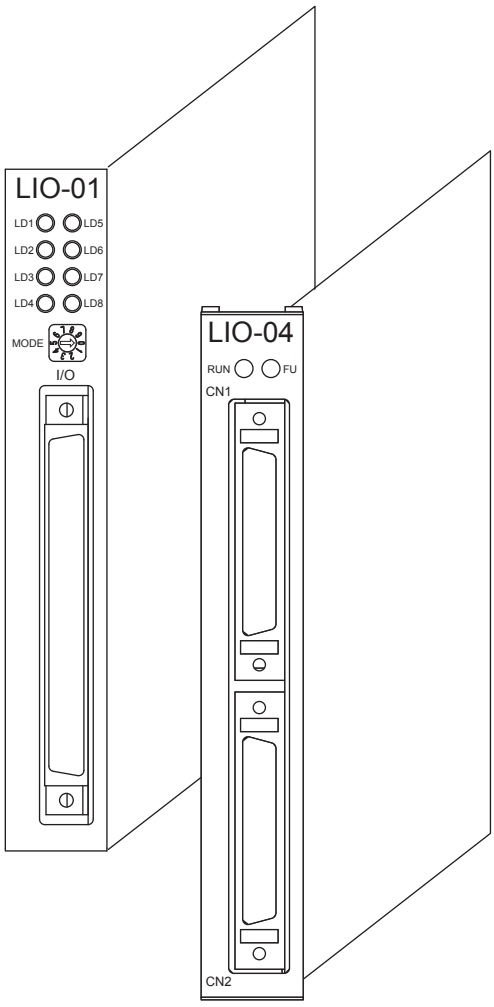
YASKAWA

Machine Controller MP2000 Series

I/O Module
USER'S MANUAL

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



MANUAL NO. SIEP C880700 34G

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> $\overline{\text{S-ON}}$ = /S-ON

$\overline{\text{P-CON}}$ = /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

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:

⚠ WARNING

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

⚠ CAUTION

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.

PROHIBITED

Indicates prohibited actions. Specific prohibitions are indicated inside ⃠ .

For example,  indicates no fire or open flame.

MANDATORY

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

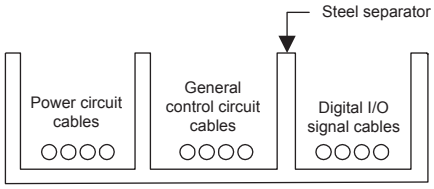
- Check the wiring to be sure it has been performed correctly.
  There is a risk of motor run-away, injury, or an accident.
- Always use a power supply of the specified voltage.
  There is a risk of burning.
- In places with poor power supply conditions, take all steps necessary to ensure that the input 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.

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.

(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.

Contents

1

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.

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*1	CPU-01	JAPMC-CP2200 (-E)	30 modules	The maximum number of connectable Modules is the total for the maximum expansion to four racks.*2
	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.*2
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.

