P   | Common 24 V_1                                 | 40      | +24V_1      | P   | Common 24 V_1                                 |
| 16      | DO_04       | O   | Digital output 4                              | 41      | DO_05       | O   | Digital output 5                              |
| 17      | DO_06       | O   | Digital output 6                              | 42      | DO_07       | O   | Digital output 7                              |
| 18      |             |     |                                               | 43      |             |     |                                               |
| 19      | DO_08       | O   | Digital output 8                              | 44      | DO_09       | O   | Digital output 9                              |
| 20      | DO_10       | O   | Digital output 10                             | 45      | DO_11       | O   | Digital output 11                             |
| 21      |             |     |                                               | 46      | 0V_2        | P   | 0-V power supply 2                            |
| 22      | +24V_2      | P   | Common 24 V_2                                 | 47      | +24V_2      | P   | Common 24 V_1                                 |
| 23      | DO_12       | O   | Digital output 12                             | 48      | DO_13       | O   | Digital output 13                             |
| 24      | DO_14       | O   | Digital output 14                             | 49      | DO_15       | O   | Digital output 15                             |
| 25      |             |     |                                               | 50      |             |     |                                               |

♦ P: Power supply input, I: Input signal, O: Output signal

### ■ CN2 Connector Pin Arrangement (Viewed from Wiring Side)

|    |         |    |         |    |        |    |        |
|----|---------|----|---------|----|--------|----|--------|
| 2  | DI_16   | 1  | DICOM_3 | 27 | DI_17  | 26 |        |
| 4  | DI_20   | 3  | DI_18   | 29 | DI_21  | 28 | DI_19  |
| 6  | DICOM_4 | 5  | DI_22   | 31 |        | 30 | DI_23  |
| 8  | DI_26   | 7  | DI_24   | 33 | DI_27  | 32 | DI_25  |
| 10 | DI_30   | 9  | DI_28   | 35 | DI_31  | 34 | DI_29  |
| 12 | DO_16   | 11 |         | 37 | DO_17  | 36 |        |
| 14 |         | 13 | DO_18   | 39 | 0V_3   | 38 | DO_19  |
| 16 | DO_20   | 15 | +24V_3  | 41 | DO_21  | 40 | +24V_3 |
| 18 |         | 17 | DO_22   | 43 |        | 42 | DO_23  |
| 20 | DO_26   | 19 | DO_24   | 45 | DO_27  | 44 | DO_25  |
| 22 | +24V_4  | 21 |         | 47 | +24V_4 | 46 | 0V_4   |
| 24 | DO_30   | 23 | DO_28   | 49 | DO_31  | 48 | DO_29  |
|    |         | 25 |         |    |        | 50 |        |

### ■ CN2 Connector Details

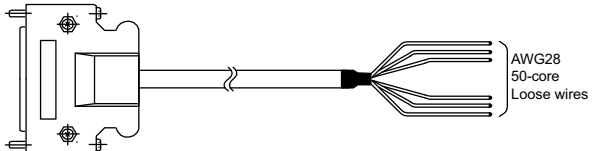
| Pin No. | Signal Name | I/O | Remarks                                        | Pin No. | Signal Name | I/O | Remarks                                        |
|---------|-------------|-----|------------------------------------------------|---------|-------------|-----|------------------------------------------------|
| 1       | DICOM_3     | P   | Input common 3                                 | 26      |             |     |                                                |
| 2       | DI_16       | I   | Digital input 16 (shared with interrupt input) | 27      | DI_17       | I   | Digital input 17 (shared with interrupt input) |
| 3       | DI_18       | I   | Digital input 18                               | 28      | DI_19       | I   | Digital input 19                               |
| 4       | DI_20       | I   | Digital input 20                               | 29      | DI_21       | I   | Digital input 21                               |
| 5       | DI_22       | I   | Digital input 22                               | 30      | DI_23       | I   | Digital input 23                               |
| 6       | DICOM_4     | P   | Input common 4                                 | 31      |             |     |                                                |
| 7       | DI_24       | I   | Digital input 24                               | 32      | DI_25       | I   | Digital input 25                               |
| 8       | DI_26       | I   | Digital input 26                               | 33      | DI_27       | I   | Digital input 27                               |
| 9       | DI_28       | I   | Digital input 28                               | 34      | DI_29       | I   | Digital input 29                               |
| 10      | DI_30       | I   | Digital input 30                               | 35      | DI_31       | I   | Digital input 31                               |
| 11      |             |     |                                                | 36      |             |     |                                                |
| 12      | DO_16       | O   | Digital output 16                              | 37      | DO_17       | O   | Digital output 17                              |
| 13      | DO_18       | O   | Digital output 18                              | 38      | DO_19       | O   | Digital output 19                              |
| 14      |             |     |                                                | 39      | 0V_3        | P   | 0-V power supply 3                             |
| 15      | +24V_3      | P   | Common 24 V_3                                  | 40      | +24V_3      | P   | Common 24 V_3                                  |
| 16      | DO_20       | O   | Digital output 20                              | 41      | DO_21       | O   | Digital output 21                              |
| 17      | DO_22       | O   | Digital output 22                              | 42      | DO_23       | O   | Digital output 23                              |
| 18      |             |     |                                                | 43      |             |     |                                                |
| 19      | DO_24       | O   | Digital output 24                              | 44      | DO_25       | O   | Digital output 25                              |
| 20      | DO_26       | O   | Digital output 26                              | 45      | DO_27       | O   | Digital output 27                              |
| 21      |             |     |                                                | 46      | 0V_4        | P   | 0-V power supply 4                             |
| 22      | +24V_4      | P   | Common 24 V_4                                  | 47      | +24V_4      | P   | Common 24 V_4                                  |
| 23      | DO_28       | O   | Digital output 28                              | 48      | DO_29       | O   | Digital output 29                              |
| 24      | DO_30       | O   | Digital output 30                              | 49      | DO_31       | O   | Digital output 31                              |
| 25      |             |     |                                                | 50      |             |     |                                                |

- P: Power supply input, I: Input signal, O: Output signal

### 3.2.2 Cable Specifications

The following shows the specifications of the LIO-04/LIO-05 Module standard cables.

#### ( 1 ) Standard Cable Model List

| Name                                                      | Model            | Length | External Appearance (JEPMC-W6060-□□-E)                                             |
|-----------------------------------------------------------|------------------|--------|------------------------------------------------------------------------------------|
| Cable for LIO-4/<br>LIO-05 Modules<br>(Single loose wire) | JEPMC-W6060-05-E | 0.5 m  |  |
|                                                           | JEPMC-W6060-10-E | 1 m    |                                                                                    |
|                                                           | JEPMC-W6060-30-E | 3 m    |                                                                                    |

#### ( 2 ) Standard Cable Wiring Table

The wiring table for the standard cable JEPMC-W6060-□□-E is shown below.

| 50-pin<br>Connector<br>Terminal No. | Marking          | Wire Color | Marking          | 50-pin<br>Connector<br>Terminal No. |
|-------------------------------------|------------------|------------|------------------|-------------------------------------|
| 1                                   | —                | Orange     | —                | 26                                  |
| 2                                   | —                | Gray       | —                | 27                                  |
| 3                                   | —                | White      | —                | 28                                  |
| 4                                   | —                | Yellow     | —                | 29                                  |
| 5                                   | —                | Pink       | —                | 30                                  |
| 6                                   | --               | Orange     | --               | 31                                  |
| 7                                   | --               | Gray       | --               | 32                                  |
| 8                                   | --               | White      | --               | 33                                  |
| 9                                   | --               | Yellow     | --               | 34                                  |
| 10                                  | --               | Pink       | --               | 35                                  |
| 11                                  | ----             | Orange     | ----             | 36                                  |
| 12                                  | ----             | Gray       | ----             | 37                                  |
| 13                                  | ----             | White      | ----             | 38                                  |
| 14                                  | ----             | Yellow     | ----             | 39                                  |
| 15                                  | ----             | Pink       | ----             | 40                                  |
| 16                                  | -----            | Orange     | ----- Continuous | 41                                  |
| 17                                  | -----            | Gray       | ----- Continuous | 42                                  |
| 18                                  | -----            | White      | ----- Continuous | 43                                  |
| 19                                  | -----            | Yellow     | ----- Continuous | 44                                  |
| 20                                  | -----            | Pink       | ----- Continuous | 45                                  |
| 21                                  | ----- Continuous | Orange     | -----            | 46                                  |
| 22                                  | ----- Continuous | Gray       | -----            | 47                                  |
| 23                                  | ----- Continuous | White      | -----            | 48                                  |
| 24                                  | ----- Continuous | Yellow     | -----            | 49                                  |
| 25                                  | ----- Continuous | Pink       | -----            | 50                                  |

### 3.2.3 Input Circuit

The following table shows the LIO-04/LIO-05 Module input circuit specifications.

| Item                | Specifications                                                                                                                                                                                         |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inputs              | 32 points                                                                                                                                                                                              |
| Input Format        | Sink mode/source mode input                                                                                                                                                                            |
| Isolation Method    | Photocoupler                                                                                                                                                                                           |
| Input Voltage       | 24 VDC $\pm$ 20% (+19.2 V to +28.8 V)                                                                                                                                                                  |
| Input Current       | 4.1 mA (typ.)                                                                                                                                                                                          |
| ON Voltage/Current  | 15 V min./2.0 mA min.                                                                                                                                                                                  |
| OFF Voltage/Current | 5 V min./1.0 mA min.                                                                                                                                                                                   |
| ON Time/OFF Time    | ON: 0.5 ms max.<br>OFF: 0.5 ms max.                                                                                                                                                                    |
| Number of Commons   | 4 (8 points/common)                                                                                                                                                                                    |
| Other Functions     | DI_00 is shared with an interrupt input. If DI_00 is turned ON while interrupts are enabled, the interrupt processing drawing (program) is executed.<br>DI_01, DI_16, and DI_17 are the same as DI_00. |

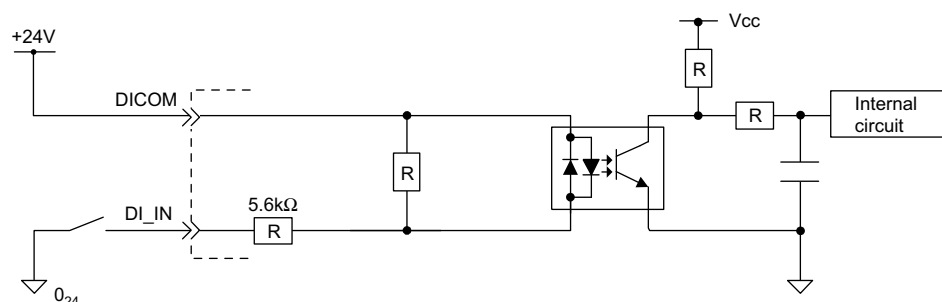


Fig. 3.2 Digital Input Circuit (Source Mode Input)

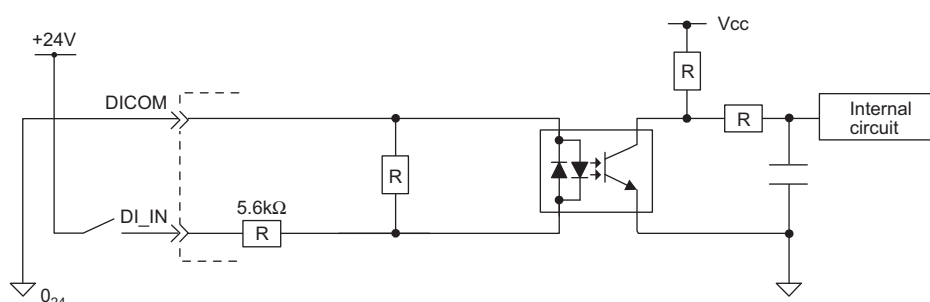


Fig. 3.3 Digital Input Circuit (Sink Mode Input)

3.2.4 Output Circuit

The following table shows the LIO-04/LIO-05 Module output circuit specifications.

| Item                     | Specifications                                                                                                                                                                           |                                |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Outputs                  | 32 points                                                                                                                                                                                |                                |
| Output Format            | LIO-04                                                                                                                                                                                   | Transistor, sink mode output   |
|                          | LIO-05                                                                                                                                                                                   | Transistor, source mode output |
| Isolation Method         | Photocoupler                                                                                                                                                                             |                                |
| Output Voltage           | 24 VDC±20% (+19.2 V to +28.8 V)                                                                                                                                                          |                                |
| Output Current           | 100 mA max.                                                                                                                                                                              |                                |
| Leakage Current When OFF | 0.1 mA max.                                                                                                                                                                              |                                |
| ON Time/OFF Time         | ON: 0.5 ms max.<br>OFF: 1 ms max.                                                                                                                                                        |                                |
| Number of Commons        | 4 (8 points/common)                                                                                                                                                                      |                                |
| Protection Circuit       | Fuse<br>The fuse is not, however, for circuit protection. It is for protecting against fire at output shorts. Attach a fuse externally to each output if circuit protection is required. |                                |
| Fuse Rating              | 1.2 A                                                                                                                                                                                    |                                |
| Error Detection          | Fuse blown detection<br>Replace the Module when the fuse blown is detected.                                                                                                              |                                |

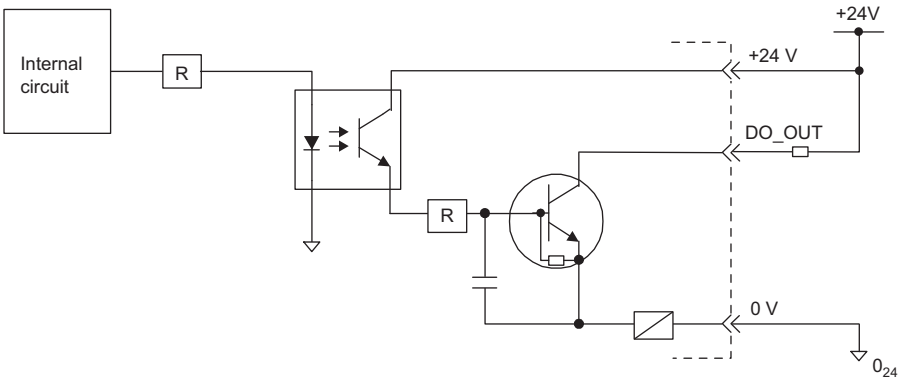


Fig. 3.4 LIO-04 Digital Output Circuit (Sink Mode Output)

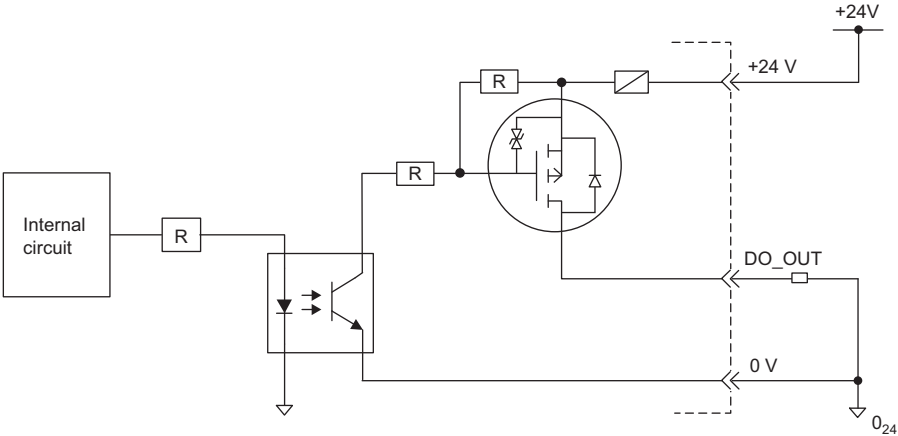
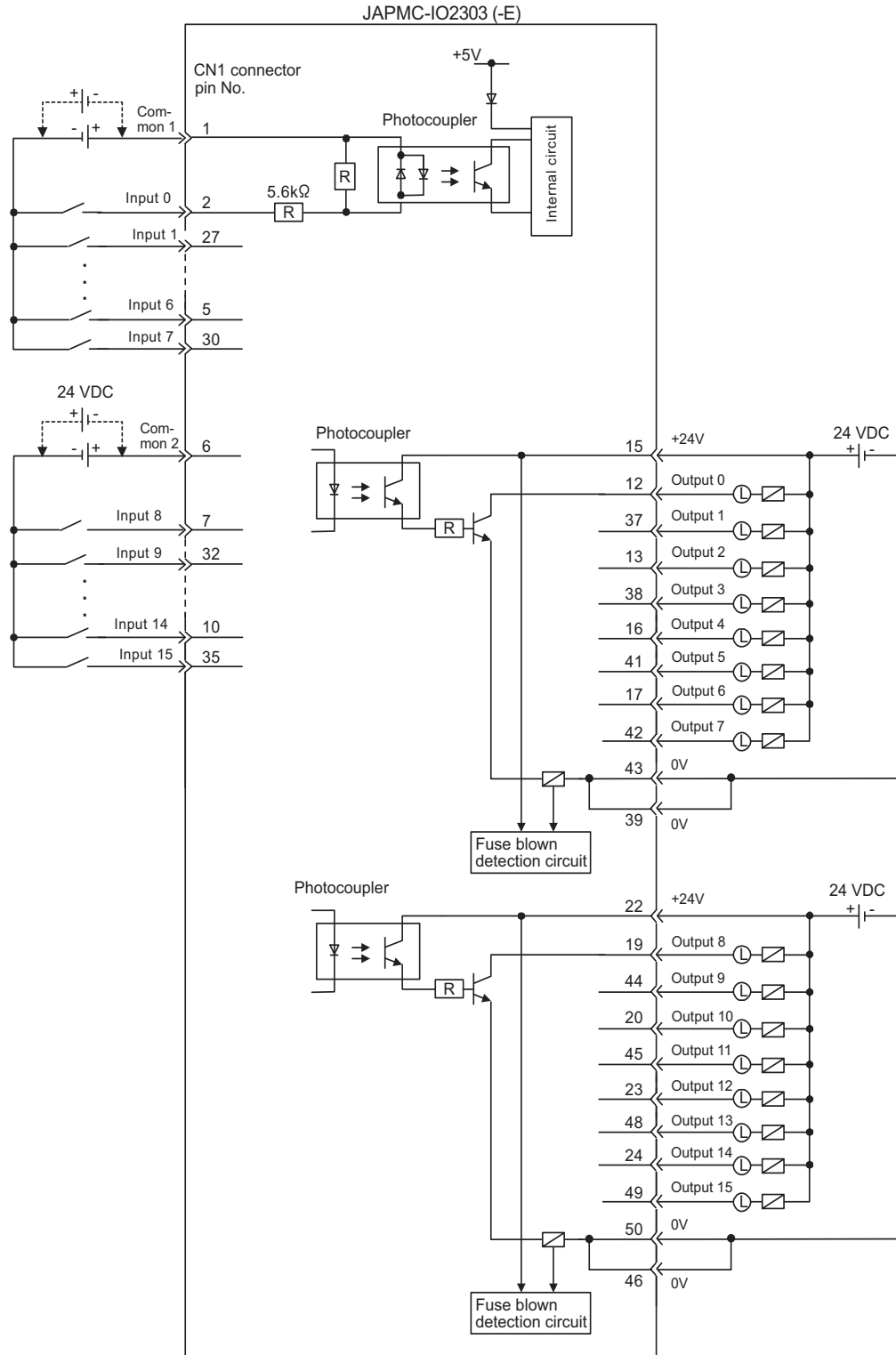


Fig. 3.5 LIO-05 Digital Output Circuit (Source Mode Output)

### 3.2.5 LIO-04 Module Connections

The following diagrams show connection examples for CN1/CN2 connector of the LIO-04 Module.

#### ( 1 ) CN1 Connector

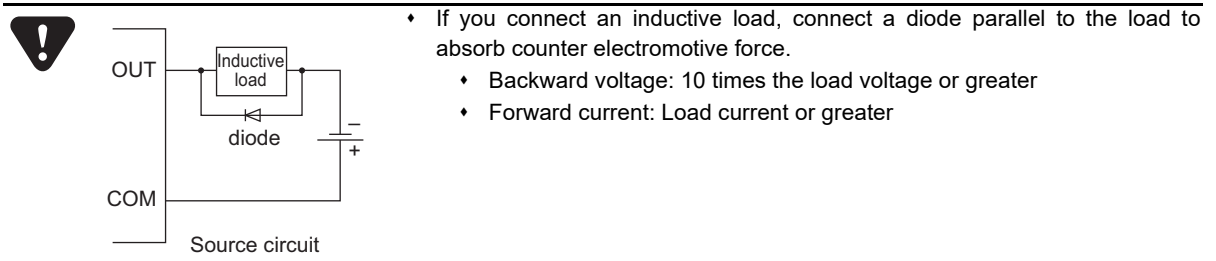


- The pins No. 39 and 43 and the pins No. 46 and 50 are internally connected. Connect them externally as well.

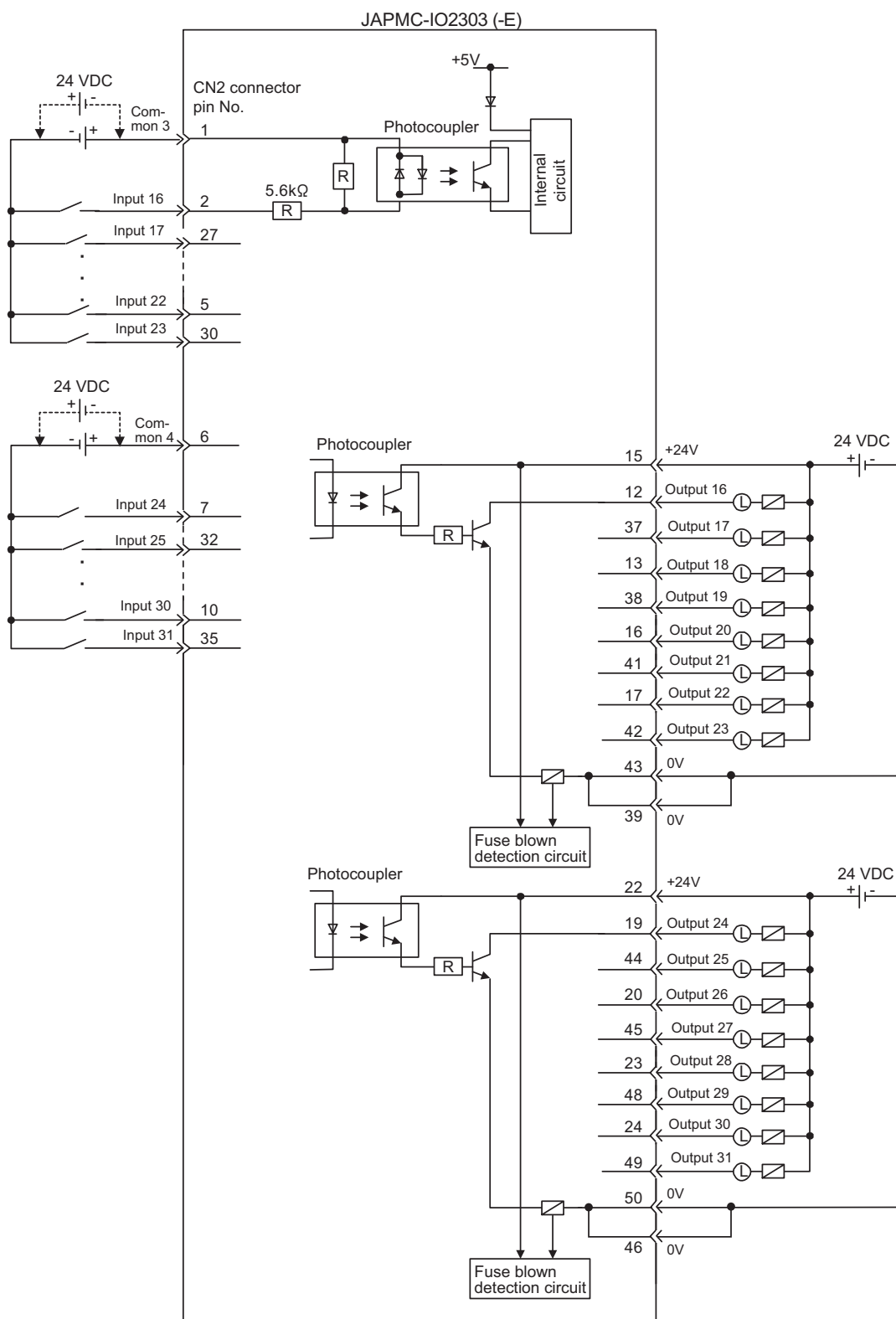


- A fuse is inserted in the output common line of the LIO-04 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.

### 3.2.5 LIO-04 Module Connections



## ( 2 ) CN2 Connector

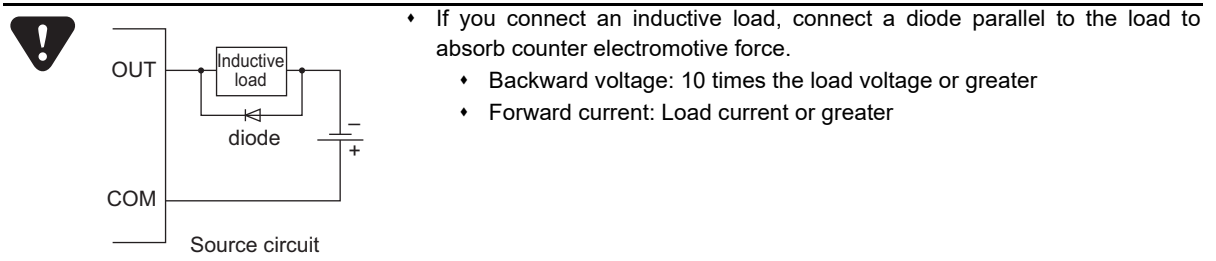


- The pins No. 39 and 43 and the pins No. 46 and 50 are internally connected. Connect them externally as well.



- A fuse is inserted in the output common line of the LIO-04 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.

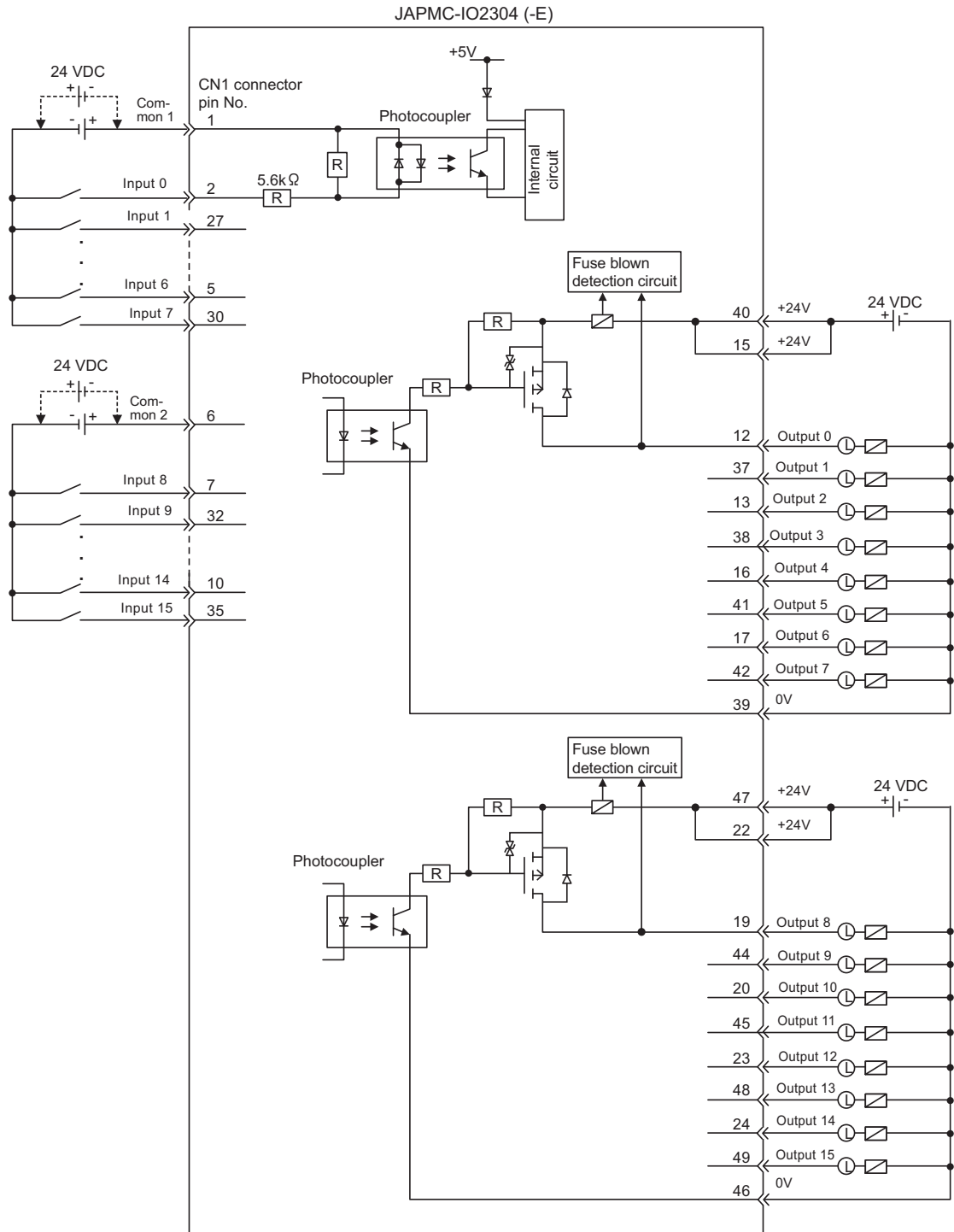
### 3.2.5 LIO-04 Module Connections



### 3.2.6 LIO-05 Module Connections

The following diagrams show connection examples for CN1/CN2 connector of the LIO-05 Module.