<table>
<tr><th rowspan="2">I/O Module</th><th colspan="2" rowspan="2">Machine Controller</th><th colspan="4">Corresponding Version</th></tr>
<tr><th>CPU</th><th>MPE720 Ver.5</th><th>MPE720 Ver.6</th><th>MPE720 Ver.7</th></tr>
<tr><td rowspan="20">LIO-01/02</td><td colspan="2">MP2300</td><td rowspan="20">All versions</td><td>Ver. 4.41 or later</td><td>All versions</td><td rowspan="11">All versions</td></tr>
<tr><td colspan="2">MP2310</td><td rowspan="3">Ver. 5.38 or later</td><td rowspan="3">Ver. 6.04 or later</td></tr>
<tr><td colspan="2">MP2300S</td></tr>
<tr><td rowspan="4">MP2200</td><td>CPU-01</td><td>Ver. 5.10 or later</td><td>All versions</td></tr>
<tr><td>CPU-02</td><td>Ver. 5.30 or later</td><td>All versions</td></tr>
<tr><td>CPU-03</td><td>Ver. 5.50 or later</td><td>Ver. 6.20 or later</td></tr>
<tr><td>CPU-04</td><td>Ver. 5.52 or later</td><td>Ver. 6.22 or later</td></tr>
<tr><td colspan="2">MP2100M</td><td>Ver. 5.10 or later</td><td>All versions</td></tr>
<tr><td colspan="2">MP2101M</td><td rowspan="2">Ver. 5.54 or later</td><td rowspan="2">Ver. 6.24 or later</td></tr>
<tr><td colspan="2">MP2101TM</td></tr>
<tr><td rowspan="2">MP3100</td><td>MP3100 (16 axes)</td><td rowspan="9">–</td><td rowspan="9">–</td><td>Ver. 7.38 or later</td></tr>
<tr><td>MP3100 (32 axes)</td></tr>
<tr><td rowspan="2">MP3200</td><td>CPU-201</td><td>All versions</td></tr>
<tr><td>CPU-202</td></tr>
<tr><td rowspan="4">MP3300</td><td>CPU-301 (16 axes)</td><td>Ver. 7.26 or later</td></tr>
<tr><td>CPU-301 (32 axes)</td><td>Ver. 7.28 or later</td></tr>
<tr><td>CPU-302 (16 axes)</td><td rowspan="2">Ver. 7.33 or later</td></tr>
<tr><td>CPU-302 (32 axes)</td></tr>
<tr><td rowspan="20">LIO-04</td><td colspan="2">MP2300</td><td>Ver. 2.20 or later</td><td>Ver. 5.12 or later</td><td>All versions</td><td rowspan="11">All versions</td></tr>
<tr><td colspan="2">MP2310</td><td rowspan="2">All versions</td><td rowspan="2">Ver. 5.38 or later</td><td rowspan="2">Ver. 6.04 or later</td></tr>
<tr><td colspan="2">MP2300S</td></tr>
<tr><td rowspan="3">MP2200</td><td>CPU-01</td><td>Ver. 2.20 or later</td><td>Ver. 5.10 or later</td><td>All versions</td></tr>
<tr><td>CPU-02</td><td rowspan="3">All versions</td><td>Ver. 5.30 or later</td><td>All versions</td></tr>
<tr><td>CPU-03</td><td>Ver. 5.50 or later</td><td>Ver. 6.20 or later</td></tr>
<tr><td>CPU-04</td><td>Ver. 5.52 or later</td><td>Ver. 6.22 or later</td></tr>
<tr><td colspan="2">MP2100M</td><td>Ver. 2.30 or later</td><td>Ver. 5.12 or later</td><td>All versions</td></tr>
<tr><td colspan="2">MP2101M</td><td rowspan="2">All versions</td><td rowspan="2">Ver. 5.54 or later</td><td rowspan="2">Ver. 6.24 or later</td></tr>
<tr><td colspan="2">MP2101TM</td></tr>
<tr><td rowspan="2">MP3100</td><td>MP3100 (16 axes)</td><td rowspan="9">All versions</td><td rowspan="9">–</td><td rowspan="9">–</td><td>Ver. 7.38 or later</td></tr>
<tr><td>MP3100 (32 axes)</td></tr>
<tr><td rowspan="2">MP3200</td><td>CPU-201</td><td>All versions</td></tr>
<tr><td>CPU-202</td></tr>
<tr><td rowspan="4">MP3300</td><td>CPU-301 (16 axes)</td><td>Ver. 7.26 or later</td></tr>
<tr><td>CPU-301 (32 axes)</td><td>Ver. 7.28 or later</td></tr>
<tr><td>CPU-302 (16 axes)</td><td rowspan="2">Ver. 7.33 or later</td></tr>
<tr><td>CPU-302 (32 axes)</td></tr>
</table>

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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				
		CPU-02				
		CPU-03	All versions	Ver. 5.50 or later	Ver. 6.20 or later	
		CPU-04		Ver. 5.52 or later	Ver. 6.22 or later	
	MP2100M		Ver. 2.63 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)				

(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*1			
		MP3100 (32 axes)				
	MP3200	CPU-201	Ver. 1.47 or later			
		CPU-202				
	MP3300	CPU-301 (16 axes)	Ver. 1.47 or later*2			
		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.

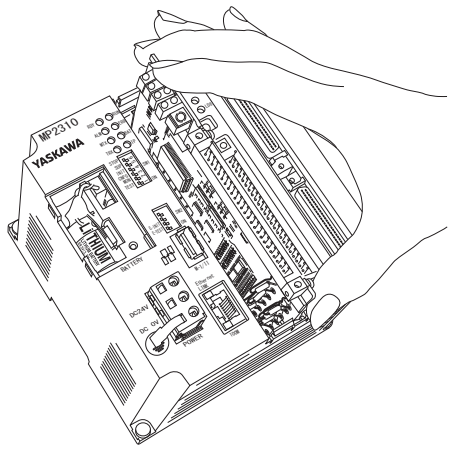
Turn OFF the power supply and remove all the cables connected to the Machine Controller or Expansion Rack (MP2200 Base Unit). Then, remove the Machine Controller and Expansion Rack from the panel or rack, and place them where there is sufficient space, such as on a work table.

(2) Installing Optional Modules

Use the following procedure to install Optional Modules.

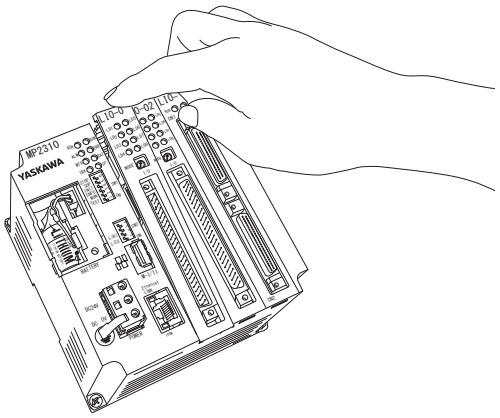
1. Hold the top and bottom of the Optional Module to be installed, line up the Module with the left side of the guide rail inside the option slot, and then insert the Module straight in.

- 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

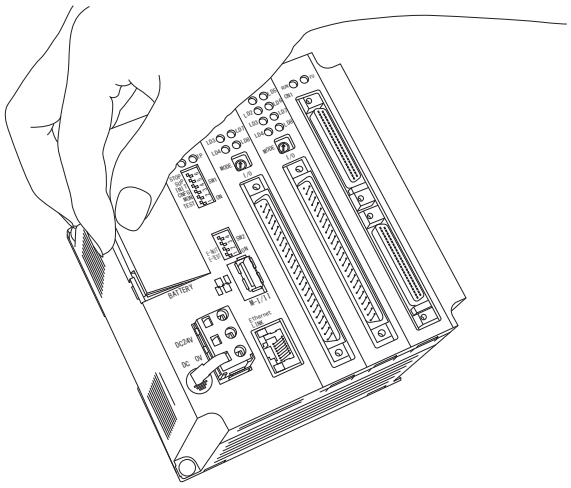
Use the following procedure to replace or add Optional Modules.

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

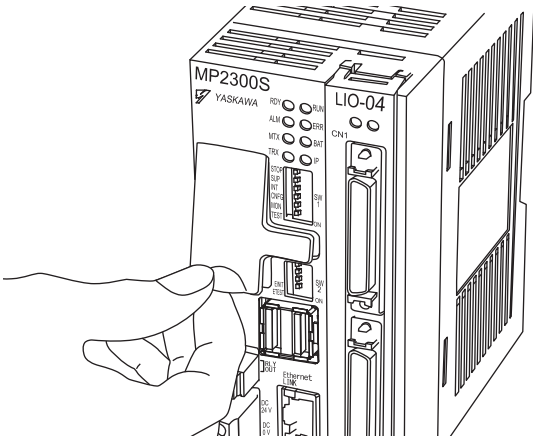
1. Turn OFF the power supply and disconnect all cables from the Machine Controller.