#### ( 1 ) CN1 Connector

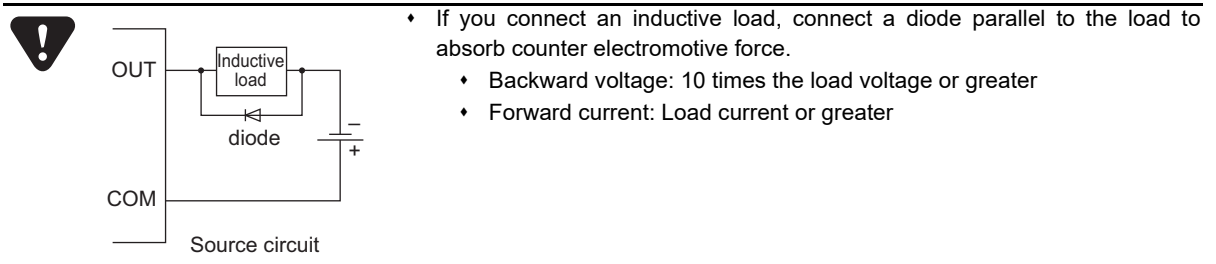


- Check the polarity of the external power supply when wiring. An adverse connection may cause a load malfunction.
- The pins No. 15 and 40 and the pins No. 22 and 47 are internally connected. Connect them externally as well.

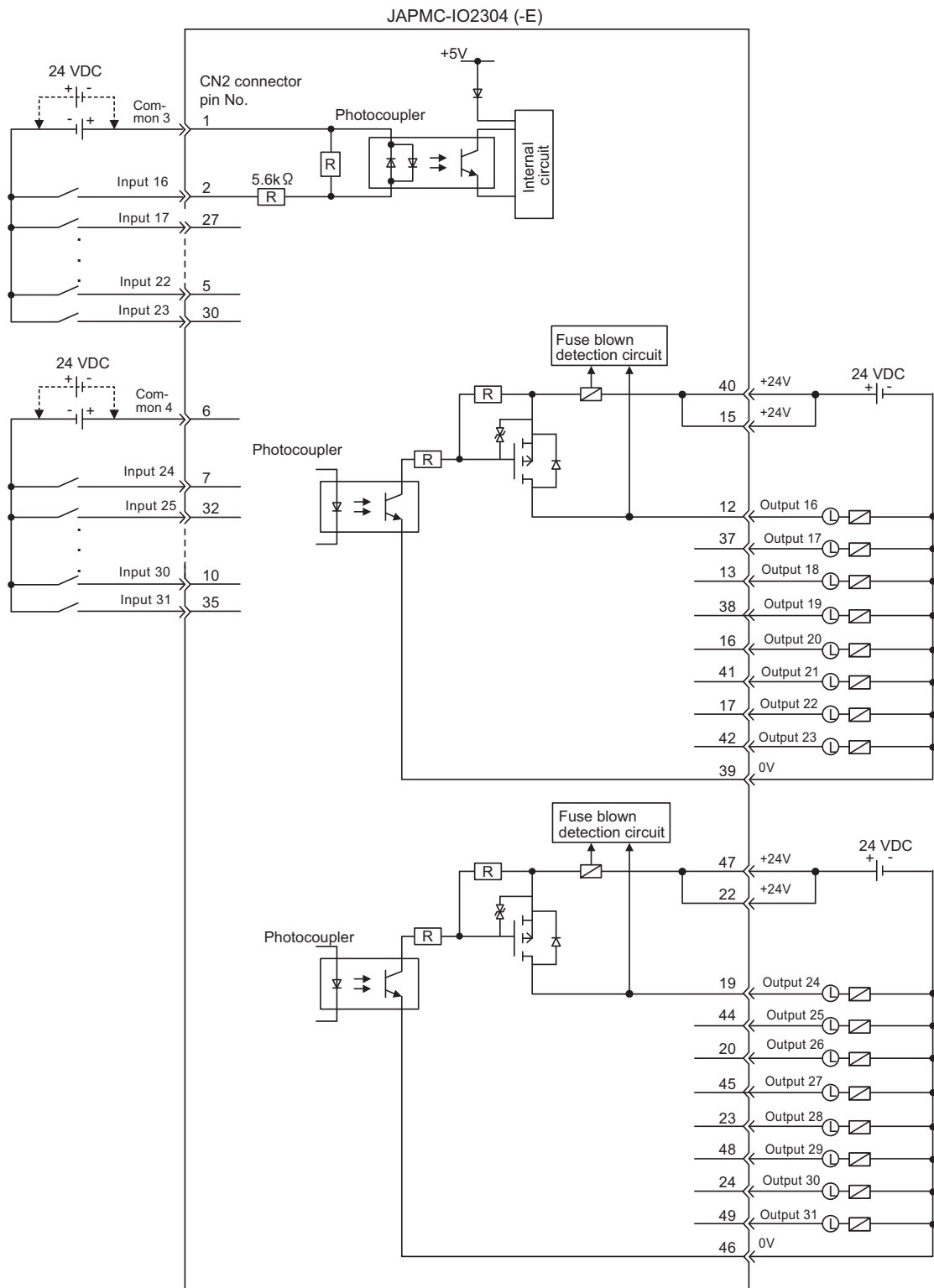


- A fuse is inserted in the output common line of the LIO-05 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.

### 3.2.6 LIO-05 Module Connections



## ( 2 ) CN2 Connector



- Check the polarity of the external power supply when wiring. An adverse connection may cause a load malfunction.
- The pins No. 15 and 40 and the pins 22 and 47 are internally connected. Connect them externally as well.



- A fuse is inserted in the output common line of the LIO-05 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.

## 3.3 LIO-04/ LIO-05 Module Details

LIO-04/LIO-05 Module details, such as the local I/O, can be set in the **Local I/O** Window or the **Counter Module** Window. These windows can be displayed from the **Module Configuration** Window.

### 3.3.1 Displaying the Local I/O Window

Double-click **LIO32** in the **Function Module/Slave** Column of the **Module Configuration** Window.

| Module            | Function Module/Slave | Status | Circuit No/AxisAddress |             | Motion Register | Register(Input/Output)                                            |                |      |      | Comment |
|-------------------|-----------------------|--------|------------------------|-------------|-----------------|-------------------------------------------------------------------|----------------|------|------|---------|
|                   |                       |        | Start                  | cupied circ |                 | Disabled                                                          | Start - End    | Size | Scan |         |
| 01 [MP2300] : --- |                       |        |                        |             |                 |                                                                   |                |      |      |         |
| 00 [MP2300] : --- | 01 CPU                | ---    | ---                    | ---         | ---             | ---                                                               | ---            | ---  | ---  |         |
|                   | 02 IO                 | ---    | ---                    | 1           | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0000 - 0001[H] | 2    | ---  |         |
|                   | 03 [SVB]              | ---    | Circuit No1            | 1           | 8000 - 87FF[H]  | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0010 - 040F[H] | 1024 | ---  |         |
|                   | 04 [SVR]              | ---    | Circuit No2            | 1           | 8800 - 8FFF[H]  | ---                                                               | ---            | ---  | ---  |         |
| 01 [LIO-02] : --- | 01 LIO                | ---    | ---                    | 1           | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0440 - 0441[H] | 2    | ---  |         |
|                   | 02 CNTR               | ---    | ---                    | 1           | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0450 - 046F[H] | 32   | ---  |         |
| 02 [LIO-04] : --- | 01 LIO32              | ---    | ---                    | 1           | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0410 - 0411[H] | 2    | ---  |         |
| 03 [DO-01] : ---  | 01 DO                 | ---    | ---                    | 1           | ---             | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0420 - 0423[H] | 4    | ---  |         |

A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **Local I/O** Window will be displayed.

- ♦ Refer to 1.4.1 *Displaying the Module Configuration Window* on page 1-15 for information on displaying the **Module Configuration** Window.

### 3.3.2 Local I/O Configuration Details

The following items are displayed in the **Local I/O** Window. The discrete inputs, discrete outputs, and interrupt inputs can be set.

In LIO-04 module and LIO-05 module, the register numbers allocated to the inputs and outputs are same.

| No | Item           | D                                   | REG      | Word  | SCAN | Current Value | HEX |
|----|----------------|-------------------------------------|----------|-------|------|---------------|-----|
| 1  | Local Input 1  | <input type="checkbox"/>            | IW00410  | 1     | HIGH |               |     |
| 2  | Local Input 2  | <input type="checkbox"/>            | IW00411  | 1     | HIGH |               |     |
| 3  | Local Output 1 | <input type="checkbox"/>            | OW00410  | 1     | HIGH |               |     |
| 4  | Local Output 2 | <input type="checkbox"/>            | OW00411  | 1     | HIGH |               |     |
| 5  | IRQ Input 1    | <input checked="" type="checkbox"/> | IB004100 | ----- | -    |               |     |
| 6  | IRQ Input 2    | <input checked="" type="checkbox"/> | IB004101 | ----- | -    |               |     |
| 7  | IRQ Input 3    | <input checked="" type="checkbox"/> | IB004110 | ----- | -    |               |     |
| 8  | IRQ Input 4    | <input checked="" type="checkbox"/> | IB004111 | ----- | -    |               |     |

D : Enable or disable each item by clicking on the cell.

☐ : Enabled, ☒ : Disabled

The register length is fixed at one word, i.e., 16 points are set for each input or output register.

REG : Displays the register number allocated to the inputs or outputs. It cannot be changed.

Word : Displays the word size of the register data. It cannot be changed.

SCAN : Select the speed from **HIGH**, **LOW**, or **NA** (none specified), for the scan that processes the inputs or outputs.

Current Value : The current value of the register will be displayed in binary when online. It will not be displayed when offline.

The outputs to external devices can be set by changing the current value of the discrete outputs.

When the set value is confirmed, it is immediately saved in the register.

Other current values cannot be changed.

HEX : The current value of the register will be displayed in hexadecimal when online. It will not be displayed when offline.

After changing the local I/O configuration, save the definition data by selecting **Online – Save to Flash** from the main menu.



- Precautions for JAPMC-IO2303-E and JAPMC-IO2304-E Hardware (-E added to models)  
The operation of discrete input 2 depends on the version of the CPU Module as shown in the following table.

| Software Version of CPU Module |                         | Operation of Discrete Input 2                                                                                                                                                                                                                                                                                                                              |
|--------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MP2000 Series                  | MP3000 Series           |                                                                                                                                                                                                                                                                                                                                                            |
| Version 3.00 or earlier        | Version 1.22 or earlier | <ul style="list-style-type: none"> <li>• When Discrete Input 1 Is Enabled in the D Column<br/>Operation is performed with the SCAN set value for discrete input 1.<br/>*The SCAN set value for discrete input 2 is disabled.</li> <li>• When Discrete Input 1 Is Disabled in the D Column<br/>The input value for discrete input 2 is always 0.</li> </ul> |
| Version 3.01 or later          | Version 1.23 or later   | Operation is performed with the SCAN set value for discrete input 2.                                                                                                                                                                                                                                                                                       |

## LIO-06 Module

This chapter describes the LIO-06 Module in detail.

|                                                                  |             |
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## 4.1 Outline of LIO-06 Module

### 4.1.1 Outline of Functions

The LIO-06 Module is I/O Modules having digital I/O, analog I/O, and pulse counter functions. There are 8 digital inputs (DI) and 8 digital outputs (DO) (sink mode outputs) for the digital I/O function, and 1 analog input (AI) channel and 1 analog output (AO) channel for the analog I/O function. There is also 1 pulse input (PI) channel for the pulse counter function.

Digital I/O, analog I/O, and pulse input are made at a periodical cycle for each high-speed scan or low-speed scan of the MP2000 Series Machine Controller. The following diagram outlines the functions of the LIO-06 Module.

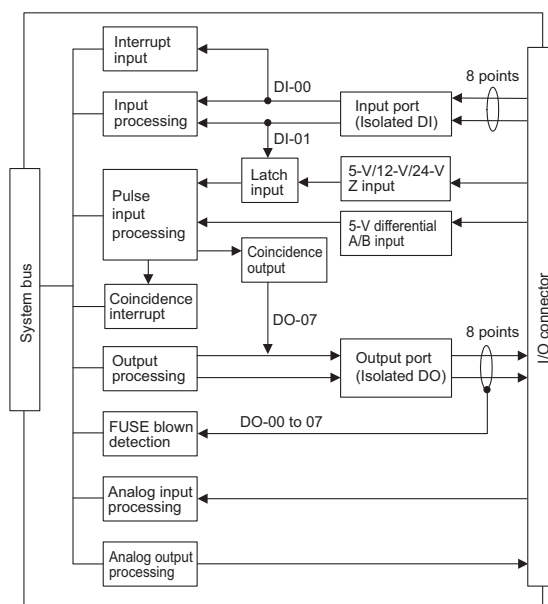
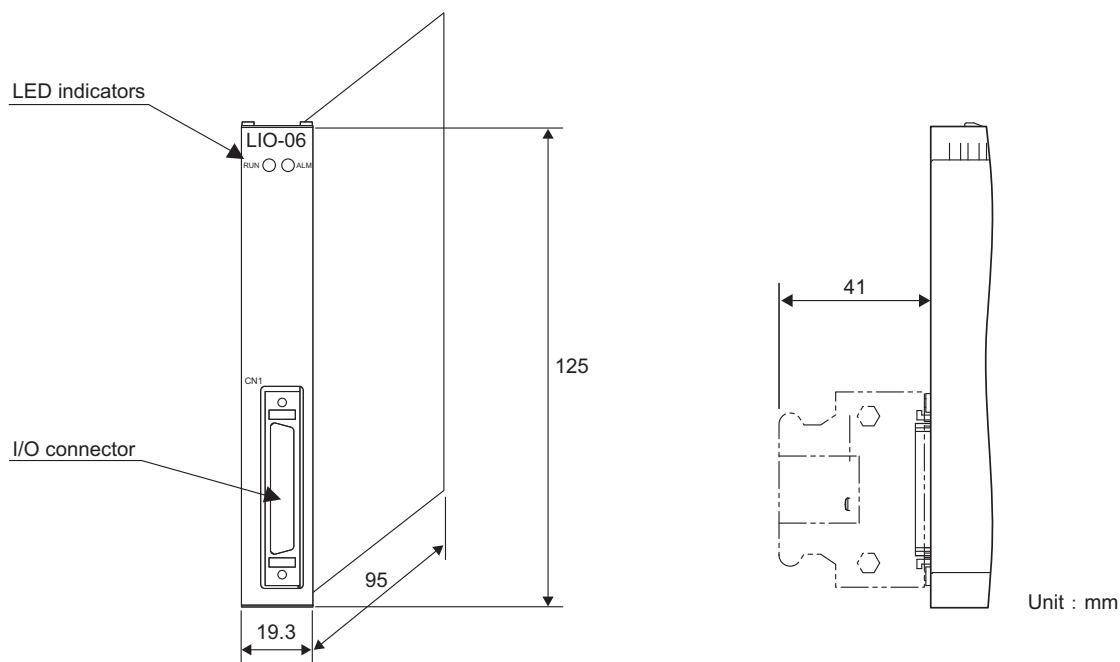


Fig. 4.1 Outline of LIO-06 Module Functions

### 4.1.2 LIO-06 Module Appearance and Connector External Dimensions

The following figure shows the appearance of the LIO-06 Module and the connector external dimensions.



### 4.1.3 Specifications

The following shows the specifications of the LIO-06 Module.

#### ( 1 ) Hardware Specifications

| Item                | Specifications                                                                                                                                                                               |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Classification      | I/O Module                                                                                                                                                                                   |
| Name                | LIO-06                                                                                                                                                                                       |
| Model               | JAPMC-IO2305-E                                                                                                                                                                               |
| Digital Input       | 8 inputs<br>24 VDC, 4.1 mA, combined sink mode/source mode inputs<br>(DI_00 also used for interrupts, DI-01 also used for pulse latch inputs)                                                |
| Digital Output      | 8 outputs<br>24 VDC transistor open-collector outputs, sink mode outputs<br>(DO_07 also used for coincidence outputs)                                                                        |
| Analog Input        | 1 channel<br>Analog input range: -10 to +10 V<br>Resolution: 16 bits (-31276 to +31276)                                                                                                      |
| Analog Output       | 1 channel<br>Analog output range: -10 to +10 V<br>Resolution: 16 bits (-31276 to +31276)                                                                                                     |
| Pulse Input         | Phase A/B/Z inputs<br>Phase AB: 5-V differential input, not isolated, max. frequency: 4 MHz<br>Phase Z: 5-V/12-V/24-V photocoupler input<br>Latch input<br>Pulse latch for phase Z or DI_01. |
| Connector           | I/O: I/O connector                                                                                                                                                                           |
| LED Indicators      | RUN (green)<br>ALM (red)                                                                                                                                                                     |
| Current Consumption | 800 mA max.                                                                                                                                                                                  |
| Dimensions (mm)     | 125 × 95 (H × D)                                                                                                                                                                             |
| Mass                | 80 g                                                                                                                                                                                         |

## ( 2 ) Environmental Conditions

| Item                            |                               | Specifications                                                                                                                                                                                                                                                                       |
|---------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions        | Ambient Operating Temperature | 0 to 50°C                                                                                                                                                                                                                                                                            |
|                                 | Ambient Storage Temperature   | -25 to 85°C                                                                                                                                                                                                                                                                          |
|                                 | Ambient Operating Humidity    | 30% to 95% (with no condensation)                                                                                                                                                                                                                                                    |
|                                 | Ambient Storage Humidity      | 5% to 95% (with no condensation)                                                                                                                                                                                                                                                     |
|                                 | Pollution Level               | Pollution level 2 (conforming to JIS B 3502)                                                                                                                                                                                                                                         |
|                                 | Corrosive Gas                 | There must be no combustible or corrosive gas.                                                                                                                                                                                                                                       |
|                                 | Operating Altitude            | 2,000 m above sea level or lower                                                                                                                                                                                                                                                     |
| Mechanical Operating Conditions | Vibration Resistance          | Conforming to JIS B 3502:<br><ul style="list-style-type: none"> <li>• 10 to 57 Hz with single-amplitude of 0.075 mm</li> <li>• 57 to 150 Hz with fixed acceleration of 9.8 m/s<sup>2</sup></li> <li>• 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)</li> </ul> |
|                                 | Shock Resistance              | Conforming to JIS B 3502:<br>Peak acceleration of 147 m/s <sup>2</sup> twice for 11 ms each in the X, Y, and Z directions                                                                                                                                                            |
| Electrical Operating Conditions | Noise Resistance              | Conforming to EN 61000-6-2, EN 61000-6-4, EN 55011 (Group 1 Class A)                                                                                                                                                                                                                 |
| Installation Requirements       | Ground                        | Ground to 100 Ω max.                                                                                                                                                                                                                                                                 |
|                                 | Cooling Method                | Natural cooling                                                                                                                                                                                                                                                                      |

## 4.1.4 LED Indicators

The following table shows the LIO-06 Module status when each indicator lamp is lit or unlit.

| Indicator | Color | When Lit                                                                                                                                                                                                                                  | When Unlit        |
|-----------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| RUN       | Green | Normal operation                                                                                                                                                                                                                          | Operation stopped |
| ALM       | Red   | Error occurrence (Lights when one of the following errors occurs) <ul style="list-style-type: none"> <li>• Blown fuse</li> <li>• ASIC error for counter/AO</li> <li>• Oscillator error</li> <li>• Phases A and B disconnection</li> </ul> | Normal operation  |

RUN   ALM

## 4.1.5 Analog I/O Characteristics

The analog I/O characteristics of the LIO-06 Module and the voltage characteristics are described below.

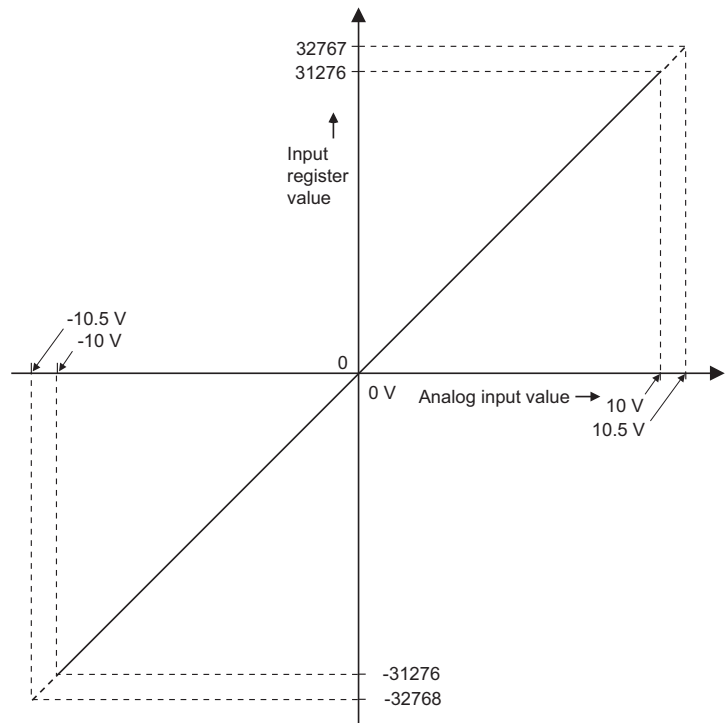
### ( 1 ) Analog Input Characteristics

#### ■ Input Characteristics Table

| Analog Input Value | Input Register Value |
|--------------------|----------------------|
| -10.5 V            | -32768               |
| -10.0 V            | -31276               |
| -5.0 V             | -15638               |
| 0.0 V              | 0                    |
| +5.0 V             | 15638                |
| +10.0 V            | 31276                |
| +10.5 V            | 32767                |

- ♦ Linearity effective range:  $\pm 10.0$  V

#### ■ Voltage Input Characteristics



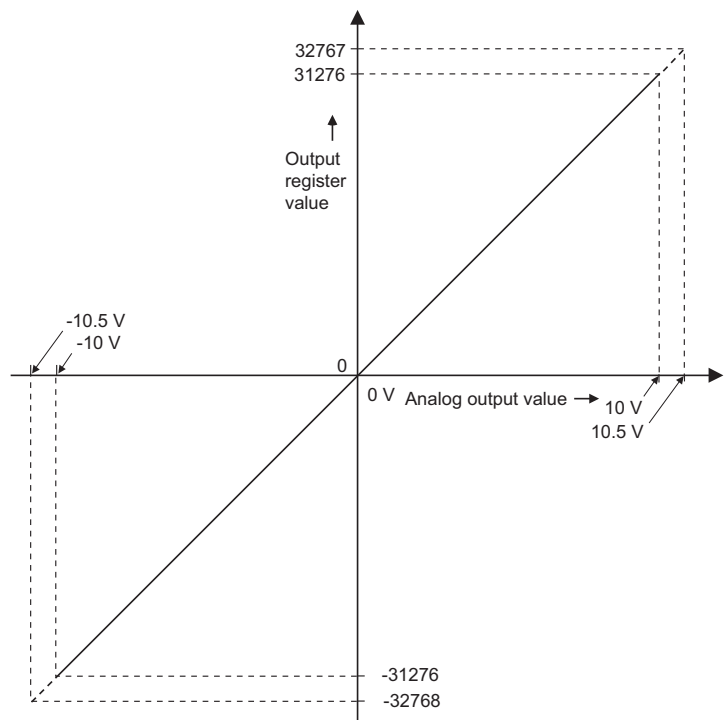
### ( 2 ) Analog Output Characteristics

#### ■ Output Characteristics Table

| Analog Output Value | Output Register Value |
|---------------------|-----------------------|
| -10.5 V             | -32768                |
| -10.0 V             | -31276                |
| -5.0 V              | -15638                |
| 0.0 V               | 0                     |
| +5.0 V              | 15638                 |
| +10.0 V             | 31276                 |
| +10.5 V             | 32767                 |

- ♦ Linearity effective range:  $\pm 10.0$  V

#### ■ Voltage Output Characteristics



4.2 Specifications of LIO-06 Module Connections

4.2.1 Connector Specifications

The LIO-06 Module connector connects the external I/O signals (digital/analog) or pulse input signal. (External digital input: 8 points, external digital output: 8 points, analog input: 1 channel, analog output: 1 channel, pulse input: 1 channel)

The following tables provide the specifications of the LIO-06 Module connector.

( 1 ) Connector Model

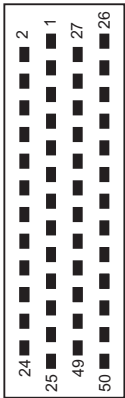


| Name                   | Connector Name | No of Pins | Connector Model                      |                                                                                                                                                                |                  |
|------------------------|----------------|------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                        |                |            | Module Side                          | Cable Side                                                                                                                                                     | Manufacturer     |
| External I/O Connector | CN1            | 50         | 10250-52A3PL<br>(Conforming to RoHS) | <ul style="list-style-type: none"><li>• Connector 10150-3000PE</li><li>• Shell 10350-52A0-008 (Screw locking), or 10350-52F0-008 (One-touch locking)</li></ul> | 3M Japan Limited |

( 2 ) LIO-06 Module Connector Pin Arrangement

The following table shows the LIO-06 Module connector (CN1) pin arrangement viewed from the wiring side and the details of the pins.

■ CN1 Connector Pin Arrangement (Viewed from Wiring Side)



|    |         |    |        |    |        |    |         |
|----|---------|----|--------|----|--------|----|---------|
| 2  | AI      | 1  | AO     | 27 | AI_GND | 26 | AO_GND  |
| 4  | PA+     | 3  |        | 29 | PB+    | 28 |         |
| 6  | GND     | 5  | PA-    | 31 | GND    | 30 | PB-     |
| 8  |         | 7  |        | 33 |        | 32 |         |
| 10 | PILC24V | 9  | PILC5V | 35 | PIL    | 34 | PILC12V |
| 12 |         | 11 |        | 37 |        | 36 |         |
| 14 | DI_00   | 13 | DICOM  | 39 | DI_01  | 38 | DICOM   |
| 16 | DI_04   | 15 | DI_02  | 41 | DI_05  | 40 | DI_03   |
| 18 |         | 17 | DI_06  | 43 |        | 42 | DI_07   |
| 20 | DO_24V  | 19 |        | 45 | DO_24V | 44 |         |
| 22 | DO_02   | 21 | DO_00  | 47 | DO_03  | 46 | DO_01   |
| 24 | DO_06   | 23 | DO_04  | 49 | DO_07  | 48 | DO_05   |
|    |         | 25 | DO_GND |    |        | 50 | DO_GND  |

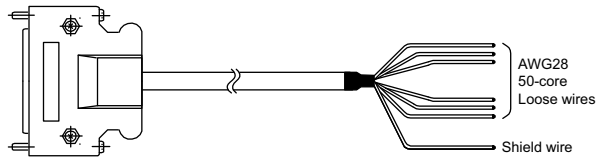
### ■ CN1 Connector Details

| Pin No.                                                       | Signal Name | I/O | Remarks                                    | Pin No. | Signal Name | I/O | Remarks                                      |
|---------------------------------------------------------------|-------------|-----|--------------------------------------------|---------|-------------|-----|----------------------------------------------|
| 1                                                             | AO          | O   | Analog output                              | 26      | AO_GND      | O   | Analog output ground                         |
| 2                                                             | AI          | I   | Analog input                               | 27      | AI_GND      | I   | Analog input ground                          |
| 3                                                             |             |     |                                            | 28      |             |     |                                              |
| 4                                                             | PA+         | I   | Phase-A pulse (+)                          | 29      | PB+         | I   | Phase-B pulse (+)                            |
| 5                                                             | PA-         | I   | Phase-A pulse (-)                          | 30      | PB-         | I   | Phase-B pulse (-)                            |
| 6                                                             | GND         | I   | Pulse input ground                         | 31      | GND         | I   | Pulse input ground                           |
| 7                                                             |             |     |                                            | 32      |             |     |                                              |
| 8                                                             |             |     |                                            | 33      |             |     |                                              |
| 9                                                             | PILC5V      | P   | Phase-Z latch input common (5 V)           | 34      | PILC12V     | P   | Phase-Z latch input common (12 V)            |
| 10                                                            | PILC24V     | P   | Phase-Z latch input common (24 V)          | 35      | PIL         | I   | Phase-Z latch input                          |
| 11                                                            |             |     |                                            | 36      |             |     |                                              |
| 12                                                            |             |     |                                            | 37      |             |     |                                              |
| 13                                                            | DICOM       | P   | Digital input common                       | 38      | DICOM       | P   | Digital input common                         |
| 14                                                            | DI_00       | I   | Digital input 0 (shared with DI interrupt) | 39      | DI_01       | I   | Digital input 1 (shared with DI latch input) |
| 15                                                            | DI_02       | I   | Digital input 2                            | 40      | DI_03       | I   | Digital input 3                              |
| 16                                                            | DI_04       | I   | Digital input 4                            | 41      | DI_05       | I   | Digital input 5                              |
| 17                                                            | DI_06       | I   | Digital input 6                            | 42      | DI_07       | I   | Digital input 7                              |
| 18                                                            |             |     |                                            | 43      |             |     |                                              |
| 19                                                            |             |     |                                            | 44      |             |     |                                              |
| 20                                                            | DO_24V      | P   | DO power supply 24 V                       | 45      | DO_24V      | P   | DO power supply 24 V                         |
| 21                                                            | DO_00       | O   | Digital output 0                           | 46      | DO_01       | O   | Digital output 1                             |
| 22                                                            | DO_02       | O   | Digital output 2                           | 47      | DO_03       | O   | Digital output 3                             |
| 23                                                            | DO_04       | O   | Digital output 4                           | 48      | DO_05       | O   | Digital output 5                             |
| 24                                                            | DO_06       | O   | Digital output 6                           | 49      | DO_07       | O   | Digital output 7                             |
| 25                                                            | DO_GND      | P   | DO common ground                           | 50      | DO_GND      | P   | DO common ground                             |
| ♦ P: Power supply input; I: Input signal;<br>O: Output signal |             |     |                                            | Shell   |             | –   | Shield wire                                  |

### 4.2.2 Cable Specifications

The following shows the specifications of the LIO-06 Module standard cables.

#### ( 1 ) Standard Cable Model List

| Name                                           | Model            | Length | External Appearance (JEPMC-W2064-□□-E)                                             |
|------------------------------------------------|------------------|--------|------------------------------------------------------------------------------------|
| Cable for LIO-06 Module<br>(Single loose wire) | JEPMC-W2064-A5-E | 0.5 m  |  |
|                                                | JEPMC-W2064-01-E | 1 m    |                                                                                    |
|                                                | JEPMC-W2064-03-E | 3 m    |                                                                                    |

#### ( 2 ) Standard Cable Wiring Table

The wiring table for the standard cable JEPMC-W2064-□□-E is shown below.

| 50-pin Connector Terminal No. | Marking          | Wire Color | Marking         | 50-pin Connector Terminal No. |
|-------------------------------|------------------|------------|-----------------|-------------------------------|
| 1                             | —                | Orange     | —               | 26                            |
| 2                             | —                | Gray       | —               | 27                            |
| 3                             | —                | White      | —               | 28                            |
| 4                             | —                | Yellow     | —               | 29                            |
| 5                             | —                | Pink       | —               | 30                            |
| 6                             | --               | Orange     | --              | 31                            |
| 7                             | --               | Gray       | --              | 32                            |
| 8                             | --               | White      | --              | 33                            |
| 9                             | --               | Yellow     | --              | 34                            |
| 10                            | --               | Pink       | --              | 35                            |
| 11                            | ---              | Orange     | ---             | 36                            |
| 12                            | ---              | Gray       | ---             | 37                            |
| 13                            | ---              | White      | ---             | 38                            |
| 14                            | ---              | Yellow     | ---             | 39                            |
| 15                            | ---              | Pink       | ---             | 40                            |
| 16                            | ----             | Orange     | ---- Continuous | 41                            |
| 17                            | ----             | Gray       | ---- Continuous | 42                            |
| 18                            | ----             | White      | ---- Continuous | 43                            |
| 19                            | ----             | Yellow     | ---- Continuous | 44                            |
| 20                            | ----             | Pink       | ---- Continuous | 45                            |
| 21                            | ----- Continuous | Orange     | =====           | 46                            |
| 22                            | ----- Continuous | Gray       | =====           | 47                            |
| 23                            | ----- Continuous | White      | =====           | 48                            |
| 24                            | ----- Continuous | Yellow     | =====           | 49                            |
| 25                            | ----- Continuous | Pink       | =====           | 50                            |
|                               |                  |            | Shield wire     | Shell                         |

### 4.2.3 Digital Input Circuits

The following table shows the LIO-06 Module digital input circuit specifications.

| Item                | Specifications                                                                                                                                                                                                                                                                                                                                          |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inputs              | 8 points                                                                                                                                                                                                                                                                                                                                                |
| Input Format        | Sink mode/source mode input                                                                                                                                                                                                                                                                                                                             |
| Isolation Method    | Photocoupler                                                                                                                                                                                                                                                                                                                                            |
| Input Voltage       | 24 VDC, +10/-20% (+19.2 to +26.4 V)                                                                                                                                                                                                                                                                                                                     |
| Input Current       | 4.1 mA (typ.)                                                                                                                                                                                                                                                                                                                                           |
| ON Voltage/Current  | 15 V min./2.0 mA min.                                                                                                                                                                                                                                                                                                                                   |
| OFF Voltage/Current | 5 V max./1.0 mA max.                                                                                                                                                                                                                                                                                                                                    |
| ON Time/OFF Time    | ON: 0.5 ms max.<br>OFF: 0.5 ms max.                                                                                                                                                                                                                                                                                                                     |
| Number of Commons   | 1 (8 points/common)                                                                                                                                                                                                                                                                                                                                     |
| Other Functions     | <ul style="list-style-type: none"> <li>DI_00 is shared with an interrupt input. If DI_00 is turned ON while interrupts are enabled, the interrupt processing drawing (program) is executed.</li> <li>DI_01 is shared with pulse latch inputs. If DI-01 is turned ON while pulse latch inputs are enabled, the pulse counter will be latched.</li> </ul> |

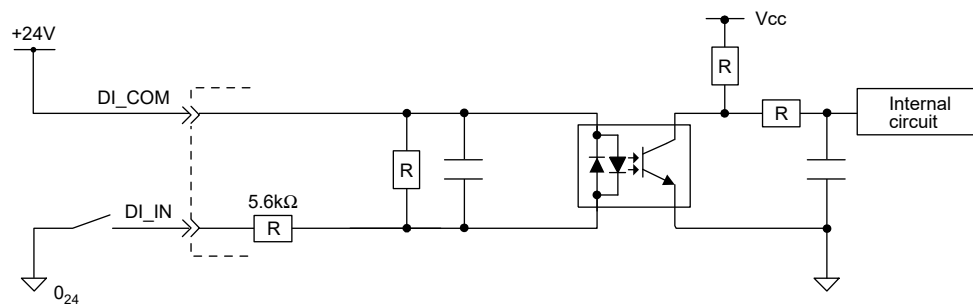


Fig. 4.2 Digital Input Circuit (Source Mode Input)

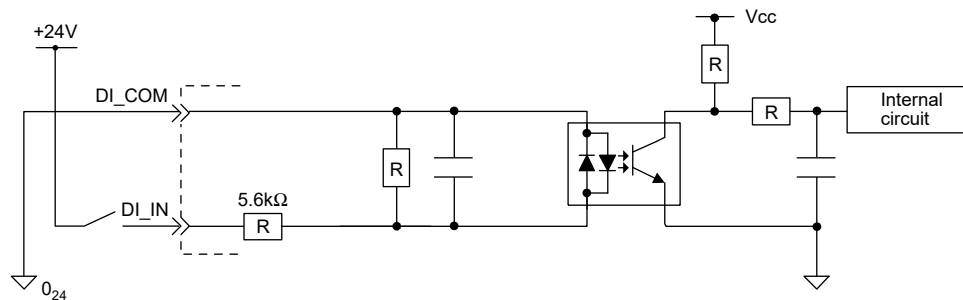


Fig. 4.3 Digital Input Circuit (Sink Mode Input)

### 4.2.4 Digital Output Circuit

The following table shows the LIO-06 Module digital output circuit specifications.

| Item                     | Specifications                                                                                                                                                                           |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Outputs                  | 8 points                                                                                                                                                                                 |
| Output Format            | Transistor, open collector sink mode output                                                                                                                                              |
| Isolation Method         | Photocoupler                                                                                                                                                                             |
| Output Voltage           | +24 VDC, $\pm 20\%$                                                                                                                                                                      |
| Output Current           | 100 mA max.                                                                                                                                                                              |
| Leakage Current When OFF | 0.1 mA max.                                                                                                                                                                              |
| ON Time/OFF Time         | ON: 0.25 ms max.<br>OFF: 1 ms max.                                                                                                                                                       |
| Number of Commons        | 1 (8 points/common)                                                                                                                                                                      |
| Protection Circuit       | Fuse<br>The fuse is not, however, for circuit protection. It is for protecting against fire at output shorts. Attach a fuse externally to each output if circuit protection is required. |
| Error Detection          | Fuse blown detection<br>Replace the Module when fuse blown is detected.                                                                                                                  |
| Other Functions          | DO_07 is shared with counter coincidence output.                                                                                                                                         |

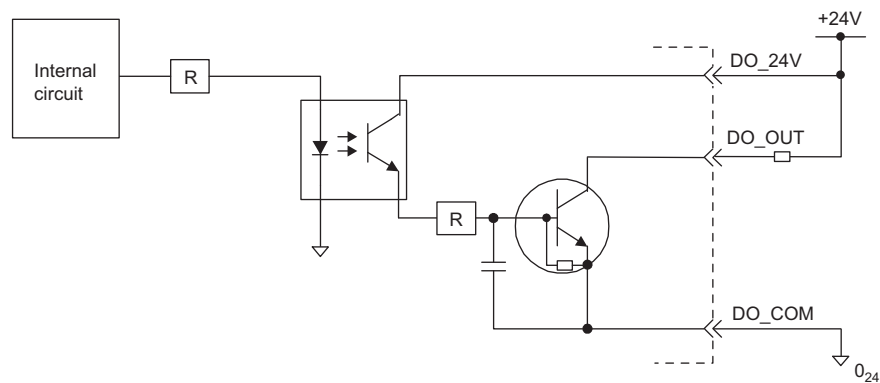


Fig. 4.4 Digital Output Circuit (Sink Mode Output)

## 4.2.5 Analog Input Circuit

The following table shows the LIO-06 Module analog input circuit specifications.

| Item                    |           | Specifications             |
|-------------------------|-----------|----------------------------|
| Number of Channels      |           | 1 channel                  |
| Isolation Method        |           | Non-isolated               |
| Analog Input Range      |           | -10 to +10 V               |
| Max. Rated Input        |           | ±15 V                      |
| Input Impedance         |           | Approx. 20 kΩ              |
| Resolution              |           | 16 bits (-31276 to +31276) |
| Accuracy                | 25°C      | ±0.1% (±10 mV)             |
|                         | 0 to 50°C | ±0.3% (±30 mV)             |
| Input Conversion Time * |           | 1.05 ms max.               |

\* Input conversion time = Delay time from input filter (1 ms max.) + 50 μs;  
Delay time from the input filter peaks at 1 ms between -10 and +10 V.

## 4.2.6 Analog Output Circuit

The following table shows the LIO-06 Module analog output circuit specifications.

| Item                        |           | Specifications                                          |
|-----------------------------|-----------|---------------------------------------------------------|
| Number of Channels          |           | 1 channel                                               |
| Isolation Method            |           | Non-isolated                                            |
| Analog Output Range         |           | -10 to +10 V                                            |
| Output Impedance            |           | 20 kΩ max.                                              |
| Resolution                  |           | 16 bits (-31276 to +31276)                              |
| Accuracy                    | 25°C      | ±0.1% (±10 mV)                                          |
|                             | 0 to 50°C | ±0.3% (±30 mV)                                          |
| Max. Allowable Load Current |           | ±5 mA                                                   |
| Output Delay Time           |           | 1.2 ms (after change with a full scale of -10 to +10 V) |

4.2.7 Pulse Input Circuit

The following table shows the LIO-06 Module pulse input circuit specifications.

| Item               | Specifications                                                                                                                                                                                        |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of Channels | 1 channel (Phase-A/B/Z input)                                                                                                                                                                         |
| Input Circuit      | Phase-AB: 5-V differential input, not isolated, max. frequency: 4 MHz<br>Phase-Z: 5-V/12-V/24-V photocoupler input                                                                                    |
| Input Mode         | Phase-A/B, signed, incremental/decremental                                                                                                                                                            |
| Latch Input        | Pulse latch on phase-Z or DI_01.<br>Response time at phase-Z input<br>ON: 1 μs max.<br>OFF: 1 μs max. (2 μs max. at 24-V input)<br>Response time at DI_01 input<br>ON: 60 μs max.<br>OFF: 0.5 ms max. |
| Other Functions    | Coincidence detection, counter preset                                                                                                                                                                 |

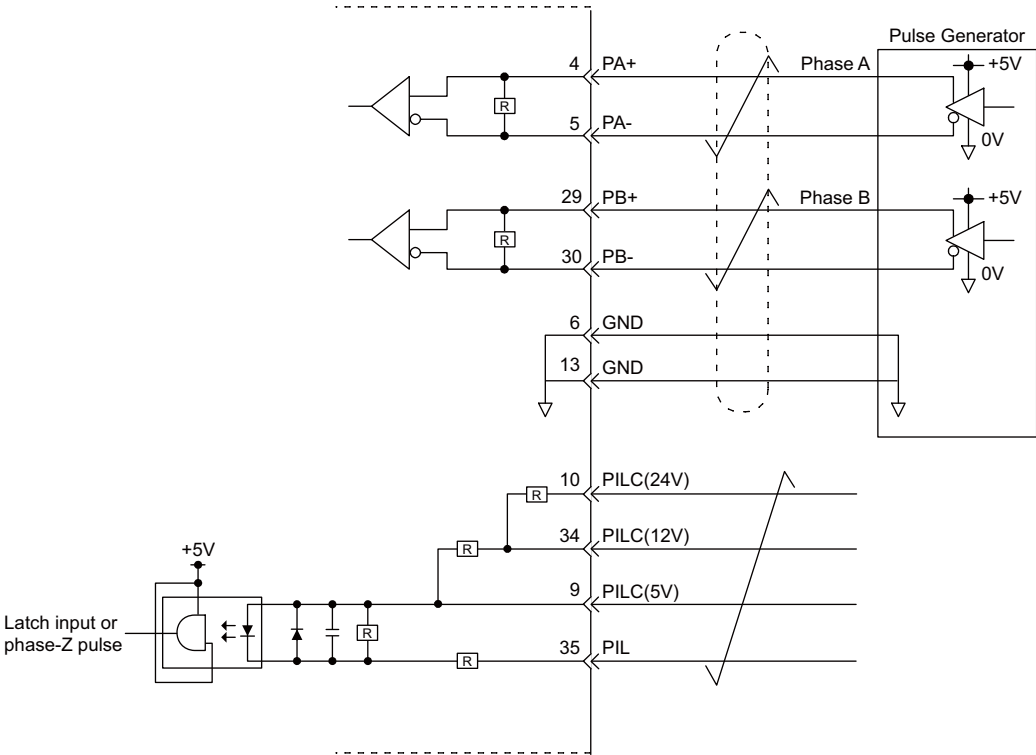
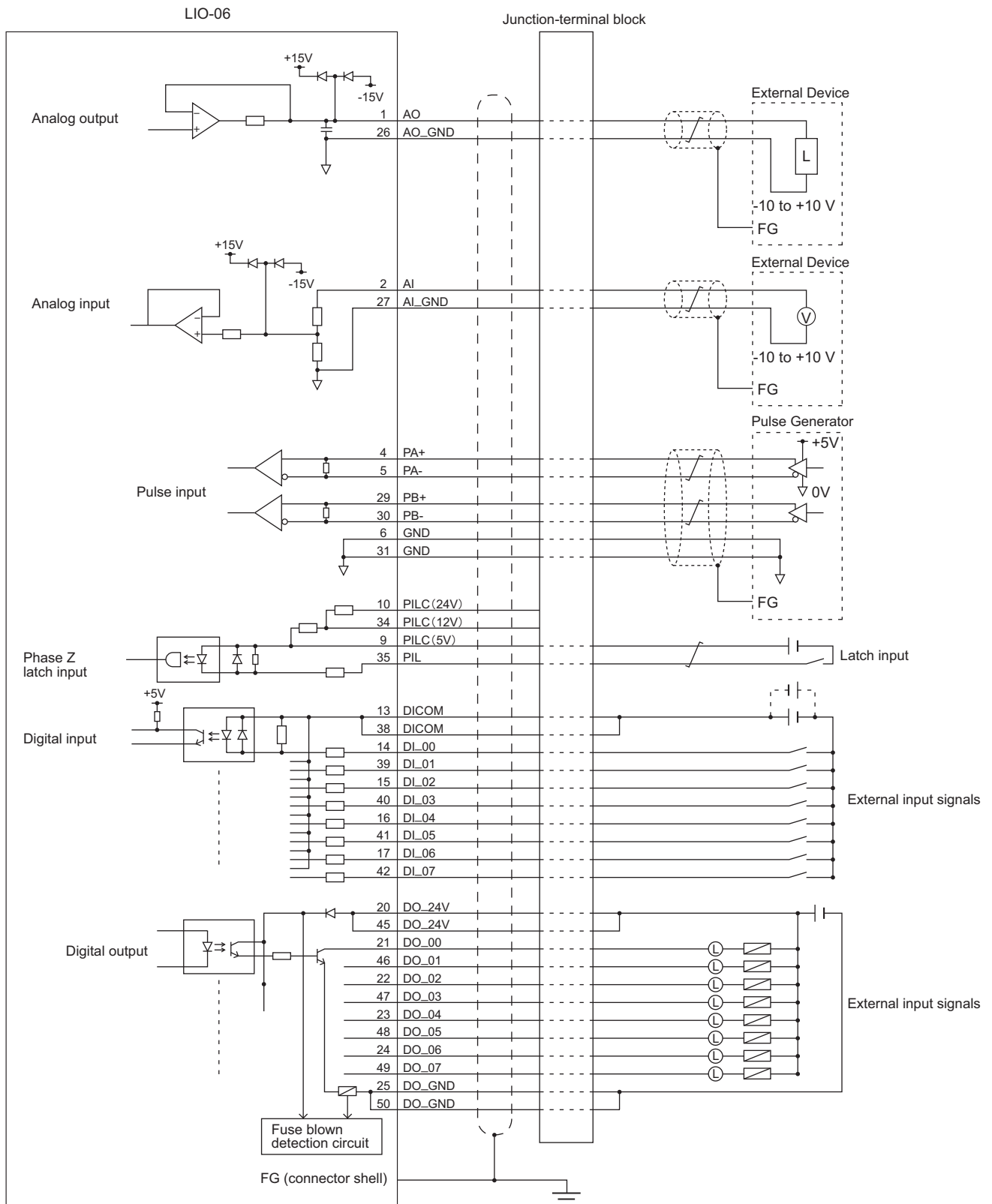


Fig. 4.5 Pulse Input Circuit

## 4.2.8 LIO-06 Module Connections

The following diagram shows connection example for LIO-06 Module connectors.

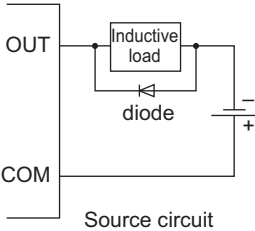


- Ground the cable shield between the external devices and the junction-terminal block on the external-device end.



- A fuse is inserted in the output common line of the LIO-06 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.
- 5 V, 12 V, and 24 V are available for phase-Z input voltage.  
Note that the pin that is used will differ, depending on the input voltage.  
Using the wrong pin may cause an accident.  
At 5 V input: Use No.9 pin.  
At 12 V input: Use No.34 pin.  
At 24 V input: Use No.10 pin.



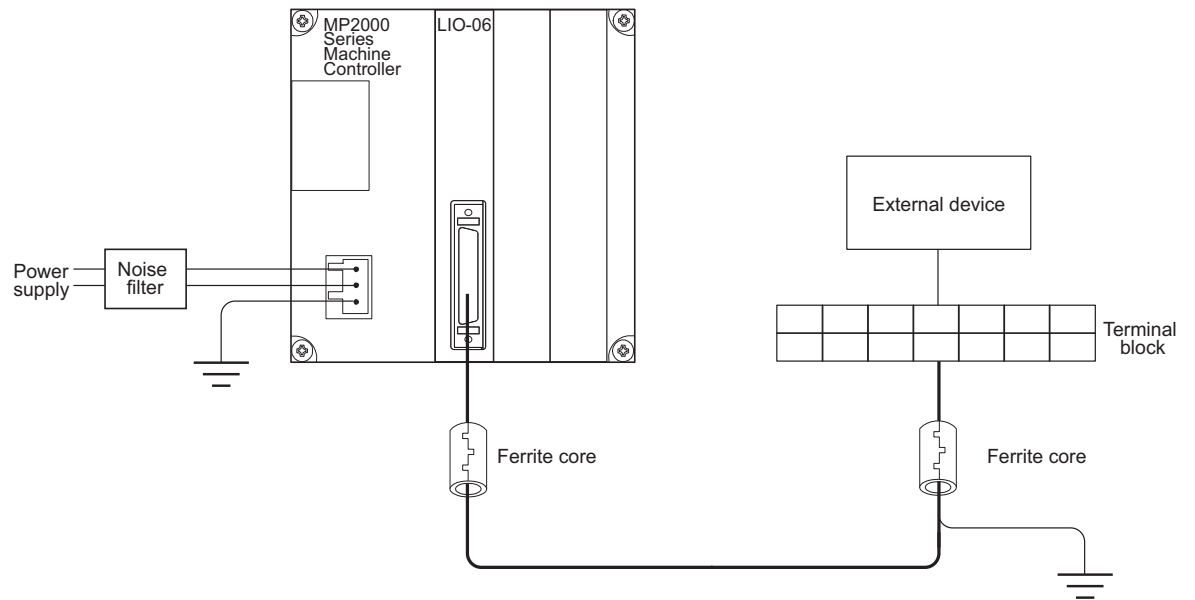


- If you connect an inductive load, connect a diode parallel to the load to absorb counter electromotive force.
  - Backward voltage: 10 times the load voltage or greater
  - Forward current: Load current or greater

4.2.9 Wiring for Noise Control

When the LIO-06 Module is mounted and used in an environment where there is high-frequency noise from an external device, the counter may not correctly execute counting. In this case, install a noise filter or a ferrite core to suppress the high-frequency noise.

The following figure shows an example of installing a noise filter and ferrite cores.



■ Recommended Parts

| Name         | Model       | Manufacturer                 |
|--------------|-------------|------------------------------|
| Ferrite core | E04SR301334 | Seiwa Electric MFG. Co. Ltd. |
| Noise filter | LF-210N     | NEC TOKIN Corporation        |

## 4.3 LIO-06 Module Details

LIO-06 Module details, such as the MIXIO, I/O offset gain, and Counter Module functions, can be set in the **MIXIO** Window or the **Counter Module** Window. These window can be displayed from the **Module Configuration** Window.

### 4.3.1 MIXIO Configuration

#### ( 1 ) Displaying the MIXIO Window

Double-click **MIXIO** in the **Function Module/Slave** Column of the **Module Configuration** Window.

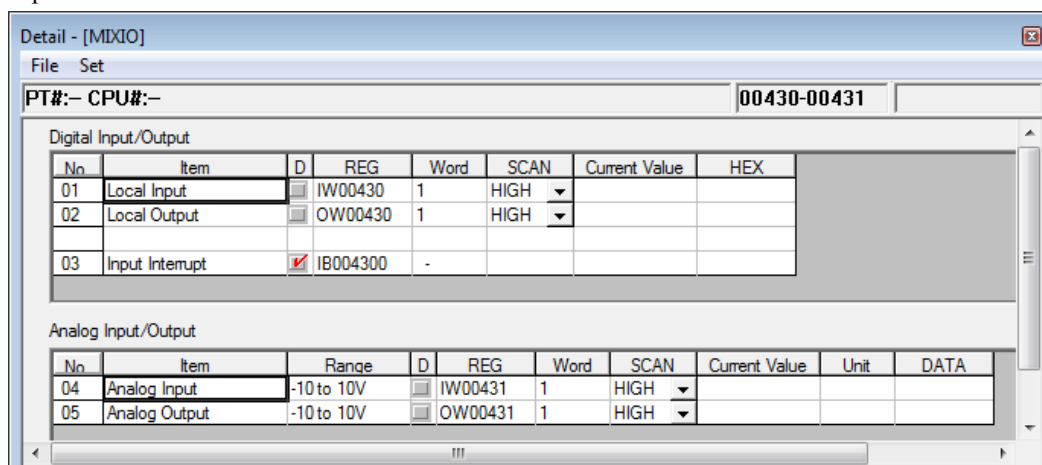
| Module            | Function Module/Slave | Status | Circuit No/AxisAddress |             | Motion Register | Register(Input/Output)                                            |                |      |      | Comment |
|-------------------|-----------------------|--------|------------------------|-------------|-----------------|-------------------------------------------------------------------|----------------|------|------|---------|
|                   |                       |        | Start                  | cupied circ |                 | Disabled                                                          | Start - End    | Size | Scan |         |
| 01 [MP2300] :---  |                       |        |                        |             |                 |                                                                   |                |      |      |         |
| 00 [MP2300] :---  | 01 CPU                | ----   | ----                   | ----        | ----            | ----                                                              | ----           | ---- | ---- |         |
|                   | 02 IO                 | ----   | ----                   | 1           | ----            | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0000 - 0001[H] | 2    | ---- |         |
|                   | 03  SVB               | ----   | Circuit No1            | 1           | 8000 - 87FF[H]  | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0010 - 040F[H] | 1024 | ---- |         |
|                   | 04  SVR               | ----   | Circuit No2            | 1           | 8800 - 8FFF[H]  | ----                                                              | ----           | ---- | ---- |         |
| 01  LIO-06[-----] | 01 MIXIO              | ----   | ----                   | 1           | ----            | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0430 - 0431[H] | 2    | ---- |         |
|                   | 02 CNTR-A             | ----   | ----                   | 1           | ----            | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0440 - 045F[H] | 32   | ---- |         |
| 02  LIO-04[-----] | 01 LIO32              | ----   | ----                   | 1           | ----            | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0410 - 0411[H] | 2    | ---- |         |
| 03  DO-01[-----]  | 01 DO                 | ----   | ----                   | 1           | ----            | <input type="checkbox"/> Input<br><input type="checkbox"/> OutPut | 0420 - 0423[H] | 4    | ---- |         |

A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **MIXIO** Window will be displayed.

- Refer to 1.4.1 *Displaying the Module Configuration Window* on page 1-15 for information on displaying the **Module Configuration** Window.

## ( 2 ) MIXIO Configuration Details

The following items are displayed in the **MIXIO** Window. The discrete inputs/outputs, interrupt inputs, and analog inputs/outputs can be set.



D : Enable or disable each item by clicking on the cell.

☐ : Enabled, ☒ : Disabled

REG : Displays the register number allocated to the inputs or outputs. It cannot be changed.

Word : Displays the word size of the register data. It cannot be changed.

The register length of discrete inputs/outputs is fixed at one word; 16 points are set for each input or output register, and 8 points of the input or output register are allocated to the lower bytes. The register length of the analog inputs/outputs is fixed at one word.

SCAN : Select the speed from **HIGH**, **LOW**, or **NA** (none specified), for the scan that processes the inputs or outputs.

Current : The current value of the register will be displayed in binary when online. It will not be displayed (Current Value) when offline.

The outputs to external devices can be set by changing the current value of the discrete outputs. When the set value is confirmed, it is immediately saved in the register.

Other current values cannot be changed.