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

<MP2200/MP2300>

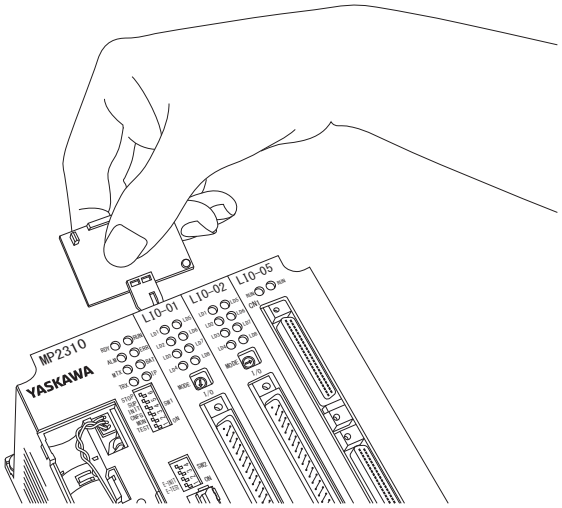


<MP2310/MP2300S>



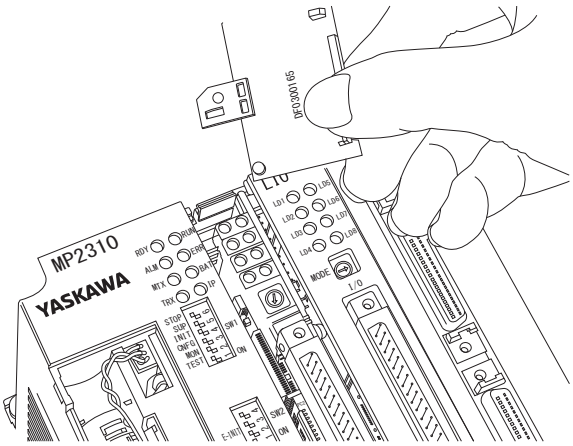
3. Insert the protruding part of the battery cover into the slot on top of the Optional Module panel to unhook the tab. Face the front of the battery cover toward you for this operation.

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

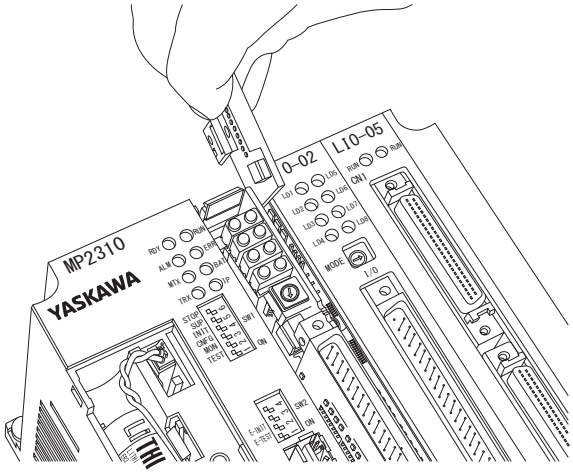


Unhook the bottom tab in the same way.

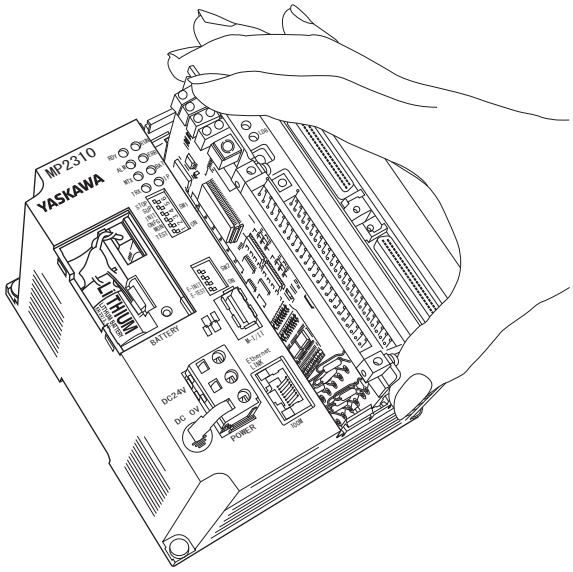
4. Pull the top of the Optional Module panel toward you and remove it. A notch on the Optional Module will be visible from the gap with the panel. Hook the round knob on the battery cover into the notch in the Optional Module.