HEX : The current value of the register will be displayed in hexadecimal when online. It will not be displayed when offline.

Unit : Displays the unit [V] of the analog input/output current value

For the range of -10.000 to +10.000 analog input value, [V] is displayed in the **Unit**. However, when the input value is out of this range, [V Above] is displayed and the **Current** (Current Value) will be fixed to 10.000 or -10.000.

<Example>

| Analog Input Value |   | Current Value | Unit      |
|--------------------|---|---------------|-----------|
| 9.999 V            | → | 9.999         | [V]       |
| 10.000 V           | → | 10.000        | [V]       |
| 10.001 V           | → | 10.000        | [V Above] |
| -9.999 V           | → | -9.999        | [V]       |
| -10.000 V          | → | -10.000       | [V]       |
| -10.001 V          | → | -10.000       | [V Above] |

DATA : Displays the analog input/output register value with parentheses.

<Example>

| Analog Input Register Value |   | DATA     |
|-----------------------------|---|----------|
| IW□□□□ = 12345              | → | [12345]  |
| IW□□□□ = -12345             | → | [-12345] |

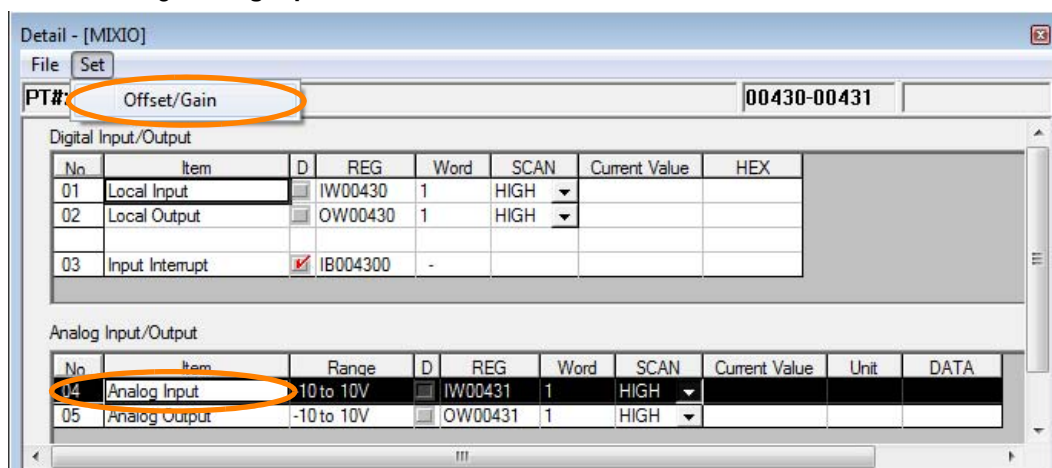
After changing the MIXIO configuration, save the definition data by selecting **Online – Save to Flash** from the main menu.

### 4.3.2 Setting the I/O Offset/Gain

The I/O offset/gain settings do not usually have to be adjusted. The LIO-06 Module has been adjusted before shipment so the appropriate input/output value is input for the specified voltage or current. If more precise adjustments are required, use the following procedure to adjust the offset/gain.

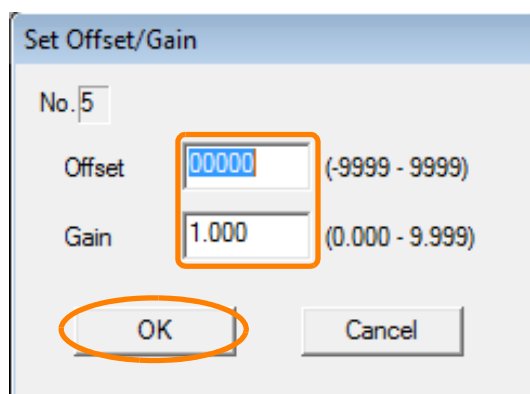
#### ( 1 ) Input Offset/Gain

1. After selecting **Analog Input** in the **MIXIO** Window, select **Set - Offset/Gain**.



The **Set Offset/Gain** Dialog Box will be displayed.

2. The voltage of the external device can be set to 0 V, 5 V, or 10 V. After changing the voltage, the **Current** (Current Value) displayed for the **Analog Input** will also change. Adjust the offset/gain accordingly so they are in accordance with the **Current** (Current Value) displayed for the **Analog Input**. Then click the **OK** Button.



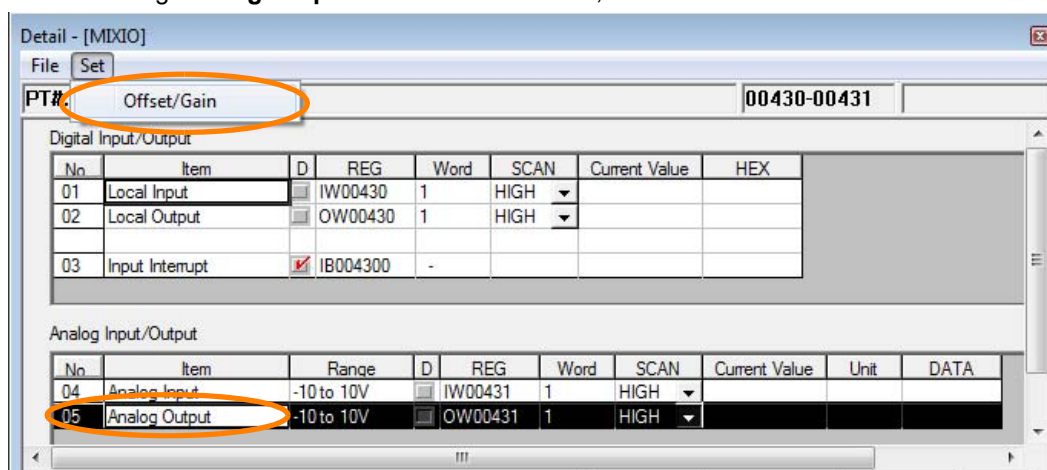
3. Save the offset/gain value to the **MIXIO** Window by selecting **Online - Save to Flash** from the main menu.
  - ♦ The offset/gain adapted value will be stored in the offset/gain input register (I register):  
Input register = A/D conversion value (data obtained from LIO-06 Module) × Gain + Offset
  - ♦ The default values of the offset and gain are as follows:  
Offset: 0000  
Gain: 1.000  
If using the default values, the Input register value equals the A/D conversion value.

#### ( 2 ) Output Offset/Gain

1. Set the output register (O register) to 0 (0 V), and measure the output voltage (Output voltage 1).
2. Calculate the offset of the output voltage using the following equation.

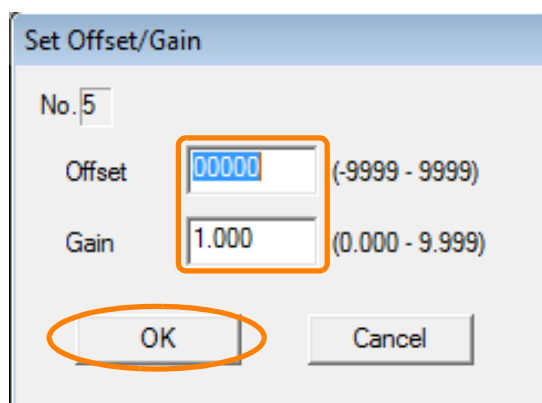
$$\text{Offset value} = \text{Output voltage 1} \times (-3127.6) \text{ (round off below decimal point)}$$

3. After selecting **Analog Output** in the **MIXIO** Window, select **Set - Offset/Gain**.



The **Set Offset/Gain** Dialog Box will be displayed.

4. Enter the calculated value at step 2 in the **Offset** Box of the **Set Offset/Gain** Dialog Box, and then click the **OK** Button.



5. Set the output register to 31276 (10 V), and measure the output voltage (Output Voltage 2).
6. Calculate the gain of the output voltage using the following equation.
- If the Output Voltage 2 is less than 10 volts,  

$$\text{Gain} = 10.0 \div \text{Output Voltage 2 (Round to three decimal places.)}$$
  - If the Output Voltage 2 is greater than 10 volts, gradually reduce the value of the output register from 31276 until the output voltage 10 V. The value of the output register if the output voltage is approximately 10 V is REG1.  

$$\text{Gain} = \text{REG1} \div 31276.0 \text{ (Round to three decimals places.)}$$
7. Select **Set - Offset/Gain** from the main menu to display the **Set Offset/Gain** Dialog Box. Enter the calculated value at step 6 in the **Offset** Box of the **Set Offset/Gain** Dialog Box, and then click the **OK** Button.
8. Save the offset/gain value to the **MIXIO** Window by selecting **Online - Save to Flash** from the main menu.
- The offset/gain adapted value will be stored in the offset/gain output register (O register):  

$$\text{Output register} = (\text{Output voltage} - \text{Offset}) \div \text{Gain}$$
  - The default values of the offset and gain are as follows:  
 Offset: 0000 (1 = 0.32 mV)  
 Gain: 1.000

### 4.3.3 Counter Module Configuration

#### ( 1 ) Displaying the Counter Module Window

Double-click **CNTR-A** in the **Function Module/Slave** Column of the **Module Configuration** Window.

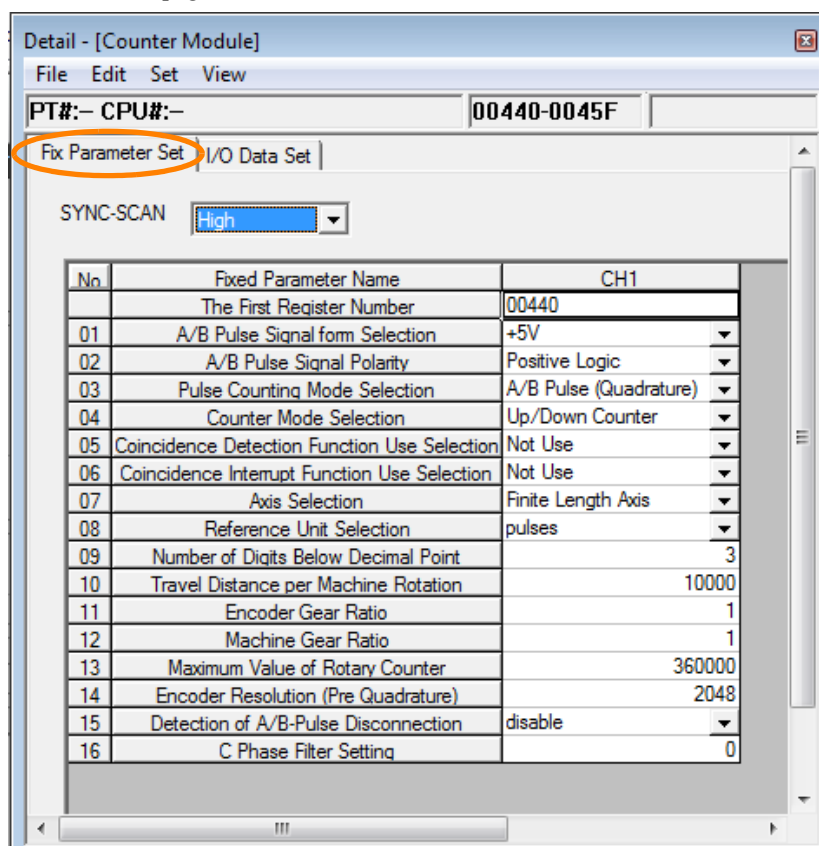
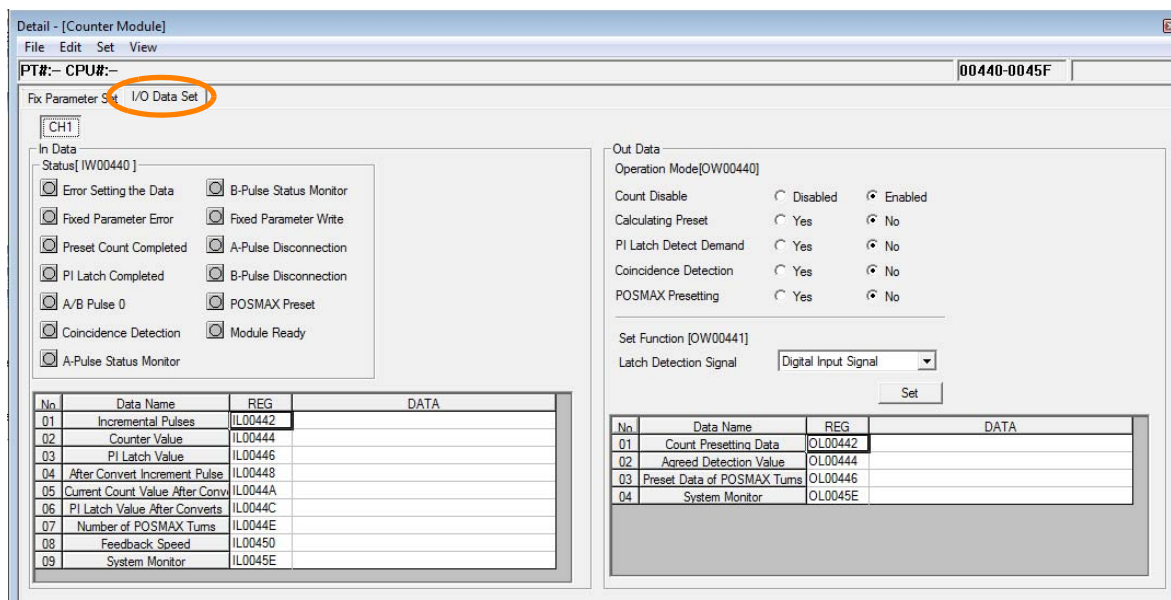
| Module           | Function Module/Slave | Status | Circuit No/AxisAddress |             | Motion Register | Register(Input/Output) |                |      |      | Comment |
|------------------|-----------------------|--------|------------------------|-------------|-----------------|------------------------|----------------|------|------|---------|
|                  |                       |        | Start                  | cupied circ |                 | Disabled               | Start - End    | Size | Scan |         |
| 01 [MP2300] :--- |                       |        |                        |             |                 |                        |                |      |      |         |
| 00 [MP2300] :--- | 01 CPU                | ----   | ----                   | ----        | ----            | ----                   | ----           | ---- | ---- |         |
|                  | 02 IO                 | ----   | ----                   | 1           | ----            | Input<br>Output        | 0000 - 0001[H] | 2    | ---- |         |
|                  | 03 [SVB]              | ----   | Circuit No1            | 1           | 8000 - 87FF[H]  | Input<br>Output        | 0010 - 040F[H] | 1024 | ---- |         |
|                  | 04 [SVR]              | ----   | Circuit No2            | 1           | 8800 - 8FFF[H]  | Input<br>Output        | ----           | ---- | ---- |         |
| 01 [LIO-06] :--- | 01 MIXIO              | ----   | ----                   | 1           | ----            | Input<br>Output        | 0430 - 0431[H] | 2    | ---- |         |
|                  | 02 <b>CNTR-A</b>      | ----   | ----                   | 1           | ----            | Input<br>Output        | 0440 - 045F[H] | 32   | ---- |         |
| 02 [LIO-04] :--- | 01 LIO32              | ----   | ----                   | 1           | ----            | Input<br>Output        | 0410 - 0411[H] | 2    | ---- |         |
| 03 [DO-01] :---  | 01 DO                 | ----   | ----                   | 1           | ----            | Input<br>Output        | 0420 - 0423[H] | 4    | ---- |         |

A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **Counter Module** Window will be displayed.

- Refer to 1.4.1 *Displaying the Module Configuration Window* on page 1-15 for information on displaying the **Module Configuration** Window.
- If the counter function is not used with LIO-06, select **UNDEFINED** instead of **CNTR-A**.

## (2) Counter Module Window

In the **Counter Module** Window, there are two tab pages, **Fix Parameter Set** and **I/O Data Set**. Fixed parameters and I/O data can be set from these tab pages.

Fig. 4.6 Counter Module **Fix Parameter Set** Tab PageFig. 4.7 Counter Module **I/O Data Set** Tab Page

### ( 3 ) Setting the Fixed Parameters

Set the following fixed parameters in the **Fix Parameter Set** tab page in the **Counter Module** Window.

#### ■ Counter Fixed Parameters

| No. | Name                                                                                         | Description                                                                                                                                                                                                                                                                                                                            | Size    | Default                              |
|-----|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------------------------|
|     | SYNC-SCAN<br>(Synchronous Scan Selection)                                                    | Select a scan cycle of the MP2000 Series Machine Controller to update the I/O data of counter function: High-speed scan or Low-speed scan.                                                                                                                                                                                             |         | High                                 |
|     | The First Register Number<br>(Leading Register Number)                                       | Displays the leading register number that corresponds to the parameter. This setting is disabled.                                                                                                                                                                                                                                      | 1 word  |                                      |
| 01  | A/B Pulse Signal Form Selection                                                              | Signal form of phases A and B. The signal form is fixed to a +5V differential input.                                                                                                                                                                                                                                                   | 1 word  | Fixed to +5V<br>(differential input) |
| 02  | A/B Pulse Signal Polarity Selection <sup>*1</sup>                                            | Select either positive or negative logic for the signal polarity of phases A and B.                                                                                                                                                                                                                                                    | 1 word  | Positive logic                       |
| 03  | Pulse Counting Mode Selection <sup>*1</sup>                                                  | Specify the pulse counting mode <sup>*1</sup> among the following 7 equations.<br><ul style="list-style-type: none"> <li>• Pulse and Direction</li> <li>• Pulse and Direction * 2</li> <li>• Up/Down Counter</li> <li>• Up/Down Counter * 2</li> <li>• A/B Pulse</li> <li>• A/B Pulse * 2</li> <li>• A/B Pulse (Quadrature)</li> </ul> | 1 word  | A/B Pulse<br>(Quadrature)            |
| 04  | Counter Mode Selection                                                                       | The counter mode is fixed to Up/Down Counter.                                                                                                                                                                                                                                                                                          | 1 word  | Fixed to Up/Down Counter             |
| 05  | Coincidence Detection Function Use Selection                                                 | Set whether or not the coincidence detection <sup>*2</sup> is to be used.                                                                                                                                                                                                                                                              | 1 word  | Not use                              |
| 06  | Coincidence Interrupt Function Use Selection                                                 | Set whether or not the coincidence interrupt function <sup>*2</sup> is to be used.<br>(Valid only when the coincidence detection function is set.)                                                                                                                                                                                     | 1 word  | Not use                              |
| 07  | Axis Selection                                                                               | Set the axis type <sup>*3</sup> : Finite or infinite length axis.                                                                                                                                                                                                                                                                      | 1 word  | Finite length axis                   |
| 08  | Reference Unit Selection                                                                     | Specify the reference unit.<br><ul style="list-style-type: none"> <li>• pulse</li> <li>• mm</li> <li>• deg</li> <li>• inch</li> </ul> If pulse is selected, an electronic gear is not to be used; If a unit other than pulse is selected, an electronic gear is to be used.                                                            | 1 word  | pulse                                |
| 09  | Number of Digits Below Decimal Point                                                         | Set the number of digits 0 to 5 below the decimal point <sup>*4</sup> for the minimum reference unit.<br><i>Example:</i><br>If the minimum reference unit is 1 $\mu\text{m}$ ( $10^{-3}\text{mm}$ ):<br>Reference unit selection : mm, and<br>Number of digits below decimal point: 3                                                  | 1 word  | 3                                    |
| 10  | Travel Distance per Machine Rotation <sup>*4, *5</sup>                                       | Set the load moving amount per load axis rotation.<br>Setting range: 1 to 2147483647 (reference unit)                                                                                                                                                                                                                                  | 2 words | 10000                                |
| 11  | Encoder Gear Ratio <sup>*4, *5</sup>                                                         | Set the value m so that the encoder axis rotates m times when the load axis rotates n times.<br>Setting range: 1 to 65535                                                                                                                                                                                                              | 1 word  | 1                                    |
| 12  | Machine Gear Ratio (Load) <sup>*4, *5</sup>                                                  | Set the value n so that the encoder axis rotates m times when the load axis rotates n times.<br>Setting range: 1 to 65535                                                                                                                                                                                                              | 1 word  | 1                                    |
| 13  | Maximum Value of Rotary Counter (Infinite Length Axis Reset Position (POSMAX)) <sup>*3</sup> | If the Infinite Length Axis was selected for fixed parameter No.07, specify the number of rotations (1 to 2147483647 reference units) after which the axis will be reset.                                                                                                                                                              | 2 words | 360000                               |

(cont'd)

| No. | Name                                                                                                            | Description                                                                                        | Size    | Default |
|-----|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------|---------|
| 14  | Encoder Resolution<br>(Pre Quadrature)<br>(Number of Pulses Per<br>Encoder Rotation<br>(before Multiplication)) | Set the number of input pulses per encoder rotation.<br>Setting range: 1 to 2147483647 (pulse/rev) | 2 words | 2048    |
| 15  | Detection of A/B-pulse<br>Disconnection                                                                         | Select whether or not the phase A/B disconnection detection<br>is enabled or not.                  | 1 word  | disable |

- \* 1. For details, refer to 4.4.1 *Pulse Counting Modes* on page 4-27.
- \* 2. For details, refer to 4.4.3 *Coincidence Output and Coincidence Interrupt Functions* on page 4-30.
- \* 3. For details, refer to 4.4.5 *Axis Type Selection* on page 4-32.
- \* 4. For details, refer to 4.5 *Electronic Gear Function* on page 4-33.
- \* 5. If pulse is selected for the parameter No. 08, parameters No. 10 to 12 are ignored.



- If SYNC-SCAN (Synchronous Scan Selection) is changed, be sure to save the data in the flash memory and restart the controller.

## ( 4 ) I/O Data Settings

### [ a ] I/O Data Setting Tab Page

Set the I/O data in the **I/O Data Set** Tab Page in the **Counter Module** Window.

- The channel number is fixed to CH1.

The details on the status and I/O data that can be monitored in the **I/O Data Set** Tab Page are described below.

## [ b ] In (Input) Data Details

The following table provides details of the **In Data** Area.

- Abbreviated names are given in square brackets in the Name column.

| No. | Register No. | Name                                      | Contents                                                                                                                                                                                                                                                                   | Range                     | Unit           | Size    |
|-----|--------------|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------|---------|
| –   | IW□□00<br>*1 | Status<br>(Run [RUNSTS]<br>Status)        | The run status of the Counter Module is indicated for each bit.<br>When online:<br>● : ON (= 1),<br>○ : OFF (= 0),<br>When off line: ●                                                                                                                                     | –                         | –              | 1 word  |
|     |              |                                           | Bit 0 Error Setting the Data (Data setting error)                                                                                                                                                                                                                          | –                         | –              |         |
|     |              |                                           | Bit 1 Fixed Parameter Error                                                                                                                                                                                                                                                | –                         | –              |         |
|     |              |                                           | Bit 2 Preset Count Completed                                                                                                                                                                                                                                               | –                         | –              |         |
|     |              |                                           | Bit 3 PI Latch Completed                                                                                                                                                                                                                                                   | –                         | –              |         |
|     |              |                                           | Bit 4 A/B Pulse 0 (Feedback pulse is ±1 or less)                                                                                                                                                                                                                           | –                         | –              |         |
|     |              |                                           | Bit 5 Coincidence Detection                                                                                                                                                                                                                                                | –                         | –              |         |
|     |              |                                           | Bit 6 A-Pulse Status Monitor                                                                                                                                                                                                                                               | –                         | –              |         |
|     |              |                                           | Bit 7 B-Pulse Status Monitor                                                                                                                                                                                                                                               | –                         | –              |         |
|     |              |                                           | Bit 9 Fixed Parameter Write                                                                                                                                                                                                                                                | –                         | –              |         |
|     |              |                                           | Bit A A-Pulse Disconnection                                                                                                                                                                                                                                                | –                         | –              |         |
|     |              |                                           | Bit B B-Pulse Disconnection                                                                                                                                                                                                                                                | –                         | –              |         |
|     |              |                                           | Bit C POSMAX Preset (POSMAX turns presetting completed)                                                                                                                                                                                                                    | –                         | –              |         |
|     |              |                                           | Bit F Module Ready                                                                                                                                                                                                                                                         | –                         | –              |         |
| 01  | IL□□02       | Incremental Pulses [PDV]                  | Indicates the difference between the pulse count value at previous scan and that at present scan.                                                                                                                                                                          | -2147483648 to 2147483647 | pulse          | 2 words |
| 02  | IL□□04       | Counter Value [PFB]                       | Indicates the pulse count value of each scan.                                                                                                                                                                                                                              | -2147483648 to 2147483647 | pulse          | 2 words |
| 03  | IL□□06       | PI Latch Value [FREQ]                     | Indicates the current value of the counter when an external signal is input.                                                                                                                                                                                               | -2147483648 to 2147483647 | pulse          | 2 words |
| 04  | IL□□08       | After Convert Increment Pulse [PDVG]      | Indicates the number of incremental pulses converted to a value in the reference unit. Indicates the same value as the number of incremental pulses if pulse is selected for the fixed parameter No. 08 “Reference Unit Selection” (when the electronic gear is not used). | -2147483648 to 2147483647 | Reference unit | 2 words |
| 05  | IL□□0A       | Current Count Value After Converts [PFBG] | Indicates the current value of the counter converted to a value in the reference unit. Indicates the same value as the counter current value when pulse is selected for the fixed parameter No. 08 “Reference Unit Selection” (when the electronic gear is not used).      | -2147483648 to 2147483647 | Reference unit | 2 words |
| 06  | IL□□0C       | PI Latch Value After Converts [FREQG]     | Indicates the PI latch data converted to a value in the reference unit. Indicates the same value as the PI latch data when pulse is selected for the fixed parameter No. 08 “Reference Unit Selection” (when the electronic gear is not used).                             | -2147483648 to 2147483647 | Reference unit | 2 words |

(cont'd)

| No. | Register No. | Name                   | Contents                                                                                                                                     | Range                     | Unit           | Size    |
|-----|--------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------|---------|
| 07  | IL□□0E       | Number of POSMAX Turns | Indicates the number of rotations that have been made when Infinite Length Axis is selected for the fixed parameter No. 07 "Axis Selection." | -2147483648 to 2147483647 | Rotation       | 2 words |
| 08  | IL□□10       | Feedback Speed*2       | If the electronic gear*3 is not used, the unit is pulse/s.                                                                                   | -2147483648 to 2147483647 | Reference unit | 2 words |
| 09  | IL□□1E       | System Monitor         | For system use                                                                                                                               | -2147483648 to 2147483647 | —              | 2 words |

\* 1. IW□□00 gives the register number that is displayed in **The First Register Number** cell on the **Fix Parameter Set** Tab Page + 00.

\* 2. The Feedback Speed is the moving average of the results of the following calculation for 32 scans.

- Without Electronic Gear (Reference unit: Pulse)  
Feedback Speed (pulse/s) = No. of incremental pulses × 1000/Ts
- With Electronic Gear (Reference unit: Unit other than pulse)  
Feedback Speed (reference unit/s) = No. of incremental pulses after conversion × 1000/Ts  
TS: Scan time (ms) for counter synchronized scan.

\* 3. Refer to 4.5 *Electronic Gear Function* on page 4-33.

## [ c ] Out (Output) Data Details

The following table shows details of the **Out Data** Area.