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	• The Module configuration definitions are updated. • The default allocations are made for all of the I/O Modules that are detected.
ON	OFF	• The Module configuration definitions are updated. • The definitions for any Modules for which there are already definitions are not changed. • The default values are allocated in the definitions for any new Modules that are detected.

- 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.

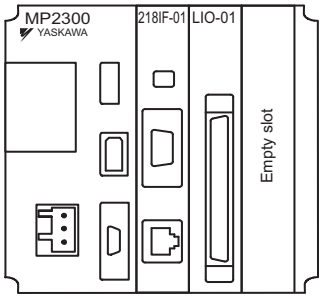
The result depends on the command that is used, as described below.

INIT	Result
Self-configuration for all Modules	• The Module configuration definitions are updated. • The definitions for any Modules for which there are already definitions are not changed. • The default values are allocated in the definitions for any new Modules that are detected.
Module Self-configuration	• Definitions are allocated only for the selected Module. • The definitions for any Modules for which there are already definitions are not changed. • The default values are allocated in the definitions for any new Modules that are detected.

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*1	2 words (0002h)
Built-in SVB*2	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/Axis	Address	Motion Register	Register(Input/Output)				Comment
			Start	cupied circ		Disabled	Start - End	Size	Scan	
01 MP2300 : ---										
00 MP2300[Driving]	01 CPU	Driving	----	----	----	----	----	----	----	
	02 IO	Driving	----	1	----	Input / OutPut	0000 - 0001[H]	2	----	
	03 SVB	Driving	Circuit No1	1	8000 - 87FF[H]	Input / 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 / OutPut	0410 - 0411[H]	2	----	
	02 CNTR	Driving	----	1	----	Input / OutPut	0420 - 043F[H]	32	----	
03 -- UNDEFINED --[----]		----								

Fig. 1.1 Module Details of a Basic Module

Module	Function Module/Slave	Status	Circuit No/AxisAddress Start	Circuit No/AxisAddress :cupied circ	Motion Register	Register(Input/Output) Disabled	Register(Input/Output) Start - End	Register(Input/Output) Size	Register(Input/Output) Scan	Comment
01 MP2300 : ---										
00 MP2300[Driving]	01 CPU	Driving	----	----	----	----	----	----	----	
	02 IO	Driving	----	1	----	Input / OutPut	0000 - 0001[H]	2	----	
	03 SVB	Driving	Circuit No1	1	8000 - 87FF[H]	Input / 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 / OutPut	0410 - 0411[H]	2	----	
	02 CNTR	Driving	----	1	----	Input / 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.