- Abbreviated names are given in square brackets in the Name column.

| No. | Register No. | Name                                                               | Contents                                                                                                                                                                                                                                                       | Range                     | Unit            | Size    |
|-----|--------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------|---------|
| –   | OW□□00<br>*1 | Operation Mode (RUN Mode) [RUNMOD]                                 | <div>Bit 0</div> Count Disable<br>ON (=1): Counting prohibited<br>OFF (=0): Counting enabled (Default)<br>Prohibits counting while the bit is ON (=1).                                                                                                         |                           | –               | 1 word  |
|     |              |                                                                    | <div>Bit 1</div> Calculating Preset (Count Preset Request)<br>ON (=1): Request preset<br>OFF (=0): Not requested (Default)<br>Resets the count to its preset value when the bit is turned ON (=1).                                                             |                           | –               |         |
|     |              |                                                                    | <div>Bit 2</div> PI Latch Detect Demand*2<br>ON (=1): Request latch detection<br>OFF (=0): Not requested (Default)<br>Stores the counter value at the moment an external signal is input while the bit is ON (=1).                                             |                           | –               |         |
|     |              |                                                                    | <div>Bit 3</div> Coincidence Detection*3<br>ON (=1): Request coincidence detection<br>OFF (=0): Not requested (Default)<br>Sends a coincidence signal if the values of the counter and the coincidence detection setting match when the bit is turned ON (=1). |                           | –               |         |
|     |              |                                                                    | <div>Bit 4</div> POSMAX Presetting (POSMAX Turns Presetting Request)<br>ON (=1): Requests preset<br>OFF (=0): Not requested (Default)<br>Resets the number of POSMAX turns to its preset value when the bit turns ON (=1).                                     |                           | –               |         |
| –   | OW□□01       | Set Function/ Latch Detection Signal                               | Select the external signal to be used for the PI latch signal. <ul style="list-style-type: none"> <li>• 0001H: DI latch (discrete input)</li> <li>• 0002H: Z latch (phase-Z input)</li> </ul>                                                                  | 0001H to 0002H            | –               | 1 word  |
| 01  | OL□□02       | Count Presetting Data [PRSDAT]                                     | The current value of the counter is reset to this value when a Count Preset Request is output.                                                                                                                                                                 | -2147483648 to 2147483647 | Reference units | 2 words |
| 02  | OL□□04       | Agreed Detection Value (Coincidence Detection Set Value) [COINDAT] | A coincidence detection signal and an interrupt signal to the MP2000 Series Machine Controller are output if the current value of the counter equals the value set in this parameter when the Coincidence Detection Request is output.                         | -2147483648 to 2147483647 | Reference units | 2 words |
| 03  | OL□□06       | Preset Data of POSMAX Turns                                        | The number of POSMAX turns is reset to the value set in this parameter when a POSMAX Turn Number Presetting Request is output.                                                                                                                                 | -2147483648 to 2147483647 | Rotations       | 2 words |
| 04  | OL□□1E       | System Monitor                                                     | For system use.                                                                                                                                                                                                                                                |                           | –               |         |

\* 1. OW□□00 gives the register number that is displayed in **The First Register Number** cell on the **Fix Parameter Set** Tab Page + 00.

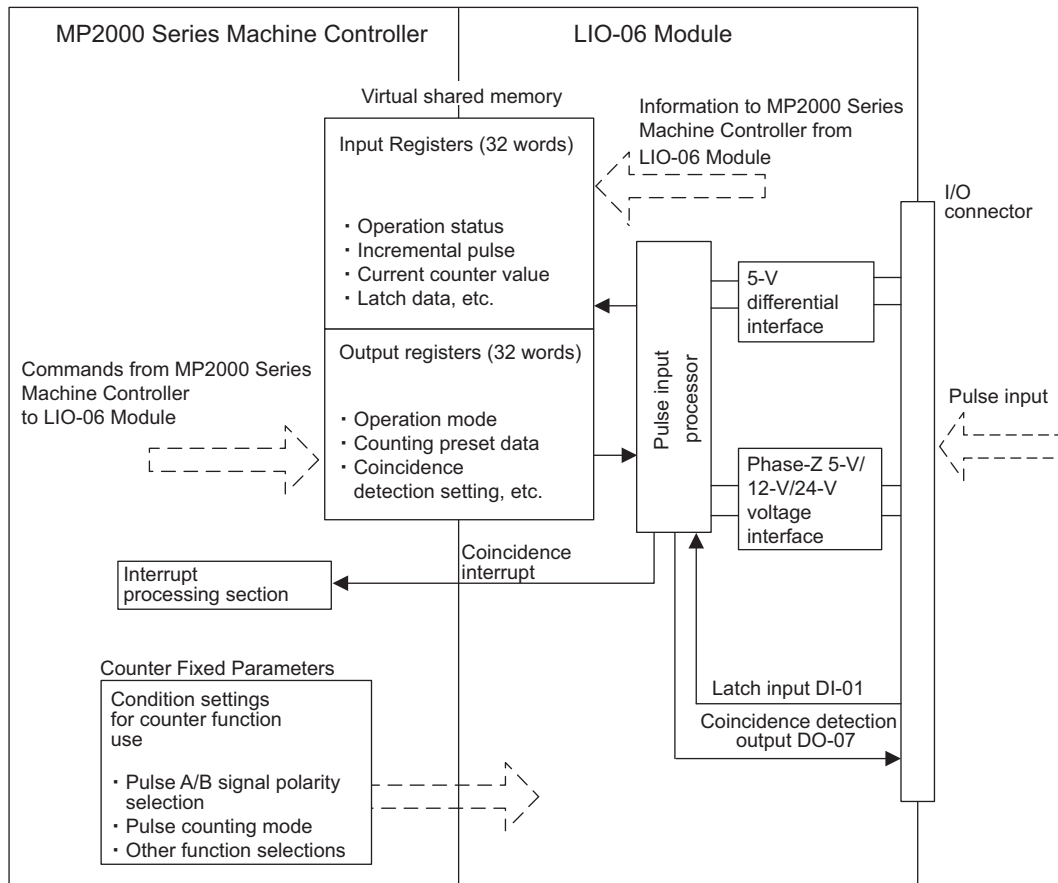
\* 2. Refer to 4.4.4 PI Latch Function on page 4-31.

\* 3. Refer to 4.4.3 Coincidence Output and Coincidence Interrupt Functions on page 4-30.

## 4.4 Details of Counter Functions

For the counter function, the command is determined according to the settings of the counter fixed parameters and output registers, and the status and counter value are stored in input registers.

The following diagram shows the data flow for the counter function.

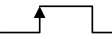
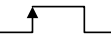
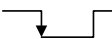
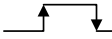
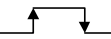
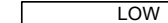
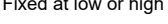
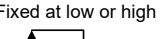
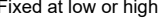
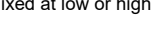
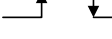
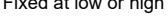
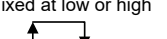
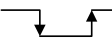
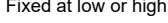
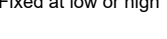
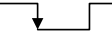
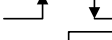
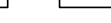
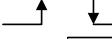


- In this section, the *fixed parameters* mean the *counter fixed parameters* if not otherwise mentioned.
- Refer to 1.3 Self-configuration on page 1-12 to execute self-configuration of the Machine Controller before setting the fixed parameters.

The following describes the details of pulse counting modes, pulse count function, coincidence output and coincidence interrupt functions, and PI latch function among the counter function of the LIO-06 Modules.

### 4.4.1 Pulse Counting Modes

The following pulse counting modes can be selected by setting the counter fixed parameter No. 3 (Pulse Counting Mode Selection) and No.2 “A/B Pulse Signal Polarity Selection.”

| Pulse Counting Mode  |     | Polarity       | Up Count (Forward)                                                                                                                                                                                              | Down Count (Reverse)                                                                                                                                                                                                |
|----------------------|-----|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pulse and Direction* | × 1 | Positive logic | Pulse A <br>Pulse B  LOW                      | Pulse A <br>Pulse B  HIGH                     |
|                      |     | Negative logic | Pulse A <br>Pulse B  HIGH                     | Pulse A <br>Pulse B  LOW                      |
|                      | × 2 | Positive logic | Pulse A <br>Pulse B  LOW                      | Pulse A <br>Pulse B  HIGH                     |
|                      |     | Negative logic | Pulse A <br>Pulse B  LOW                      | Pulse A <br>Pulse B  LOW                      |
| UP/DOWN Counter      | × 1 | Positive logic | Pulse A <br>Pulse B  Fixed at low or high     | Pulse A <br>Pulse B  Fixed at low or high     |
|                      |     | Negative logic | Pulse A <br>Pulse B  Fixed at low or high   | Pulse A <br>Pulse B  Fixed at low or high   |
|                      | × 2 | Positive logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
|                      |     | Negative logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
| A/B Pulse            | × 1 | Positive logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
|                      |     | Negative logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
|                      | × 2 | Positive logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
|                      |     | Negative logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
|                      | × 4 | Positive logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |
|                      |     | Negative logic | Pulse A <br>Pulse B  Fixed at low or high | Pulse A <br>Pulse B  Fixed at low or high |

\* In pulse and direction mode, input pulse A while sign (pulse B) is fixed.

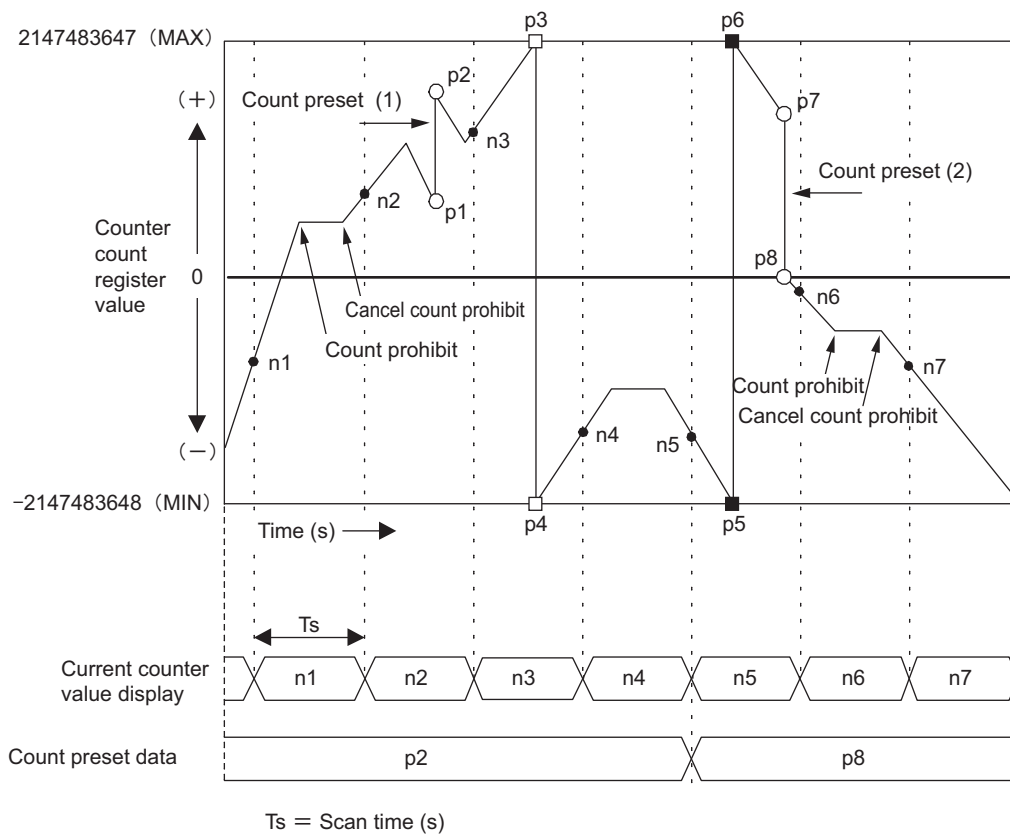


- ♦ If connecting the I/O module to a Yaskawa SERVOPACK, set either the fixed parameter or the SERVOPACK parameter as follows.
  - ♦ Fixed parameter No.2 (A/B Pulse Signal Polarity Selection): 1 (Negative logic)
  - ♦ SERVOPACK parameter 1st digit of Pn000: 1 (CW for reverse rotation: reverse rotation mode)

#### 4.4.2 Pulse Count Function

The Pulse Count Function reads A/B pulse input signals to increment (forward run) or decrement (reverse run) the count.

The following graph shows changes in the pulse count for each run mode.



<Explanation>

Current counter value

The values of n1 to n7 (counter value at each scan) is displayed sequentially in Counter Value (IL□□04).

Count preset (1)

Executing the Count preset at the position p1 forces the counter value to change to the preset value (p2 value).

## MAX overflow

When the counter value increases to the value MAX (p3), the counter value will be automatically reset to the value MIN (p4).

MIN overflow

When the counter value decreases to the value MIN (p5), the counter value will be automatically reset to the value MAX (p6).

Count preset (2)

Executing the Count preset at the position p7 forces the counter value to change to the preset value (p8 value).

### Count Preset Completion Timing

The following diagram shows the count preset completion timing of the LIO-06 Modules, which differs from the completion timing of the CNTR-01 Module (Counter Module). (Refer to Fig. 4.9 Count Preset Completion Timing of CNTR-01 Module.)

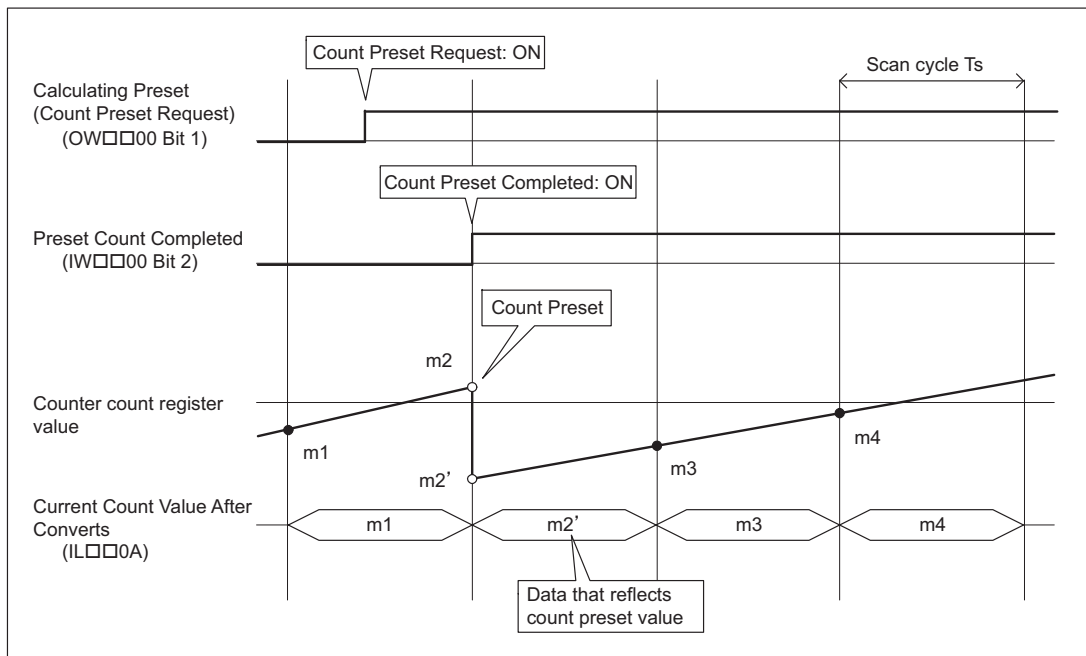


Fig. 4.8 Count Preset Completion Timing of LIO-06 Module

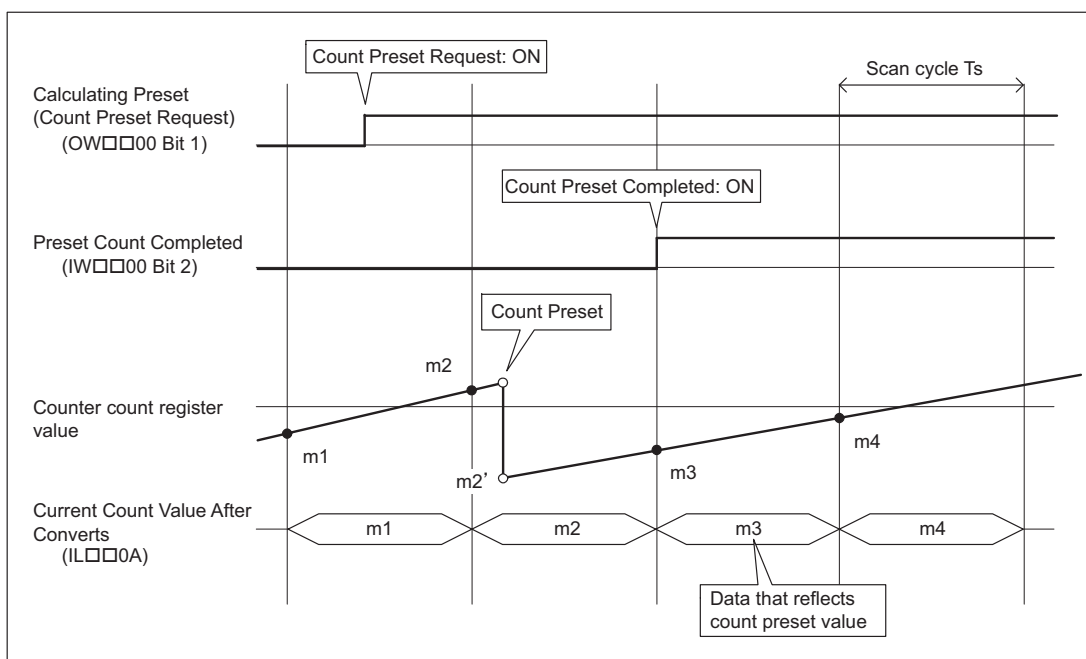


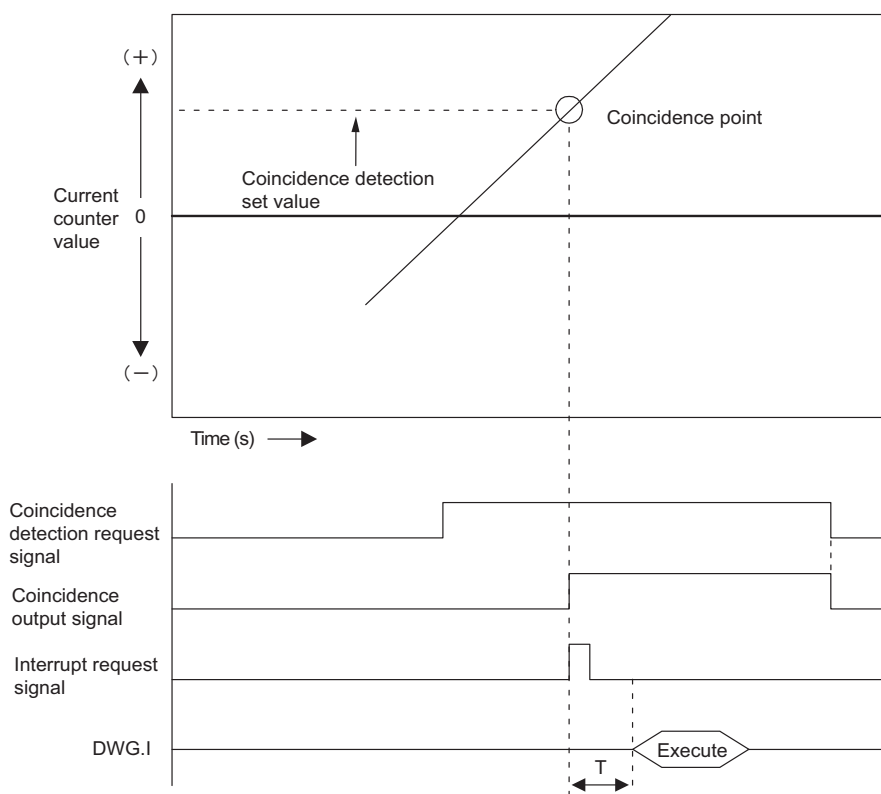
Fig. 4.9 Count Preset Completion Timing of CNTR-01 Module

### 4.4.3 Coincidence Output and Coincidence Interrupt Functions

The Coincidence Output and Coincidence Interrupt Functions output an external output signal (coincidence detection signal) and output an interrupt signal to the MP2000 Series Machine Controller when the current counter value and a preset output register value (Coincidence Detection Setting:  $OL\Box\Box\Box+4$ ) match.

- The Coincidence Output Request is enabled when “Use” is set to the counter fixed parameter No. 5 (Coincidence Detection Function Use Selection).
- The Coincidence Interrupt Request is enabled if “Use” is set to the counter fixed parameter No. 6 (Coincidence Interrupt Function Use Selection).

The following graph shows the number of occurrences from when coincidence detection request signal is output to when the coincidence point is detected and DWG.I (interrupt drawing) starts execution.



\* T: Time when the coincidence point is detected to when DWG.I (interrupt drawing) starts execution (approx. 60 to 440  $\mu$ s)

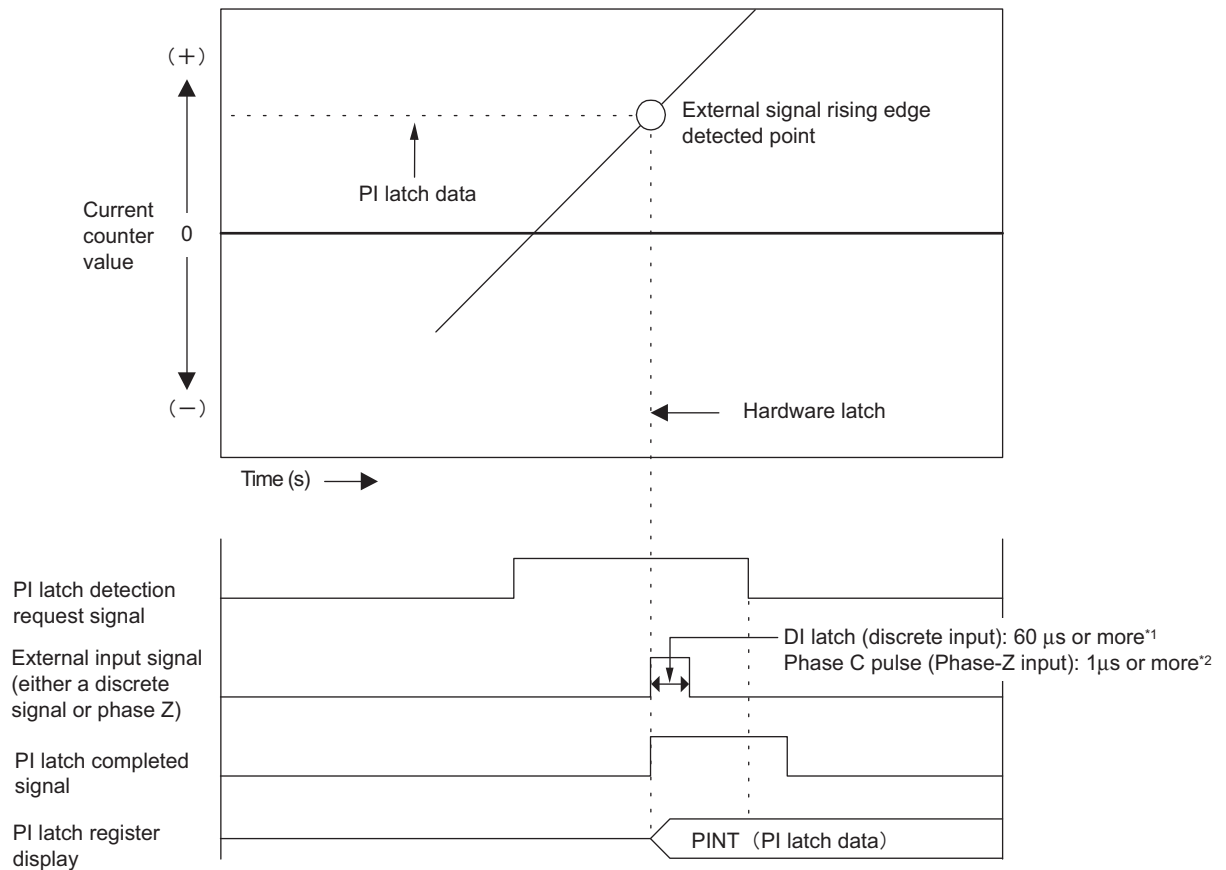
- DO-07 is used as a coincidence output signal.
- When the counter fixed parameter No. 05 (Coincidence Detection Function Use Selection) is set to “Use,” DO\_07 will be masked. So, when setting a register, which is allocated to DO\_07, using a ladder program to ON or OFF, the setting of this register will not be valid because the other setting has priority.
- To monitor the coincidence detection signal, use Coincidence Detection in the Status (Run Status).
- Disable coincidence detection request when using the Count Preset. If the Count Preset is being used with the coincidence detection request enabled, coincidence point may be detected at the incorrect point because the matching point before the coordinate system has been rebuilt will be used.

### 4.4.4 PI Latch Function

The PI latch function saves (latches) the current value to a memory register (IL□□06) on the rising edge of an external signal.

Select either a discrete input (DI latch) or phase-Z (Z latch) as the external signal.

The following graph shows the number of occurrences from when PI latch signal is output to when the rising edge of an external signal is detected and PI latch data is displayed.



- \* 1. When discrete input is changed from ON to OFF, the next ON signal cannot be received unless at least 500 μs passes after the change.
- \* 2. At 5-V/12-V input: When phase-Z input is changed from ON to OFF, the next ON signal cannot be received unless at least 1 μs passes after the change.  
At 24-V input: When phase-Z input is changed from ON to OFF, the next ON signal cannot be received unless at least 2 μs passes after the change.

### 4.4.5 Axis Type Selection

There are two types of axis: An infinite length axis that resets the current value with a specified value, and a finite length axis that does not reset the current value.

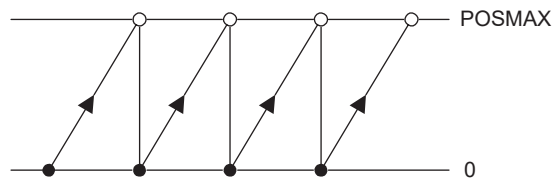
The finite length axis is used for rotation in one direction only, where the current value data does not need to be reset after rotation, and for return and other operations are performed only within a specified range.

The infinite length axis is used for applications such as resetting the current value data for a conveyor belt or other device to 0 after one rotation.

The type of the axis to be used is selected by fixed parameter No. 07 (Axis Selection).

If infinite length axis is set, the current counter value after conversion and the PI latch data after conversion is stored in the range 0 to infinite length axis reset position – 1.

Set the reset position in the counter fixed parameter No. 13 (Maximum Value of Rotary Counter) (Infinite Length Axis Reset Position) (POSMAX).



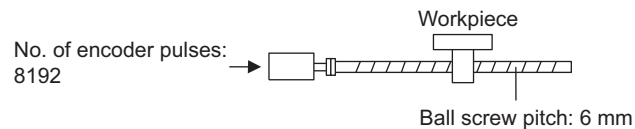
## 4.5 Electronic Gear Function

The Electronic Gear Function can be used when other than pulse is set to the counter fixed parameter No. 08 (Reference Unit Selection).

### 4.5.1 Outline

The Electronic Gear Function is used to set the workpiece travel distance per pulse input to the LIO Module counter to any value.

The following example describes differences in operations to move a workpiece 10 mm using the equipment shown below with and without electronic gear function. When using the electronic gear function, simply input the reference value calculated for the travel distance regardless of the number of pulses to move a workpiece for a specified travel distance.



#### When the Electronic Gear is Not Used

To move a workpiece 10 mm:  
 1 revolution is 6 mm. Therefore,  
 $10 \div 6 = 1.666$  revolutions  
 $2048 \times 4$  pulses is 1 revolution. Therefore,  
 $1.666 \times 8092 = 13653$  pulses  
 13653 pulses are input as reference pulses. The equation must be calculated at the host controller.

#### When the Electronic Gear is Used

To move a workpiece 10 mm:  
 Mechanical conditions and minimum reference unit are defined with electronic gear.  
 To move a workpiece 10 mm, the minimum reference unit is set to 1  $\mu\text{m}$ . Therefore,  
 $10 (\text{mm}) \div 1 (\mu\text{m}) = 10000$   
 10000 is input as reference value.

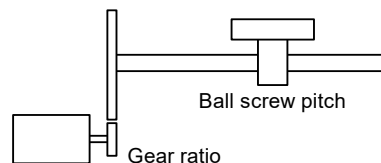
### 4.5.2 Settings

Use steps 1 to 5 in the following procedure to make the settings.

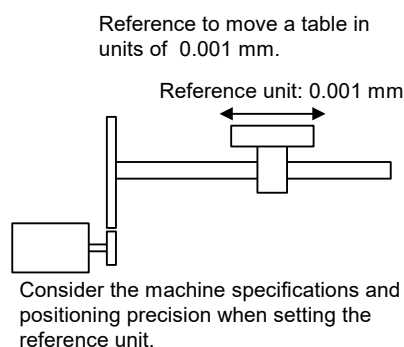
#### 1. Confirm the machine specifications.

##### Elements relating to the Electronic Gear

- Gear ratio
- Ball screw pitch
- Pulley diameter, etc.



2. Check the number of encoder pulses displayed in Counter Value, and set this value to the counter fixed parameter No. 14 (Encoder Resolution (Pre Quadrature)) (Number of Pulses Per Encoder Rotation).
3. Set the reference unit (the smallest reference unit for the reference data to move a load) according to the settings in the counter fixed parameters No. 08 (Reference Unit Selection) and No. 09 (Number of Digits Below Decimal Point).



4.5.2 Settings

- When reference unit is 1 μm:  
When 50,000 reference pulses are input, the workpiece will be moved by 50,000 × 1 μm = 50 mm.