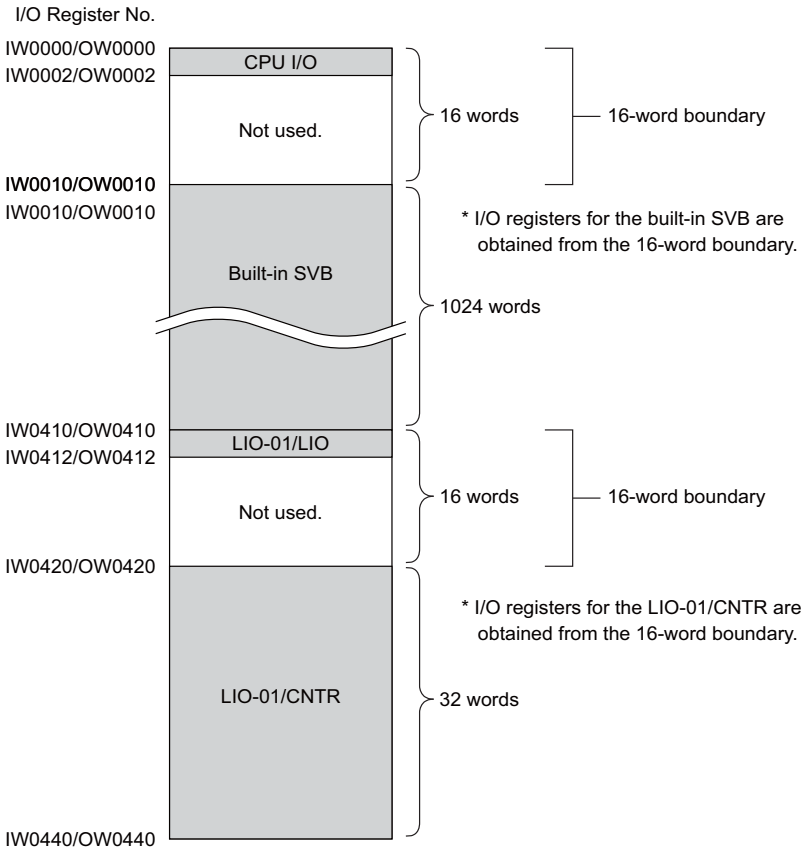


Fig. 1.3 Illustration of I/O Register Allocation

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

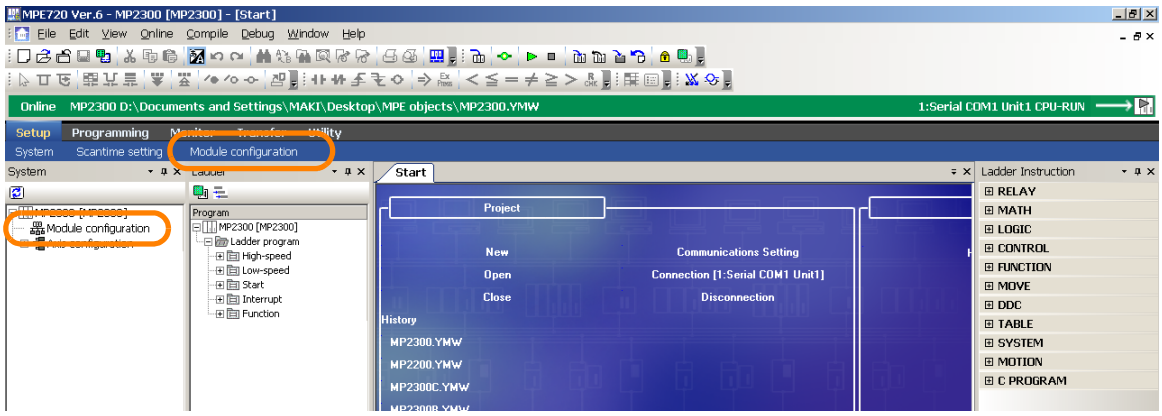
Use the following procedure to display the **Module Configuration** Window.

■ 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.



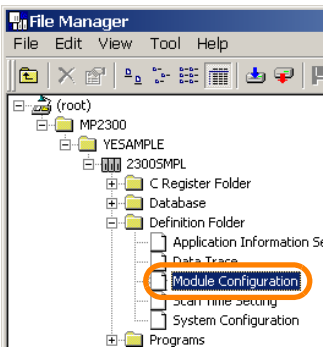
The **Module Configuration** Window will be displayed (see next page).

■ 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.