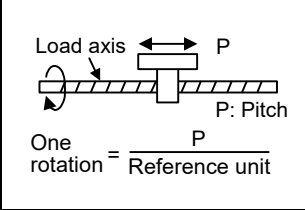
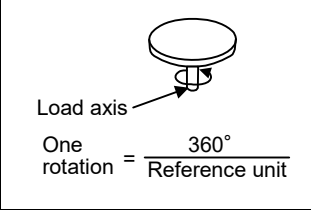
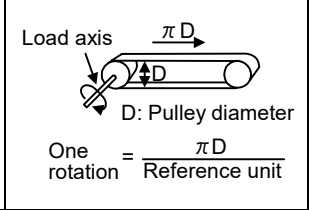
4. Find the load travel distance for each rotation of the load axis using the reference unit and set this distance to the counter fixed parameter No. 10 (Travel Distance per Machine Rotation).

Load travel distance per rotation of load axis (reference unit) =  $\frac{\text{Load travel distance per load axis rotation}}{\text{Reference unit}}$

Calculation Examples

- For a ball screw pitch of 5 mm and a reference unit of 0.001 mm:

$\frac{5}{0.001} = 5000$  (Reference unit)

| Ball screw                                                                                                                                           | Rotary table                                                                                                                                                 | Belt + pulley                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>One rotation = <math>\frac{P}{\text{Reference unit}}</math></p> |  <p>One rotation = <math>\frac{360^\circ}{\text{Reference unit}}</math></p> |  <p>One rotation = <math>\frac{\pi D}{\text{Reference unit}}</math></p> |

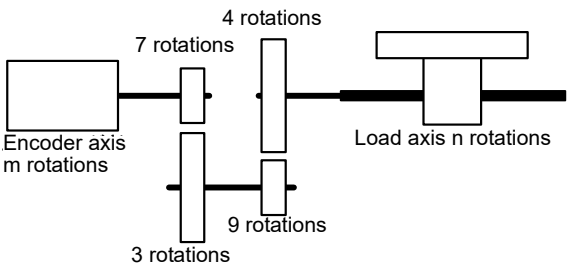
5. Set the Encoder Gear Ratio and the Machine Gear Ratio in the counter fixed parameters No. 11 and No.12.

When the encoder axis has rotated m times and the mechanical configuration allows the load axis to rotate n times, set the following values:

- No. 11 (Encoder Gear Ratio) = m rotations  
No. 12 (Machine Gear Ratio) = n rotations  
Setting range: 1 to 65,535 [rotations]

<Setting Example>

For the configuration shown in the diagram:



Gear ratio =  $n/m = (3/7) \times (4/9) = 4/21$

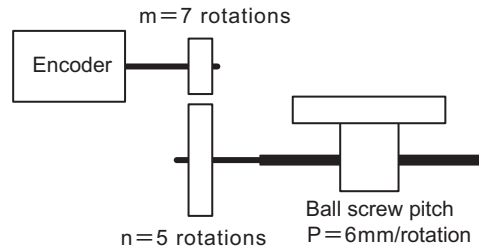
Therefore, set the following values:

- No.11 (Encoder Gear Ratio) = 4 (rotations)  
No.12 (Machine Gear Ratio) = 21 (rotations)

### 4.5.3 Electronic Gear Setting Examples

The following is setting examples for each kind of load mechanical configuration.

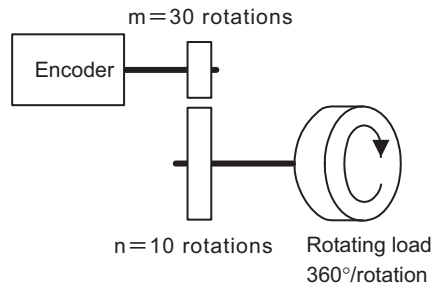
#### ( 1 ) Example A: Ball Screw



In the above machine system, if the reference unit = 0.001 mm, the setting of each parameter will be as follows:

- Moving Amount Per Machine Rotation =  $6\text{ mm}/0.001\text{ mm} = 6000$
- Counter fixed parameter No. 11 (Encoder Gear Ratio) = 7 (rotations)
- Counter fixed parameter No. 12 (Machine Gear Ratio) = 5 (rotations)

#### ( 2 ) Example B: Rotating Load



In the above machine system, if the reference unit =  $0.1^\circ$ , the setting of each parameter will be as follows:

- Moving Amount Per Machine Rotation =  $360^\circ/0.1^\circ = 3600$
- Counter fixed parameter No. 11 (Encoder Gear Ratio) = 3 (rotations)
- Counter fixed parameter No. 12 (Machine Gear Ratio) = 1 (rotation)

### 4.5.4 Precautions When Using Electronic Gears

When using electronic gears, make sure that the After Convert Incremental Pulse (Number of Incremental Pulses After Conversion) (IL□□08) is not outside the range for double integers (-2147483648 to 2147483647). If it is outside this range, counter parameters after conversion, such as the After Convert Incremental Pulse (IL□□08), Current Count Value after Conversion (IL□□0A), and PI Latch Value (IL□□0C), may not be correctly reported.

#### ■ Conditions to Fit within Range

The following is the conditional expression for the After Convert Incremental Pulse (IL□□08) to fit within the range for double integers.

$$\text{Maximum frequency of input pulse (Hz)} \times \frac{T_s^* (\text{ms})}{1000 (\text{ms})} \times \text{Workpiece travel distance per pulse (reference units/pulse)} \leq 2147483647$$

\*  $T_s$ : Scan time setting

The workpiece travel distance per pulse can be found using the following formula.

$$\begin{aligned} & \text{Workpiece travel distance per pulse (reference units/pulse)} \\ = & \frac{\text{No.10}^{*1} \text{ Travel Distance Per Machine Rotation}}{\text{No.14}^{*1} \text{ Encoder Resolution (Pre Quadrature)} \times \text{Multiplication}^{*2}} \times \frac{\text{No.12}^{*1} \text{ Machine Gear Ratio}}{\text{No.11}^{*1} \text{ Encoder Gear Ratio}} \end{aligned}$$

\* 1. No.10, No.11, No.12, and No.14 are fixed parameters.

\* 2. Multiplication value of fixed parameter No. 3, Pulse Counting Mode Selection. (For example, for A/B Pulse (Quadrature), the multiplication value is 4.)

## DO-01 Module

This chapter describes DO-01 Module in detail.

|                                                                 |      |
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## 5.1 Outline of DO-01 Module

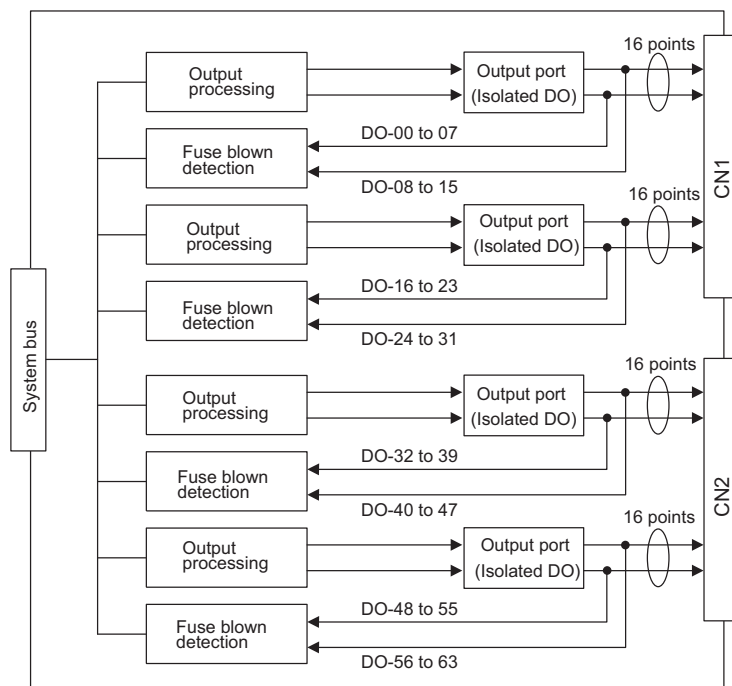
### 5.1.1 Outline of Functions

The DO-01 Module is equipped with the following digital output functions:

64 digital outputs (DO) (sink mode output)

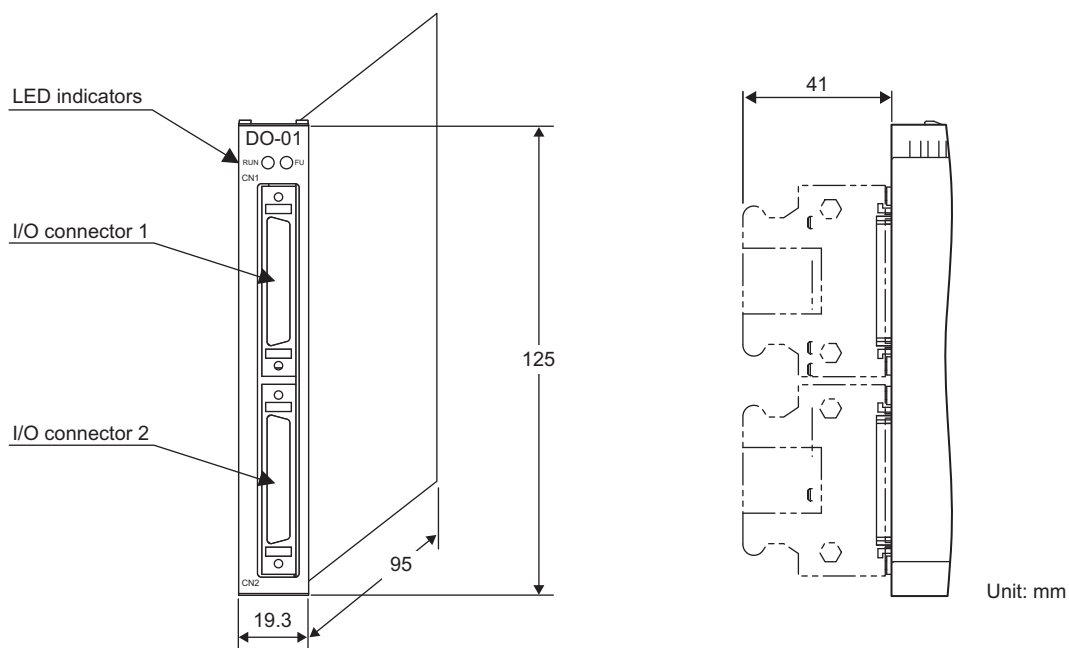
A digital output is made at a periodical cycle for each high-speed scan or low-speed scan of the MP2000 Series Machine Controller.

The following diagram outlines the DO-01 Module functions.



### 5.1.2 DO-01 Module Appearance and Connector External Dimensions

The following figure shows the appearance of the DO-01 Module and connector external dimensions.



### 5.1.3 Specifications

The following shows the specifications of the DO-01 Module.

#### ( 1 ) Hardware Specifications

| Item                | Specifications                                                                                                    |
|---------------------|-------------------------------------------------------------------------------------------------------------------|
| Classification      | I/O Module                                                                                                        |
| Name                | DO-01                                                                                                             |
| Model               | JAPMC-DO2300 (-E)                                                                                                 |
| Digital Output      | 64 outputs<br>External power supply voltage: 24 VDC $\pm$ 20% (+19.2 V to +28.8 V)<br>Output current: 100 mA max. |
| Connectors          | CN1: Output connector<br>CN2: Output connector                                                                    |
| LED Indicators      | RUN (green)<br>FUSE (red)                                                                                         |
| Current Consumption | 500 mA max.                                                                                                       |
| Dimensions (mm)     | 125 × 95 (H × D)                                                                                                  |
| Mass                | 80 g                                                                                                              |

## ( 2 ) Environmental Conditions

| Item                            |                               | Specifications                                                                                                                                                                                                                                                                       |
|---------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions        | Ambient Operating Temperature | 0 to 55°C                                                                                                                                                                                                                                                                            |
|                                 | Ambient Storage Temperature   | -25 to 85°C                                                                                                                                                                                                                                                                          |
|                                 | Ambient Operating Humidity    | 30% to 95% (with no condensation)                                                                                                                                                                                                                                                    |
|                                 | Ambient Storage Humidity      | 5% to 95% (with no condensation)                                                                                                                                                                                                                                                     |
|                                 | Pollution Level               | Pollution level 2 (conforming to JIS B 3502)                                                                                                                                                                                                                                         |
|                                 | Corrosive Gas                 | There must be no combustible or corrosive gas.                                                                                                                                                                                                                                       |
|                                 | Operating Altitude            | 2,000 m above sea level or lower                                                                                                                                                                                                                                                     |
| Mechanical Operating Conditions | Vibration Resistance          | Conforming to JIS B 3502:<br><ul style="list-style-type: none"> <li>• 10 to 57 Hz with single-amplitude of 0.075 mm</li> <li>• 57 to 150 Hz with fixed acceleration of 9.8 m/s<sup>2</sup></li> <li>• 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)</li> </ul> |
|                                 | Shock Resistance              | Conforming to JIS B 3502:<br>Peak acceleration of 147 m/s <sup>2</sup> twice for 11 ms each in the X, Y, and Z directions                                                                                                                                                            |
| Electrical Operating Conditions | Noise Resistance              | Conforming to EN 61000-6-2, EN 61000-6-4, EN 55011 (Group 1 Class A)                                                                                                                                                                                                                 |
| Installation Requirements       | Ground                        | Ground to 100 Ω max.                                                                                                                                                                                                                                                                 |
|                                 | Cooling Method                | Natural cooling                                                                                                                                                                                                                                                                      |

## 5.1.4 LED Indicators

The following table shows the DO-01 Module status when each indicator lamp is lit or unlit.

| RUN   FUSE | Indicator | Color | When Lit                                                 | When Unlit                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------|----------------------------------------------------------|-------------------------------------|
|                                                                                                                                                                                  | RUN       | Green | Normal operation                                         | Error occurrence                    |
|                                                                                                                                                                                  | FUSE      | Red   | One or some of the output protection fuses is blown out. | Output protection fuses are normal. |

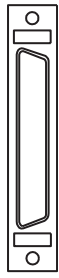
## 5.2 Specifications of DO-01 Module Connections

### 5.2.1 Connector Specifications

The DO-01 Module connector connects the external output signals (64 points).

The following table provides the specifications of the DO-01 Module connector.

#### ( 1 ) Connector Model



| Name                   | Connector Name | No of Pins | Connector Model                      |                                                                                                                                                                   |                  |
|------------------------|----------------|------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                        |                |            | Module Side                          | Cable Side                                                                                                                                                        | Manufacturer     |
| External I/O Connector | CN1/CN2        | 50         | 10250-52A3PL<br>(Conforming to RoHS) | <ul style="list-style-type: none"> <li>• Connector 10150-3000PE</li> <li>• Shell 10350-52A0-008 (Screw locking), or 10350-52F0-008 (One-touch locking)</li> </ul> | 3M Japan Limited |

## ( 2 ) DO-01 Module Connector Pin Arrangement

The following table shows the DO-01 Module connector (CN1 and CN2) pin arrangement viewed from the wiring side and the details of the pins.

## ■ CN1 Connector Pin Arrangement (Viewed from Wiring Side)

|    |       |    |        |    |       |    |       |
|----|-------|----|--------|----|-------|----|-------|
| 2  | DO_00 | 1  | +24V_1 | 27 | DO_01 | 26 | 0V_1  |
| 4  | DO_04 | 3  | DO_02  | 29 | DO_15 | 28 | DO_03 |
| 6  | 0V_1  | 5  | DO_06  | 31 | 0V_1  | 30 | DO_07 |
| 8  | DO_08 | 7  | +24V_2 | 33 | DO_09 | 32 | 0V_2  |
| 10 | DO_12 | 9  | DO_10  | 35 | DO_13 | 34 | DO_11 |
| 12 | 0V_2  | 11 | DO_14  | 37 | 0V_2  | 36 | DO_15 |
| 14 | DO_16 | 13 | +24V_3 | 39 | DO_17 | 38 | 0V_3  |
| 16 | DO_20 | 15 | DO_18  | 41 | DO_21 | 40 | DO_19 |
| 18 | 0V_3  | 17 | DO_22  | 43 | 0V_3  | 42 | DO_23 |
| 20 | DO_24 | 19 | +24V_4 | 45 | DO_25 | 44 | 0V_4  |
| 22 | DO_28 | 21 | DO_26  | 47 | DO_29 | 46 | DO_27 |
| 24 | 0V_4  | 23 | DO_30  | 49 | 0V_4  | 48 | DO_31 |
|    |       | 25 |        |    |       | 50 |       |

## ■ CN1 Connector Details

| Pin No. | Signal Name | I/O | Remarks             | Pin No. | Signal Name | I/O | Remarks           |
|---------|-------------|-----|---------------------|---------|-------------|-----|-------------------|
| 1       | +24V-1      | P   | 24-V power supply 1 | 26      | 0V-1        | P   | Common ground 1   |
| 2       | DO-00       | O   | Digital output 0    | 27      | DO-01       | O   | Digital output 1  |
| 3       | DO-02       | O   | Digital output 2    | 28      | DO-03       | O   | Digital output 3  |
| 4       | DO-04       | O   | Digital output 4    | 29      | DO-05       | O   | Digital output 5  |
| 5       | DO-06       | O   | Digital output 6    | 30      | DO-07       | O   | Digital output 7  |
| 6       | 0V-1        | P   | Common ground 1     | 31      | 0V-1        | P   | Common ground 1   |
| 7       | +24V-2      | P   | 24-V power supply 2 | 32      | 0V-2        | P   | Common ground 2   |
| 8       | DO-08       | O   | Digital output 8    | 33      | DO-09       | O   | Digital output 9  |
| 9       | DO-10       | O   | Digital output 10   | 34      | DO-11       | O   | Digital output 11 |
| 10      | DO-12       | O   | Digital output 12   | 35      | DO-13       | O   | Digital output 13 |
| 11      | DO-14       | O   | Digital output 14   | 36      | DO-15       | O   | Digital output 15 |
| 12      | 0V-2        | P   | Common ground 2     | 37      | 0V-2        | P   | Common ground 2   |
| 13      | +24V-3      | P   | 24-V power supply 3 | 38      | 0V-3        | P   | Common ground 3   |
| 14      | DO-16       | O   | Digital output 16   | 39      | DO-17       | O   | Digital output 17 |
| 15      | DO-18       | O   | Digital output 18   | 40      | DO-19       | O   | Digital output 19 |
| 16      | DO-20       | O   | Digital output 20   | 41      | DO-21       | O   | Digital output 21 |
| 17      | DO-22       | O   | Digital output 22   | 42      | DO-23       | O   | Digital output 23 |
| 18      | 0V-3        | P   | Common ground 3     | 43      | 0V-3        | P   | Common ground 3   |
| 19      | +24V-4      | P   | 24-V power supply 4 | 44      | 0V-4        | P   | Common ground 4   |
| 20      | DO-24       | O   | Digital output 24   | 45      | DO-25       | O   | Digital output 25 |
| 21      | DO-26       | O   | Digital output 26   | 46      | DO-27       | O   | Digital output 27 |
| 22      | DO-28       | O   | Digital output 28   | 47      | DO-29       | O   | Digital output 29 |
| 23      | DO-30       | O   | Digital output 30   | 48      | DO-31       | O   | Digital output 31 |
| 24      | 0V-4        | P   | Common ground 4     | 49      | 0V-4        | P   | Common ground 4   |
| 25      |             |     |                     | 50      |             |     |                   |

♦ P: Power supply input, I: Input signal, O: Output signal

### ■ CN2 Connector Pin Arrangement (Viewed from Wiring Side)

|    |       |    |        |    |       |
|----|-------|----|--------|----|-------|
| 2  | DO_32 | 1  | +24V_5 | 26 | 0V_5  |
| 4  | DO_36 | 3  | DO_34  | 27 | DO_33 |
| 6  | 0V_5  | 5  | DO_38  | 29 | DO_37 |
| 8  | DO_40 | 7  | +24V_6 | 31 | 0V_5  |
| 10 | DO_44 | 9  | DO_42  | 33 | DO_41 |
| 12 | 0V_6  | 11 | DO_46  | 35 | DO_45 |
| 14 | DO_48 | 13 | +24V_7 | 37 | 0V_6  |
| 16 | DO_52 | 15 | DO_50  | 39 | DO_49 |
| 18 | 0V_7  | 17 | DO_54  | 41 | DO_53 |
| 20 | DO_56 | 19 | +24V_8 | 43 | 0V_7  |
| 22 | DO_60 | 21 | DO_58  | 45 | DO_57 |
| 24 | 0V_8  | 23 | DO_62  | 47 | DO_61 |
|    |       | 25 |        | 49 | 0V_8  |
|    |       |    |        | 50 |       |

### ■ CN2 Connector Details

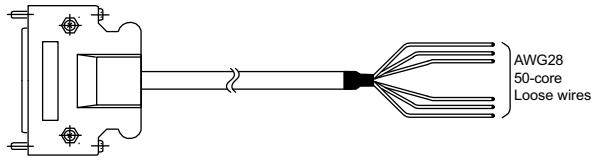
| Pin No. | Signal Name | I/O | Remarks              | Pin No. | Signal Name | I/O | Remarks           |
|---------|-------------|-----|----------------------|---------|-------------|-----|-------------------|
| 1       | +24V-5      | P   | +24-V power supply 5 | 26      | 0V-5        | P   | Common ground 5   |
| 2       | DO-32       | O   | Digital output 32    | 27      | DO-33       | O   | Digital output 33 |
| 3       | DO-34       | O   | Digital output 34    | 28      | DO-035      | O   | Digital output 35 |
| 4       | DO-36       | O   | Digital output 36    | 29      | DO-037      | O   | Digital output 37 |
| 5       | DO-38       | O   | Digital output 38    | 30      | DO-039      | O   | Digital output 39 |
| 6       | 0V-5        | P   | Common ground 5      | 31      | 0V-5        | P   | Common ground 5   |
| 7       | +24V-6      | P   | +24-V power supply 6 | 32      | 0V-6        | P   | Common ground 6   |
| 8       | DO-40       | O   | Digital output 40    | 33      | DO-41       | O   | Digital output 41 |
| 9       | DO-42       | O   | Digital output 42    | 34      | DO-43       | O   | Digital output 43 |
| 10      | DO-44       | O   | Digital output 44    | 35      | DO-45       | O   | Digital output 45 |
| 11      | DO-46       | O   | Digital output 46    | 36      | DO-47       | O   | Digital output 47 |
| 12      | 0V-6        | P   | Common ground 6      | 37      | 0V-6        | P   | Common ground 6   |
| 13      | +24V-7      | P   | +24-V power supply 7 | 38      | 0V-7        | P   | Common ground 7   |
| 14      | DO-48       | O   | Digital output 48    | 39      | DO-49       | O   | Digital output 49 |
| 15      | DO-50       | O   | Digital output 50    | 40      | DO-51       | O   | Digital output 51 |
| 16      | DO-52       | O   | Digital output 52    | 41      | DO-53       | O   | Digital output 53 |
| 17      | DO-54       | O   | Digital output 54    | 42      | DO-55       | O   | Digital output 55 |
| 18      | 0V-7        | P   | Common ground 7      | 43      | 0V-7        | P   | Common ground 7   |
| 19      | +24V-8      | P   | +24-V power supply 8 | 44      | 0V-8        | P   | Common ground 8   |
| 20      | DO-56       | O   | Digital output 56    | 45      | DO-57       | O   | Digital output 57 |
| 21      | DO-58       | O   | Digital output 58    | 46      | DO-59       | O   | Digital output 59 |
| 22      | DO-60       | O   | Digital output 60    | 47      | DO-61       | O   | Digital output 61 |
| 23      | DO-62       | O   | Digital output 62    | 48      | DO-63       | O   | Digital output 63 |
| 24      | 0V-8        | P   | Common ground 8      | 49      | 0V-8        | P   | Common ground 8   |
| 25      |             |     |                      | 50      |             |     |                   |

- P: Power supply input, I: Input signal, O: Output signal

## 5.2.2 Cable Specifications

The following shows the specifications of the DO-01 Module standard cables.

### ( 1 ) Standard Cable Model List

| Name                     | Model            | Length | External Appearance (JEPMC-W6060-□□-E)                                             |
|--------------------------|------------------|--------|------------------------------------------------------------------------------------|
| Cables for DO-01 Modules | JEPMC-W6060-05-E | 0.5 m  |  |
|                          | JEPMC-W6060-10-E | 1.0 m  |                                                                                    |
|                          | JEPMC-W6060-30-E | 3.0 m  |                                                                                    |

### ( 2 ) Standard Cable Wiring Table

The wiring table for the standard cable JEPMC-W6060-□□-E is shown below.

| 50-pin<br>Connector<br>Terminal No. | Marking         | Wire Color | Marking         | 50-pin<br>Connector<br>Terminal No. |
|-------------------------------------|-----------------|------------|-----------------|-------------------------------------|
| 1                                   | -               | Orange     | -               | 26                                  |
| 2                                   | -               | Gray       | -               | 27                                  |
| 3                                   | -               | White      | -               | 28                                  |
| 4                                   | -               | Yellow     | -               | 29                                  |
| 5                                   | -               | Pink       | -               | 30                                  |
| 6                                   | --              | Orange     | --              | 31                                  |
| 7                                   | --              | Gray       | --              | 32                                  |
| 8                                   | --              | White      | --              | 33                                  |
| 9                                   | --              | Yellow     | --              | 34                                  |
| 10                                  | --              | Pink       | --              | 35                                  |
| 11                                  | ---             | Orange     | ---             | 36                                  |
| 12                                  | ---             | Gray       | ---             | 37                                  |
| 13                                  | ---             | White      | ---             | 38                                  |
| 14                                  | ---             | Yellow     | ---             | 39                                  |
| 15                                  | ---             | Pink       | ---             | 40                                  |
| 16                                  | ----            | Orange     | ---- Continuous | 41                                  |
| 17                                  | ----            | Gray       | ---- Continuous | 42                                  |
| 18                                  | ----            | White      | ---- Continuous | 43                                  |
| 19                                  | ----            | Yellow     | ---- Continuous | 44                                  |
| 20                                  | ----            | Pink       | ---- Continuous | 45                                  |
| 21                                  | ---- Continuous | Orange     | -----           | 46                                  |
| 22                                  | ---- Continuous | Gray       | -----           | 47                                  |
| 23                                  | ---- Continuous | White      | -----           | 48                                  |
| 24                                  | ---- Continuous | Yellow     | -----           | 49                                  |
| 25                                  | ---- Continuous | Pink       | -----           | 50                                  |

### 5.2.3 Output Circuit

The following table shows the DO-01 Module output circuit specifications.

| Item                     | Specifications                                                              |
|--------------------------|-----------------------------------------------------------------------------|
| Outputs                  | 64 points                                                                   |
| Output Format            | Transistor/open collector, sink mode output                                 |
| Isolation Method         | Photocoupler                                                                |
| Output Voltage           | + 24 VDC (+19.2 to +28.8 V)                                                 |
| Output Current           | 100 mA max.                                                                 |
| Leakage Current When OFF | 0.1 mA max.                                                                 |
| ON Time/OFF Time         | ON: 0.5 ms max.<br>OFF: 1 ms max.                                           |
| Number of Commons        | 8 (8 points/common)                                                         |
| Protection Circuit       | Fuse connected to each common line                                          |
| Fuse Rating              | 1.2 A                                                                       |
| Error Detection          | Fuse blown detection<br>Replace the Module when the fuse blown is detected. |

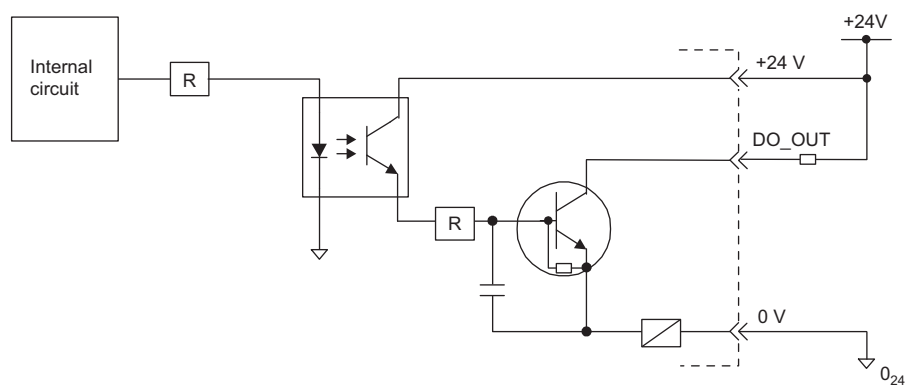
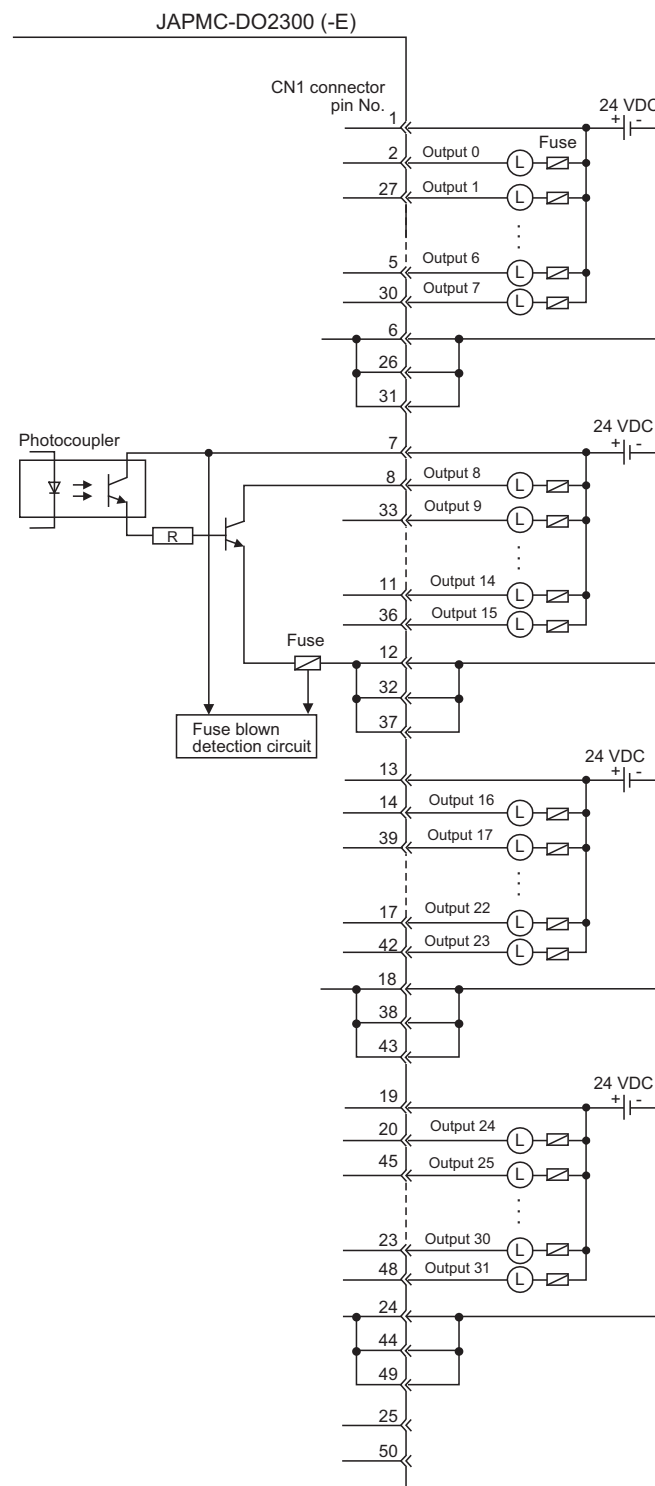


Fig. 5.1 DO-01 Digital Output Circuit (Sink Mode Output)

## 5.2.4 DO-01 Module Connections

The following diagrams show connection examples for CN1/CN2 connector of the DO-01 Module.

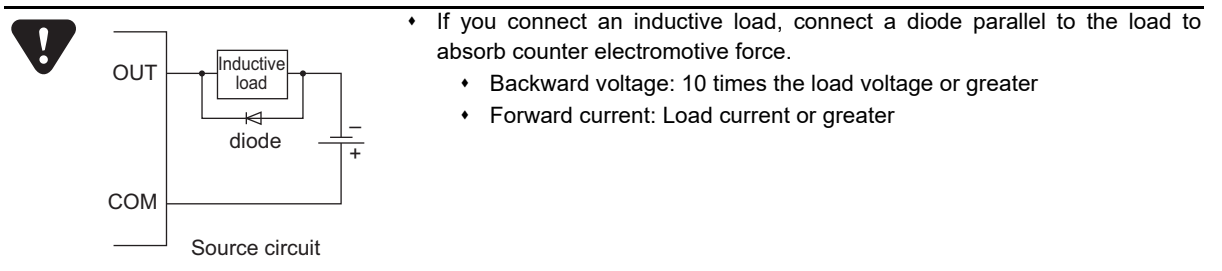
### ( 1 ) CN1 Connector



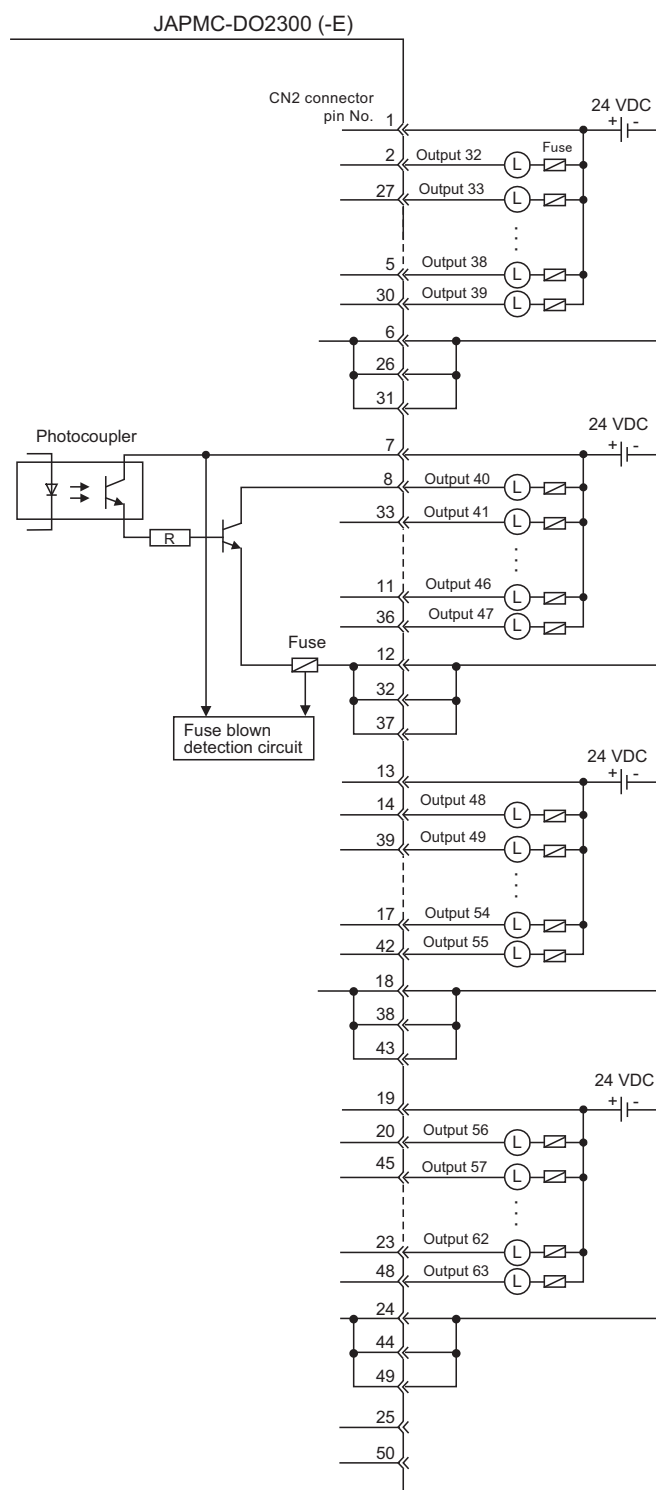
- The pins No. 6, 26, and 31, the pins 12, 32, and 37, the pins 18, 38, and 43, and the pins No. 24, 44, and 49 are internally connected. Connect them externally as well.



- A fuse is inserted in the output common line of the DO-01 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.



## ( 2 ) CN2 Connector



The pins No. 6, 26, and 31, the pins No. 12, 32, and 37, the pins No. 18, 38, and 43, and the pins No. 24, 44, and 49 are internally connected. Connect them externally as well.



- A fuse is inserted in the output common line of the DO-01 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.

OUT

COM

Inductive load

diode

Source circuit

- ♦ If you connect an inductive load, connect a diode parallel to the load to absorb counter electromotive force.
  - ♦ Backward voltage: 10 times the load voltage or greater
  - ♦ Forward current: Load current or greater

## 5.3 DO-01 Module Details

DO-01 Module details can be set in the **Module Configuration** Window.

### 5.3.1 Displaying the DO-01 Configuration Window

Double-click **DO** in the **Function Module/Slave** Column of the **Module Configuration** Window.

| Module               | Function Module/Slave | Status | Circuit No/AxisAddress |             | Motion Register | Register(Input/Output) |                 |                |      | Comment |
|----------------------|-----------------------|--------|------------------------|-------------|-----------------|------------------------|-----------------|----------------|------|---------|
|                      |                       |        | Start                  | cupied circ |                 | Disabled               | Start - End     | Size           | Scan |         |
| 01 [MP2300] : ---    |                       |        |                        |             |                 |                        |                 |                |      |         |
| 00 [MP2300] : [----] | 01 CPU                | ----   | ----                   | ----        | ----            | ----                   | ----            | ----           | ---- |         |
|                      | 02 IO                 |        | ----                   | ----        | 1               | ----                   | Input<br>OutPut | 0000 - 0001[H] | 2    | ----    |
|                      | 03 [SVB]              |        | ----                   | Circuit No1 | 1               | 8000 - 87FF[H]         | Input<br>OutPut | 0010 - 040F[H] | 1024 | ----    |
|                      | 04 [SVR]              |        | ----                   | Circuit No2 | 1               | 8800 - 8FFF[H]         | ----            | ----           | ---- | ----    |
| 01 [LIO-06] : [----] | 01 MIXIO              |        | ----                   | ----        | 1               | ----                   | Input<br>OutPut | 0430 - 0431[H] | 2    | ----    |
|                      | 02 CNTR-A             |        | ----                   | ----        | 1               | ----                   | Input<br>OutPut | 0440 - 045F[H] | 32   | ----    |
| 02 [LIO-04] : [----] | 01 LIO32              |        | ----                   | ----        | 1               | ----                   | Input<br>OutPut | 0410 - 0411[H] | 2    | ----    |
| 03 [DO-01] : [----]  | 01 DO                 |        | ----                   | ----        | 1               | ----                   | Input<br>OutPut | 0420 - 0423[H] | 4    | ----    |

A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **DO-01 Configuration** Window will be displayed.

- Refer to *1.4.1 Displaying the Module Configuration Window* on page 1-15 for information on displaying the **Module Configuration** Window.

## 5.3.2 DO-01 Configuration Details

The following items are displayed in the **DO-01 Configuration** Window. The discrete outputs can be set.

The screenshot shows a window titled "Detail - [DO-01 Configuration]". It has a menu bar with "File" and "Edit". Below the menu bar, there are fields for "PT#:-" and "CPU#:-", with "00420-00423" entered in the CPU# field. The main area contains a table with the following columns: "Item", "D", "REG", "WD", "SCAN", "Current Value", and "HEX". The table has four rows for "Local Output1" through "Local Output4". Each row has a checkbox in the "D" column, a register address in "REG", a word size of "1" in "WD", a scan speed of "HIGH" in "SCAN", and empty fields for "Current Value" and "HEX". At the bottom of the window, there is a status bar that says "For Help, press F1".

| Item          | D                        | REG     | WD | SCAN | Current Value | HEX |
|---------------|--------------------------|---------|----|------|---------------|-----|
| Local Output1 | <input type="checkbox"/> | OW00420 | 1  | HIGH |               |     |
| Local Output2 | <input type="checkbox"/> | OW00421 | 1  | HIGH |               |     |
| Local Output3 | <input type="checkbox"/> | OW00422 | 1  | HIGH |               |     |
| Local Output4 | <input type="checkbox"/> | OW00423 | 1  | HIGH |               |     |

D : Enable or disable each item by clicking on the cell.

☐ : Enabled, ☒ : Disabled

The register length is fixed at one word, i.e., 16 points are set.

REG : Displays the register number allocated to the outputs. It cannot be changed.

Word : Displays the word size of the register data. It cannot be changed.

SCAN : Select the speed from **HIGH**, **LOW**, or **NA** (none specified), for the scan that processes the outputs.

Current Value : The current value of the register will be displayed in binary when online. It will not be displayed when offline.

The outputs to external devices can be set by changing the current value of the discrete outputs.

When the set value is confirmed, it is immediately saved in the register.

HEX : The current value of the register will be displayed in hexadecimal when online. It will not be displayed when offline.

After changing the DO-01 configuration, save the definition data by selecting **Online – Save to Flash** from the main menu.

## DI-01 Module

This chapter describes DI-01 Module in detail.

|                                                                 |      |
|-----------------------------------------------------------------|------|
| 6.1 Outline of DI-01 Module                                     | 6-2  |
| 6.1.1 Outline of Functions                                      | 6-2  |
| 6.1.2 DI-01 Module Appearance and Connector External Dimensions | 6-3  |
| 6.1.3 Specifications                                            | 6-3  |
| 6.1.4 LED Indicators                                            | 6-5  |
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| 6.2.1 Connector Specifications                                  | 6-6  |
| 6.2.2 Cable Specifications                                      | 6-9  |
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| 6.2.4 DI-01 Module Connections                                  | 6-11 |
| 6.3 DI-01 Module Details                                        | 6-13 |
| 6.3.1 Displaying the DI-01 Configuration Window                 | 6-13 |
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## 6.1 Outline of DI-01 Module

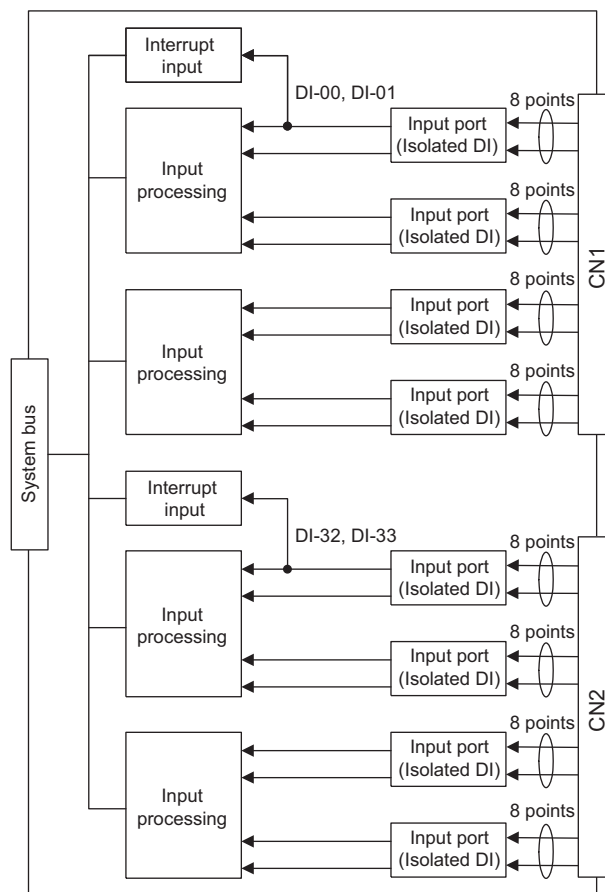
### 6.1.1 Outline of Functions

The DI-01 Module is equipped with the following digital input functions:

64 digital inputs (DI) (combined sink mode/source mode inputs)

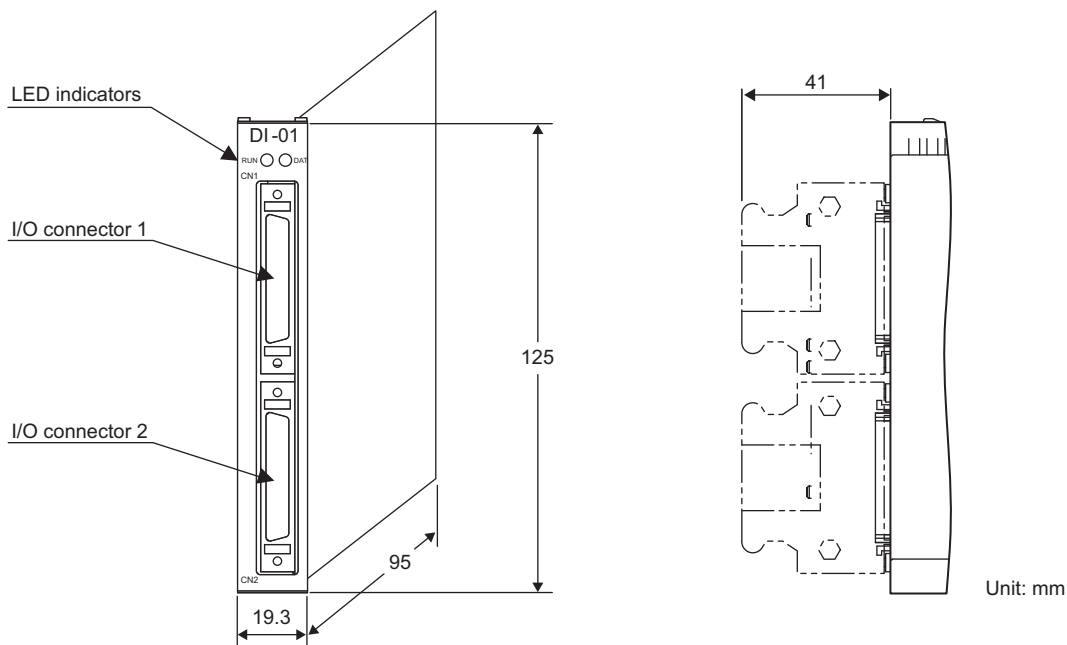
A digital input is made at a periodical cycle for each high-speed scan or low-speed scan of the MP2000 Series Machine Controller.

The following diagram outlines the DI-01 Module functions.



### 6.1.2 DI-01 Module Appearance and Connector External Dimensions

The following figure shows the appearance of the DI-01 Module and connector external dimensions.



### 6.1.3 Specifications

The following shows the specifications of the DI-01 Module.

#### ( 1 ) Hardware Specifications

| Item                | Specifications                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Classification      | I/O Module                                                                                                                                                                                                                                                                                                                                                                                                          |
| Name                | DI-01                                                                                                                                                                                                                                                                                                                                                                                                               |
| Model               | JAPMC-DI2300-E                                                                                                                                                                                                                                                                                                                                                                                                      |
| Digital Output      | 64 inputs<br>24 VDC $\pm$ 20% (+19.2 V to +28.8 V), 4.1 mA (TYP), combined sink mode/<br>source mode inputs (DI-00, -01, -32, and -33 also used for interrupts)<br>Number of simultaneously ON inputs: 10 (with 24 VDC),<br>7 (with 28.8 VDC)<br>For details on the number of simultaneously ON inputs, refer to ( 3 ) <i>Number of Simultaneously ON Inputs - Ambient Temperature Characteristics</i> on page 6-4. |
| Connectors          | CN1: Input connector<br>CN2: Input connector                                                                                                                                                                                                                                                                                                                                                                        |
| LED Indicators      | RUN (green)<br>DAT (green)                                                                                                                                                                                                                                                                                                                                                                                          |
| Current Consumption | 500 mA max.                                                                                                                                                                                                                                                                                                                                                                                                         |
| Dimensions (mm)     | 125 $\times$ 95 (H $\times$ D)                                                                                                                                                                                                                                                                                                                                                                                      |
| Mass                | 170 g                                                                                                                                                                                                                                                                                                                                                                                                               |

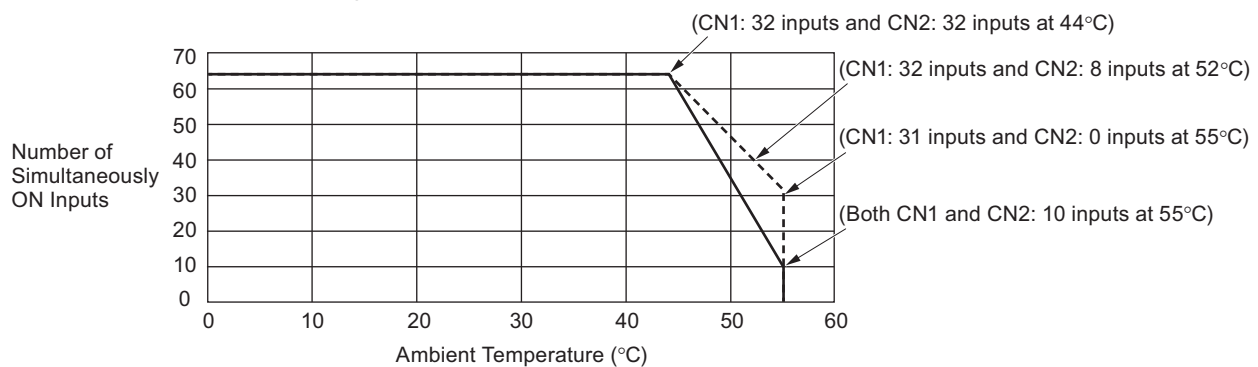
## ( 2 ) Environmental Conditions

| Item                            |                               | Specifications                                                                                                                                                                                                          |
|---------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions        | Ambient Operating Temperature | 0 to 55°C                                                                                                                                                                                                               |
|                                 | Ambient Storage Temperature   | -25 to 85°C                                                                                                                                                                                                             |
|                                 | Ambient Operating Humidity    | 30% to 95% (with no condensation)                                                                                                                                                                                       |
|                                 | Ambient Storage Humidity      | 5% to 95% (with no condensation)                                                                                                                                                                                        |
|                                 | Pollution Level               | Pollution level 2 (conforming to JIS B 3502)                                                                                                                                                                            |
|                                 | Corrosive Gas                 | There must be no combustible or corrosive gas.                                                                                                                                                                          |
|                                 | Operating Altitude            | 2,000 m above sea level or lower                                                                                                                                                                                        |
| Mechanical Operating Conditions | Vibration Resistance          | Conforming to JIS B 3502:<br>• 10 to 57 Hz with single-amplitude of 0.075 mm<br>• 57 to 150 Hz with fixed acceleration of 9.8 m/s <sup>2</sup><br>• 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min) |
|                                 | Shock Resistance              | Conforming to JIS B 3502:<br>Peak acceleration of 147 m/s <sup>2</sup> twice for 11 ms each in the X, Y, and Z directions                                                                                               |
| Electrical Operating Conditions | Noise Resistance              | Conforming to EN 61000-6-2, EN 61000-6-4, EN 55011 (Group 1 Class A)                                                                                                                                                    |
| Installation Requirements       | Ground                        | Ground to 100 Ω max.                                                                                                                                                                                                    |
|                                 | Cooling Method                | Natural cooling                                                                                                                                                                                                         |

## ( 3 ) Number of Simultaneously ON Inputs - Ambient Temperature Characteristics

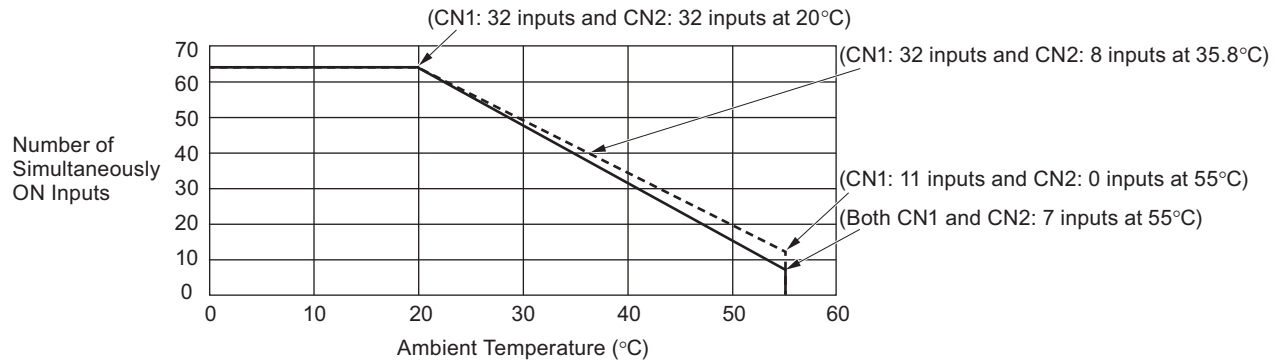
The following graph shows the number of inputs that can be simultaneously ON depending on the ambient temperature.

■ When the Input Voltage is 24 VDC



- There is a limit on the number of simultaneously ON inputs in locations where the ambient temperature exceeds 44°C. As shown by the dashed line on the graph, the number of simultaneously ON inputs can be increased by giving preference to CN1 over CN2.

### ■ When the Input Voltage is 28.8 VDC



- There is a limit on the number of simultaneously ON inputs in locations where the ambient temperature exceeds 20°C. As shown by the dashed line on the graph, the number of simultaneously ON inputs can be increased by giving preference to CN1 over CN2.

## 6.1.4 LED Indicators

The following table shows the DI-01 Module status when each indicator lamp is lit or unlit.

RUN   DAT

| Indicator | Color | When Lit                                | When Unlit               |
|-----------|-------|-----------------------------------------|--------------------------|
| RUN       | Green | Normal operation                        | Error occurrence         |
| DAT       | Green | One or some of the DI signals is input. | No DI signals are input. |

## 6.2 Specifications of DI-01 Module Connections

### 6.2.1 Connector Specifications

The DI-01 Module connectors (CN1 and CN2) connect the external input signals (64 points).  
The following table provides the specifications of the DI-01 Module connector.

( 1 ) Connector Model

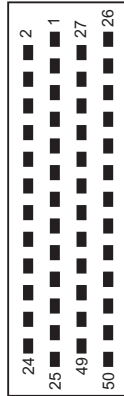


| Name                   | Connector Name | No of Pins | Connector Model                      |                                                                                                                                                                                    |                  |
|------------------------|----------------|------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                        |                |            | Module Side                          | Cable Side                                                                                                                                                                         | Manufacturer     |
| External I/O Connector | CN1/CN2        | 50         | 10250-52A3PL<br>(Conforming to RoHS) | <ul style="list-style-type: none"><li>• Connector<br/>10150-3000PE</li><li>• Shell<br/>10350-52A0-008<br/>(Screw locking), or<br/>10350-52F0-008<br/>(One-touch locking)</li></ul> | 3M Japan Limited |

## ( 2 ) DI-01 Module Connector Pin Arrangement

The following table shows the DI-01 Module connector (CN1 and CN2) pin arrangement viewed from the wiring side and the details of the pins.

### ■ CN1 Connector Pin Arrangement (Viewed from Wiring Side)



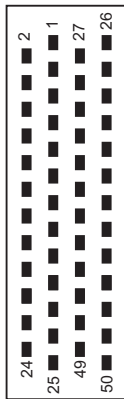
|    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|
| 2  | DI_00 | 1  | COM_1 | 27 | DI_01 | 26 |       |
| 4  | DI_04 | 3  | DI_02 | 29 | DI_05 | 28 | DI_03 |
| 6  |       | 5  | DI_06 | 31 |       | 30 | DI_07 |
| 8  | DI_08 | 7  | COM_2 | 33 | DI_09 | 32 |       |
| 10 | DI_12 | 9  | DI_10 | 35 | DI_13 | 34 | DI_11 |
| 12 |       | 11 | DI_14 | 37 |       | 36 | DI_15 |
| 14 | DI_16 | 13 | COM_3 | 39 | DI_17 | 38 |       |
| 16 | DI_20 | 15 | DI_18 | 41 | DI_21 | 40 | DI_19 |
| 18 |       | 17 | DI_22 | 43 |       | 42 | DI_23 |
| 20 | DI_24 | 19 | COM_4 | 45 | DI_25 | 44 |       |
| 22 | DI_28 | 21 | DI_26 | 47 | DI_29 | 46 | DI_27 |
| 24 |       | 23 | DI_30 | 49 |       | 48 | DI_31 |
|    |       | 25 |       |    |       | 50 |       |

### ■ CN1 Connector Details

| Pin No. | Signal Name | I/O | Remarks                                       | Pin No. | Signal Name | I/O | Remarks                                       |
|---------|-------------|-----|-----------------------------------------------|---------|-------------|-----|-----------------------------------------------|
| 1       | COM_1       | P   | Input common 1                                | 26      |             |     |                                               |
| 2       | DI_00       | I   | Digital input 0 (shared with interrupt input) | 27      | DI_01       | I   | Digital input 1 (shared with interrupt input) |
| 3       | DI_02       | I   | Digital input 2                               | 28      | DI_03       | I   | Digital input 3                               |
| 4       | DI_04       | I   | Digital input 4                               | 29      | DI_05       | I   | Digital input 5                               |
| 5       | DI_06       | I   | Digital input 6                               | 30      | DI_07       | I   | Digital input 7                               |
| 6       |             |     |                                               | 31      |             |     |                                               |
| 7       | COM_2       | P   | Input common 2                                | 32      |             |     |                                               |
| 8       | DI_08       | I   | Digital input 8                               | 33      | DI_09       | I   | Digital input 9                               |
| 9       | DI_10       | I   | Digital input 10                              | 34      | DI_11       | I   | Digital input 11                              |
| 10      | DI_12       | I   | Digital input 12                              | 35      | DI_13       | I   | Digital input 13                              |
| 11      | DI_14       | I   | Digital input 14                              | 36      | DI_15       | I   | Digital input 15                              |
| 12      |             |     |                                               | 37      |             |     |                                               |
| 13      | COM_3       | P   | Input common 3                                | 38      |             |     |                                               |
| 14      | DI_16       | I   | Digital input 16                              | 39      | DI_17       | I   | Digital input 17                              |
| 15      | DI_18       | I   | Digital input 18                              | 40      | DI_19       | I   | Digital input 19                              |
| 16      | DI_20       | I   | Digital input 20                              | 41      | DI_21       | I   | Digital input 21                              |
| 17      | DI_22       | I   | Digital input 22                              | 42      | DI_23       | I   | Digital input 23                              |
| 18      |             |     |                                               | 43      |             |     |                                               |
| 19      | COM_4       | P   | Input common 4                                | 44      |             |     |                                               |
| 20      | DI_24       | I   | Digital input 24                              | 45      | DI_25       | I   | Digital input 25                              |
| 21      | DI_26       | I   | Digital input 26                              | 46      | DI_27       | I   | Digital input 27                              |
| 22      | DI_28       | I   | Digital input 28                              | 47      | DI_29       | I   | Digital input 29                              |
| 23      | DI_30       | I   | Digital input 30                              | 48      | DI_31       | I   | Digital input 31                              |
| 24      |             |     |                                               | 49      |             |     |                                               |
| 25      |             |     |                                               | 50      |             |     |                                               |

- P: Power supply input, I: Input signal

### ■ CN2 Connector Pin Arrangement (Viewed from Wiring Side)



|    |       |    |       |    |       |
|----|-------|----|-------|----|-------|
| 2  | DI_32 | 1  | COM_5 | 26 |       |
| 4  | DI_36 | 3  | DI_34 | 27 | DI_33 |
| 6  |       | 5  | DI_38 | 29 | DI_37 |
| 8  | DI_40 | 7  | COM_6 | 31 |       |
| 10 | DI_44 | 9  | DI_42 | 33 | DI_41 |
| 12 |       | 11 | DI_46 | 35 | DI_45 |
| 14 | DI_48 | 13 | COM_7 | 37 |       |
| 16 | DI_52 | 15 | DI_50 | 39 | DI_49 |
| 18 |       | 17 | DI_54 | 41 | DI_53 |
| 20 | DI_56 | 19 | COM_8 | 43 |       |
| 22 | DI_60 | 21 | DI_58 | 45 | DI_57 |
| 24 |       | 23 | DI_62 | 47 | DI_61 |
|    |       | 25 |       | 49 |       |
|    |       |    |       | 26 |       |
|    |       |    |       | 28 | DI_35 |
|    |       |    |       | 30 | DI_39 |
|    |       |    |       | 32 |       |
|    |       |    |       | 34 | DI_43 |
|    |       |    |       | 36 | DI_47 |
|    |       |    |       | 38 |       |
|    |       |    |       | 40 | DI_51 |
|    |       |    |       | 42 | DI_55 |
|    |       |    |       | 44 |       |
|    |       |    |       | 46 | DI_59 |
|    |       |    |       | 48 | DI_63 |
|    |       |    |       | 50 |       |

### ■ CN2 Connector Details

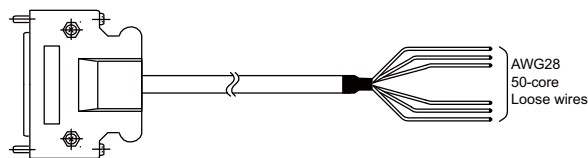
| Pin No. | Signal Name | I/O | Remarks                                           | Pin No. | Signal Name | I/O | Remarks                                           |
|---------|-------------|-----|---------------------------------------------------|---------|-------------|-----|---------------------------------------------------|
| 1       | COM_5       | P   | Input common 5                                    | 26      |             |     |                                                   |
| 2       | DI_32       | I   | Digital input 32<br>(shared with interrupt input) | 27      | DI_33       | I   | Digital input 33<br>(shared with interrupt input) |
| 3       | DI_34       | I   | Digital input 34                                  | 28      | DI_35       | I   | Digital input 35                                  |
| 4       | DI_36       | I   | Digital input 36                                  | 29      | DI_37       | I   | Digital input 37                                  |
| 5       | DI_38       | I   | Digital input 38                                  | 30      | DI_39       | I   | Digital input 39                                  |
| 6       |             |     |                                                   | 31      |             |     |                                                   |
| 7       | COM_6       | P   | Input common 6                                    | 32      |             |     |                                                   |
| 8       | DI_40       | I   | Digital input 40                                  | 33      | DI_41       | I   | Digital input 41                                  |
| 9       | DI_42       | I   | Digital input 42                                  | 34      | DI_43       | I   | Digital input 43                                  |
| 10      | DI_44       | I   | Digital input 44                                  | 35      | DI_45       | I   | Digital input 45                                  |
| 11      | DI_46       | I   | Digital input 46                                  | 36      | DI_47       | I   | Digital input 47                                  |
| 12      |             |     |                                                   | 37      |             |     |                                                   |
| 13      | COM_7       | P   | Input common 7                                    | 38      |             |     |                                                   |
| 14      | DI_48       | I   | Digital input 48                                  | 39      | DI_49       | I   | Digital input 49                                  |
| 15      | DI_50       | I   | Digital input 50                                  | 40      | DI_51       | I   | Digital input 51                                  |
| 16      | DI_52       | I   | Digital input 52                                  | 41      | DI_53       | I   | Digital input 53                                  |
| 17      | DI_54       | I   | Digital input 54                                  | 42      | DI_55       | I   | Digital input 55                                  |
| 18      |             |     |                                                   | 43      |             |     |                                                   |
| 19      | COM_8       | P   | Input common 8                                    | 44      |             |     |                                                   |
| 20      | DI_56       | I   | Digital input 56                                  | 45      | DI_57       | I   | Digital input 57                                  |
| 21      | DI_58       | I   | Digital input 58                                  | 46      | DI_59       | I   | Digital input 59                                  |
| 22      | DI_60       | I   | Digital input 60                                  | 47      | DI_61       | I   | Digital input 61                                  |
| 23      | DI_62       | I   | Digital input 62                                  | 48      | DI_63       | I   | Digital input 63                                  |
| 24      |             |     |                                                   | 49      |             |     |                                                   |
| 25      |             |     |                                                   | 50      |             |     |                                                   |

♦ P: Power supply input, I: Input signal

## 6.2.2 Cable Specifications

The following shows the specifications of the DI-01 Module standard cables.

### ( 1 ) Standard Cable Model List

| Name                     | Model            | Length | External Appearance (JEPMC-W6060-□□-E)                                             |
|--------------------------|------------------|--------|------------------------------------------------------------------------------------|
| Cables for DI-01 Modules | JEPMC-W6060-05-E | 0.5 m  |  |
|                          | JEPMC-W6060-10-E | 1.0 m  |                                                                                    |
|                          | JEPMC-W6060-30-E | 3.0 m  |                                                                                    |

### ( 2 ) Standard Cable Wiring Table

The wiring table for the standard cable JEPMC-W6060-□□-E is shown below.

| 50-pin Connector Terminal No. | Marking         | Wire Color | Marking         | 50-pin Connector Terminal No. |
|-------------------------------|-----------------|------------|-----------------|-------------------------------|
| 1                             | -               | Orange     | -               | 26                            |
| 2                             | -               | Gray       | -               | 27                            |
| 3                             | -               | White      | -               | 28                            |
| 4                             | -               | Yellow     | -               | 29                            |
| 5                             | -               | Pink       | -               | 30                            |
| 6                             | --              | Orange     | --              | 31                            |
| 7                             | --              | Gray       | --              | 32                            |
| 8                             | --              | White      | --              | 33                            |
| 9                             | --              | Yellow     | --              | 34                            |
| 10                            | --              | Pink       | --              | 35                            |
| 11                            | ---             | Orange     | ---             | 36                            |
| 12                            | ---             | Gray       | ---             | 37                            |
| 13                            | ---             | White      | ---             | 38                            |
| 14                            | ---             | Yellow     | ---             | 39                            |
| 15                            | ---             | Pink       | ---             | 40                            |
| 16                            | ----            | Orange     | ---- Continuous | 41                            |
| 17                            | ----            | Gray       | ---- Continuous | 42                            |
| 18                            | ----            | White      | ---- Continuous | 43                            |
| 19                            | ----            | Yellow     | ---- Continuous | 44                            |
| 20                            | ----            | Pink       | ---- Continuous | 45                            |
| 21                            | ---- Continuous | Orange     | -----           | 46                            |
| 22                            | ---- Continuous | Gray       | -----           | 47                            |
| 23                            | ---- Continuous | White      | -----           | 48                            |
| 24                            | ---- Continuous | Yellow     | -----           | 49                            |
| 25                            | ---- Continuous | Pink       | -----           | 50                            |

6.2.3 Input Circuit

The following table shows the DI-01 Module input circuit specifications.

| Item                | Specifications                                                                                                                                                                                         |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inputs              | 64 points                                                                                                                                                                                              |
| Input Format        | Sink mode/source mode input                                                                                                                                                                            |
| Isolation Method    | Photocoupler                                                                                                                                                                                           |
| Input Voltage       | 24 VDC (+19.2 to +28.8 V)                                                                                                                                                                              |
| Input Current       | 4.1 mA (TYP)                                                                                                                                                                                           |
| ON Voltage/Current  | 15 V min./2.0 mA min.                                                                                                                                                                                  |
| OFF Voltage/Current | 5 V max./1.0 mA max.                                                                                                                                                                                   |
| ON Time/OFF Time    | ON: 0.5 ms max.OFF: 0.5 ms max.                                                                                                                                                                        |
| Number of Commons   | 8 (8 points/common)                                                                                                                                                                                    |
| Other Functions     | DI_00 is shared with an interrupt input. If DI_00 is turned ON while interrupts are enabled, the interrupt processing drawing (program) is executed.<br>DI_01, DI_32, and DI_33 are the same as DI_00. |

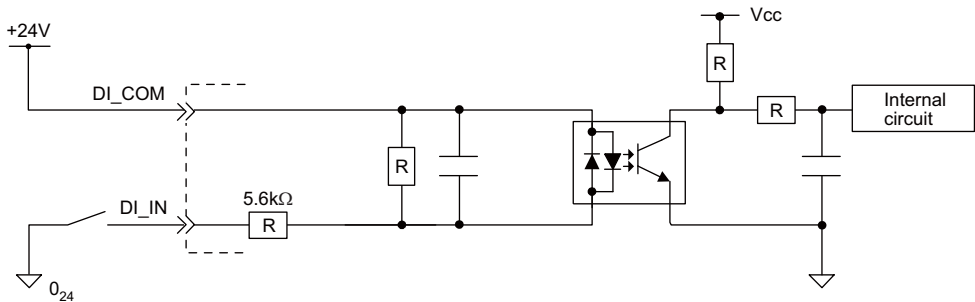


Fig. 6.1 Digital Input Circuit (Source Mode Input)

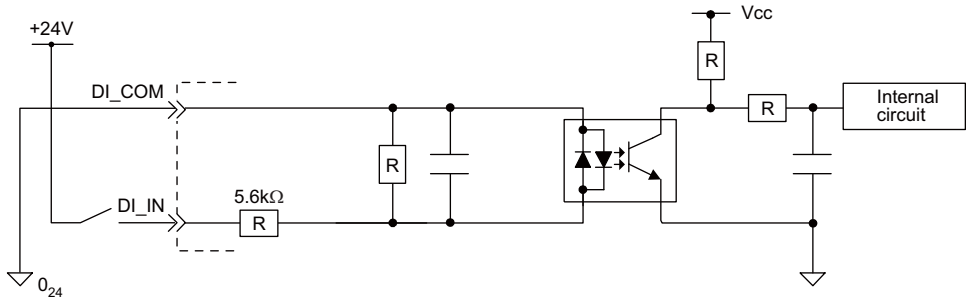
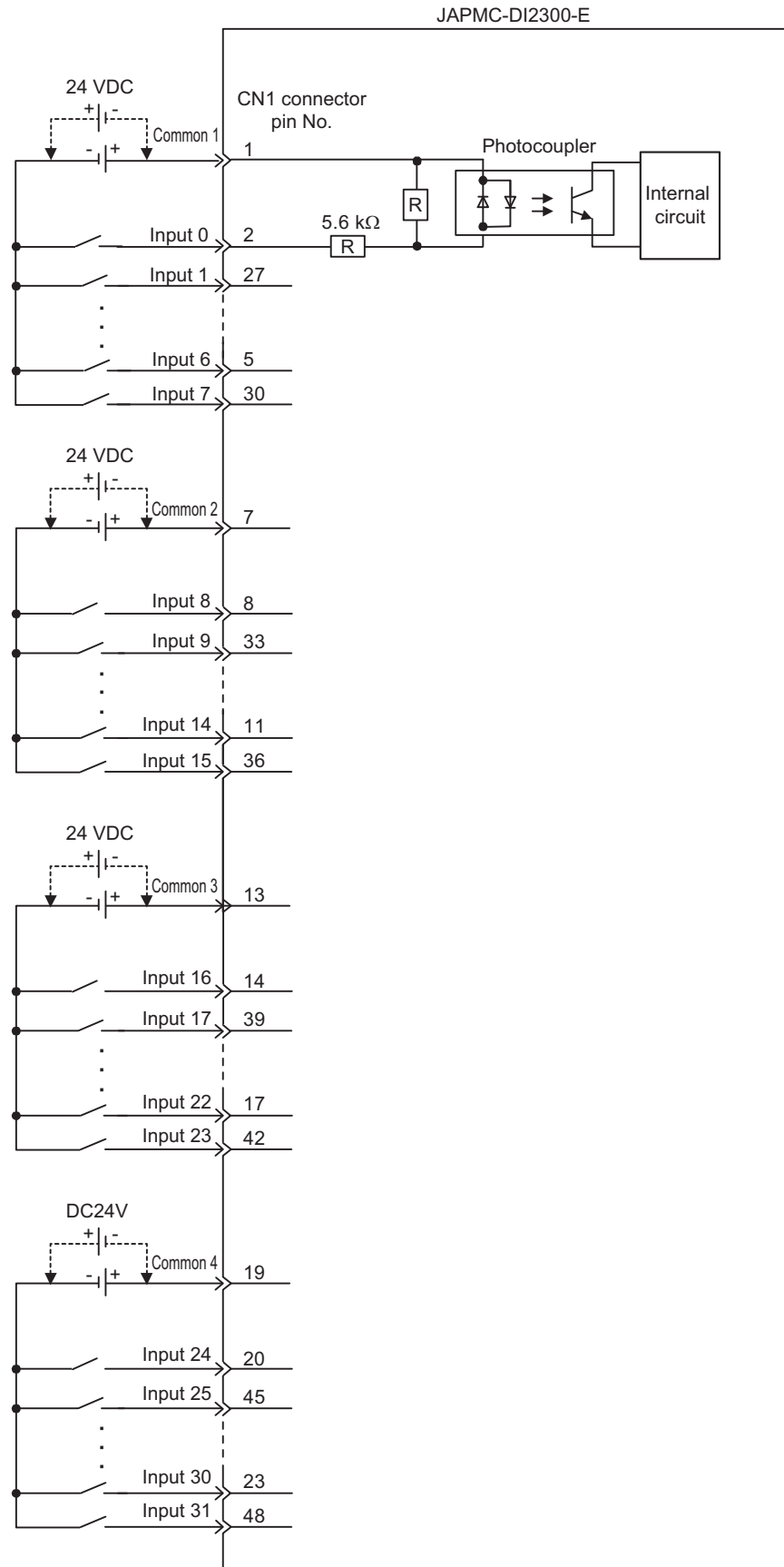


Fig. 6.2 Digital Input Circuit (Sink Mode Input)

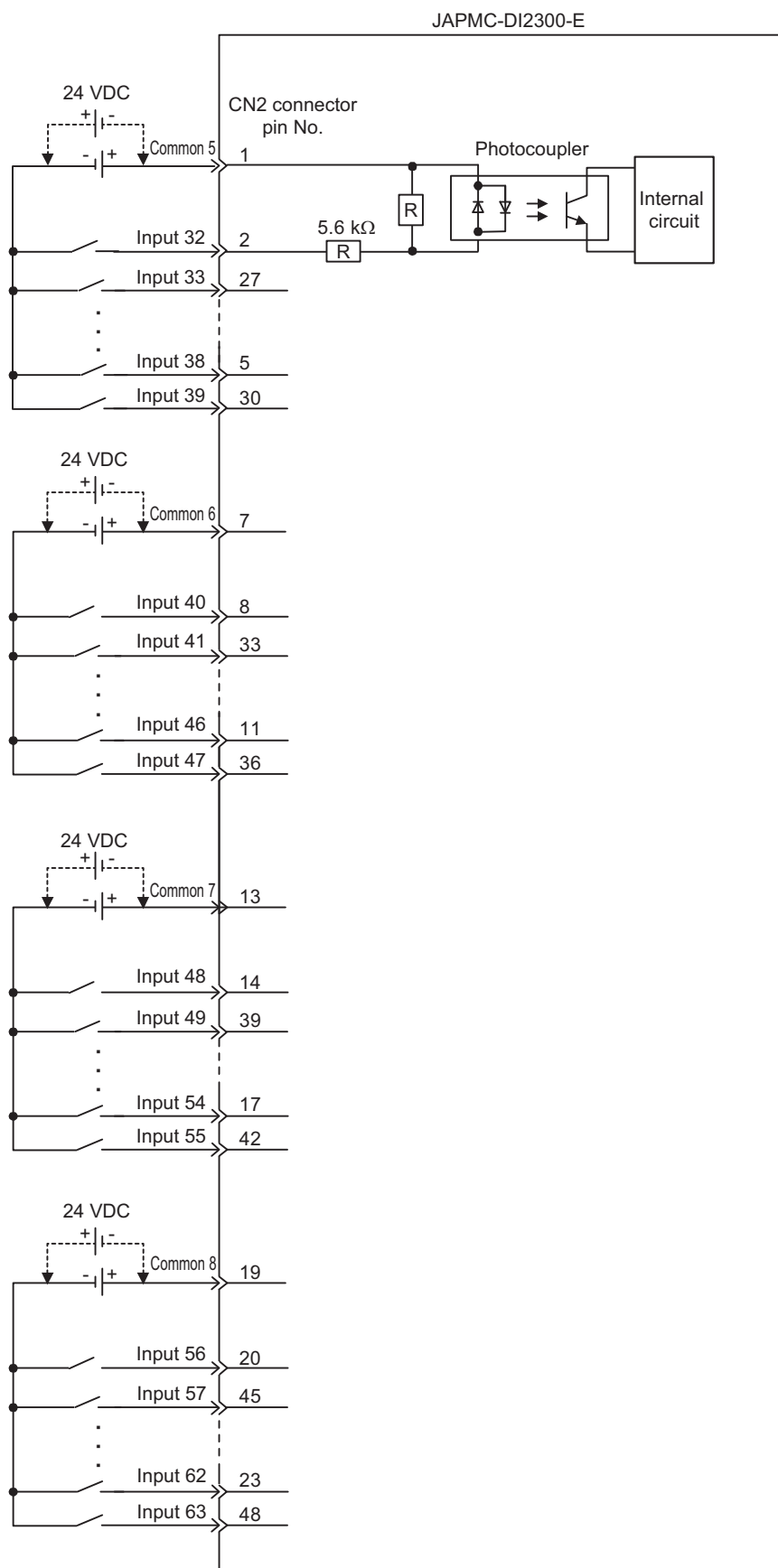
## 6.2.4 DI-01 Module Connections

The following diagrams show connection examples for CN1/CN2 connector of the DI-01 Module.

### ( 1 ) CN1 Connector



## ( 2 ) CN2 Connector



## 6.3 DI-01 Module Details

DI-01 Module details can be set in the **Local I/O Window** or the **Counter Module Window**. These windows can be displayed from the **Module Configuration Window**.

### 6.3.1 Displaying the DI-01 Configuration Window

Double-click **DI** in the **Function Module/Slave** Column of the **Module Configuration Window**.

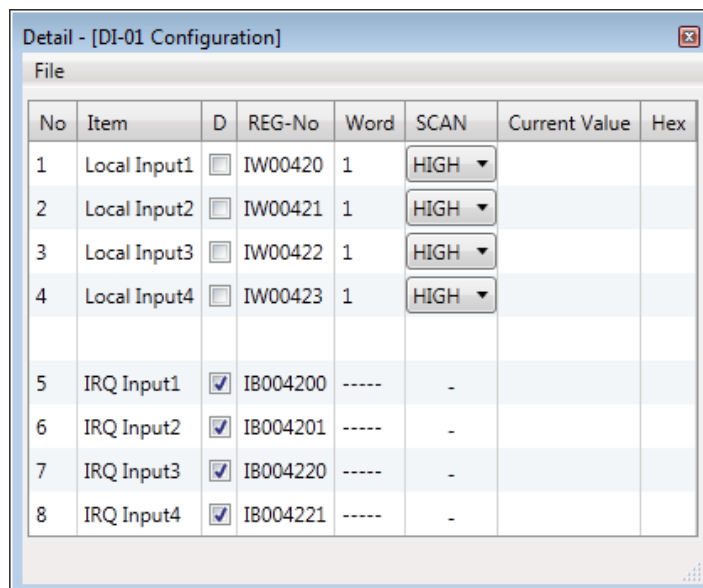
| Module              | Function Module/Slave | Status | Circuit No/AxisAddress |             | Motion Register | Register(Input/Output) |                |      |      | Comment |
|---------------------|-----------------------|--------|------------------------|-------------|-----------------|------------------------|----------------|------|------|---------|
|                     |                       |        | Start                  | cupied circ |                 | Disabled               | Start - End    | Size | Scan |         |
| 01 [MP2300] : ---   |                       |        |                        |             |                 |                        |                |      |      |         |
| 00 [MP2300] : [---] | 01 CPU                | ----   | ----                   | ----        | ----            | -----                  | ----           | ---- | ---- |         |
|                     | 02 IO                 | ----   | ----                   | 1           | ----            | Input<br>Output        | 0000 - 0001[H] | 2    | ---- |         |
|                     | 03 [SVB]              | ----   | Circuit No1            | 1           | 8000 - 87FF[H]  | Input<br>Output        | 0010 - 040F[H] | 1024 | ---- |         |
|                     | 04 [SVR]              | ----   | Circuit No2            | 1           | 8800 - 8FFF[H]  | -----                  | ----           | ---- | ---- |         |
| 01 [LIO-06] : [---] | 01 MIXIO              | ----   | ----                   | 1           | ----            | Input<br>Output        | 0430 - 0431[H] | 2    | ---- |         |
|                     | 02 CNTR-A             | ----   | ----                   | 1           | ----            | Input<br>Output        | 0440 - 045F[H] | 32   | ---- |         |
| 02 [LIO-04] : [---] | 01 LIO32              | ----   | ----                   | 1           | ----            | Input<br>Output        | 0410 - 0411[H] | 2    | ---- |         |
| 03 [DI-01] : [---]  | 01 DI                 | ----   | ----                   | 1           | ----            | Input<br>Output        | 0420 - 0423[H] | 4    | ---- |         |

A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **DI-01 Configuration Window** will be displayed.

- Refer to 1.4.1 *Displaying the Module Configuration Window* on page 1-15 for information on displaying the **Module Configuration Window**.

## 6.3.2 DI-01 Configuration Details

The following items are displayed in the **DI-01 Configuration** Window. The discrete inputs can be set.



| No | Item         | D                                   | REG-No   | Word  | SCAN   | Current Value | Hex |
|----|--------------|-------------------------------------|----------|-------|--------|---------------|-----|
| 1  | Local Input1 | <input type="checkbox"/>            | IW00420  | 1     | HIGH ▾ |               |     |
| 2  | Local Input2 | <input type="checkbox"/>            | IW00421  | 1     | HIGH ▾ |               |     |
| 3  | Local Input3 | <input type="checkbox"/>            | IW00422  | 1     | HIGH ▾ |               |     |
| 4  | Local Input4 | <input type="checkbox"/>            | IW00423  | 1     | HIGH ▾ |               |     |
| 5  | IRQ Input1   | <input checked="" type="checkbox"/> | IB004200 | ----- | -      |               |     |
| 6  | IRQ Input2   | <input checked="" type="checkbox"/> | IB004201 | ----- | -      |               |     |
| 7  | IRQ Input3   | <input checked="" type="checkbox"/> | IB004220 | ----- | -      |               |     |
| 8  | IRQ Input4   | <input checked="" type="checkbox"/> | IB004221 | ----- | -      |               |     |

D : Enable or disable each item by clicking on the cell.

☐ : Enabled, ☒ : Disabled

The register length is fixed at one word, i.e., 16 points are set.

REG : Displays the register number allocated to the inputs. It cannot be changed.

Word : Displays the word size of the register data. It cannot be changed.

SCAN : Select the speed from **HIGH**, **LOW**, or **NA** (none specified), for the scan that processes the inputs.

Current Value : The current value of the register will be displayed in binary when online. It will not be displayed when offline.

Current values cannot be changed.

HEX : The current value of the register will be displayed in hexadecimal when online. It will not be displayed when offline.

After changing the DI-01 configuration, save the definition data by selecting **Online – Save to Flash** from the main menu.

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# Machine Controller MP2000 Series

# I/O Module

# USER'S MANUAL

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**IRUMA BUSINESS CENTER (SOLUTION CENTER)**

480, Kamifujisawa, Iruma, Saitama, 358-8555, Japan  
Phone: +81-4-2962-5151 Fax: +81-4-2962-6138  
www.yaskawa.co.jp

**YASKAWA AMERICA, INC.**

2121, Norman Drive South, Waukegan, IL 60085, U.S.A.  
Phone: +1-800-YASKAWA (927-5292) or +1-847-887-7000 Fax: +1-847-887-7310  
www.yaskawa.com

**YASKAWA ELÉTRICO DO BRASIL LTDA.**

777, Avenida Piraporinha, Diadema, São Paulo, 09950-000, Brasil  
Phone: +55-11-3585-1100 Fax: +55-11-3585-1187  
www.yaskawa.com.br

**YASKAWA EUROPE GmbH**

Philipp-Reis-Str. 6, 65795 Hattersheim am Main, Germany  
Phone: +49-6196-569-300 Fax: +49-6196-569-398  
www.yaskawa.eu.com E-mail: info@yaskawa.eu.com

**YASKAWA ELECTRIC KOREA CORPORATION**

6F, 112, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea  
Phone: +82-31-8015-4224 Fax: +82-31-8015-5034  
www.yaskawa.co.kr

**YASKAWA ASIA PACIFIC PTE. LTD.**

30A, Kallang Place, #06-01, 339213, Singapore  
Phone: +65-6282-3003 Fax: +65-6289-3003  
www.yaskawa.com.sg

**YASKAWA ELECTRIC (THAILAND) CO., LTD.**

59, 1F-5F, Flourish Building, Soi Ratchadapisek 18, Ratchadapisek Road, Huaykwang, Bangkok, 10310, Thailand  
Phone: +66-2-017-0099 Fax: +66-2-017-0799  
www.yaskawa.co.th

**YASKAWA ELECTRIC (CHINA) CO., LTD.**

22F, Link Square 1, No.222, Hubin Road, Shanghai, 200021, China  
Phone: +86-21-5385-2200 Fax: +86-21-5385-3299  
www.yaskawa.com.cn

**YASKAWA ELECTRIC (CHINA) CO., LTD. BEIJING OFFICE**

Room 1011, Tower W3 Oriental Plaza, No.1, East Chang An Avenue,  
Dong Cheng District, Beijing, 100738, China  
Phone: +86-10-8518-4086 Fax: +86-10-8518-4082

**YASKAWA ELECTRIC TAIWAN CORPORATION**

12F, No. 207, Section 3, Beishin Road, Shindian District, New Taipei City 23143, Taiwan  
Phone: +886-2-8913-1333 Fax: +886-2-8913-1513 or +886-2-8913-1519  
www.yaskawa.com.tw

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