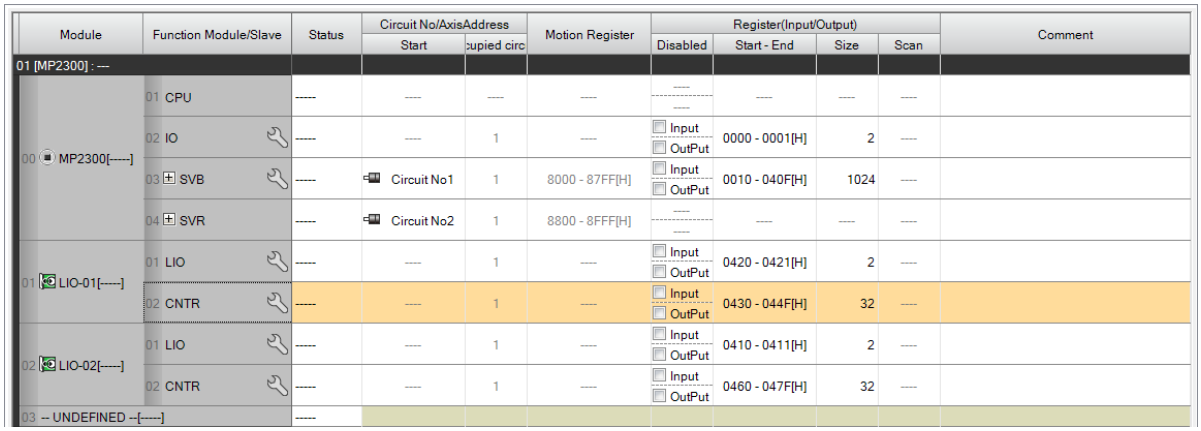


Fig. 1.4 MP2300/MP2300S/MP2310 **Module Configuration** Window

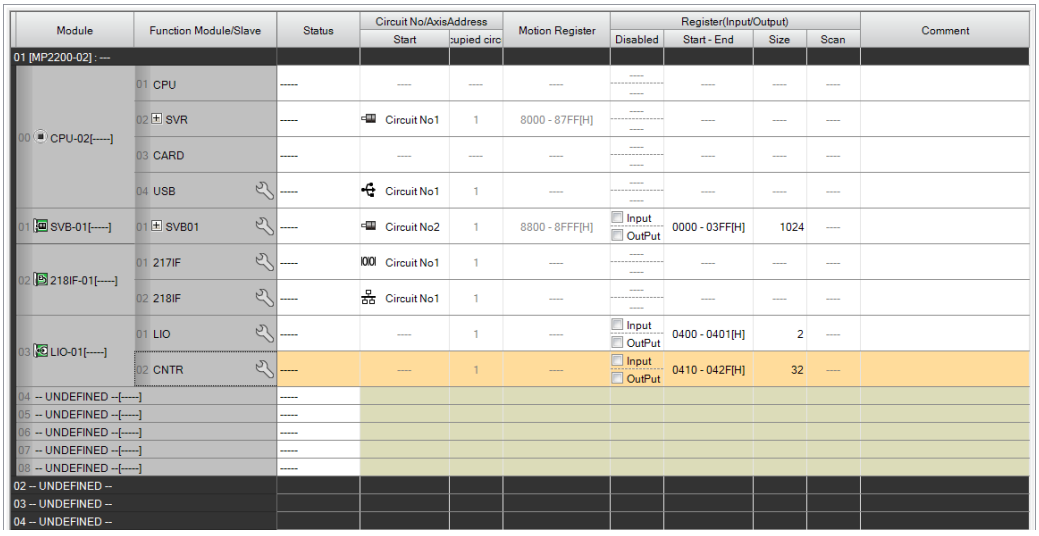


Fig. 1.5 MP2100M/MP2200 **Module Configuration** Window

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 Start	Circuit No/AxisAddress cupied circ	Motion Register	Register(Input/Output) Disabled	Register(Input/Output) Start - End	Register(Input/Output) Size	Register(Input/Output) Scan	Comment
01 [MP2300] : ---										
00 MP2300[-----]	01 CPU	-----	----	----	----	----	----	----	----	
	02 IO	-----	----	1	----	Input / OutPut	0000 - 0001[H]	2	----	
	03 SVB	-----	Circuit No1	1	8000 - 87FF[H]	Input / OutPut	0010 - 040F[H]	1024	----	
	04 SVR	-----	Circuit No2	1	8800 - 8FFF[H]	----	----	----	----	
01 LIO-02[-----]	01 LIO	-----	----	1	----	Input / OutPut	0420 - 0421[H]	2	----	
	02 CNTR	-----	----	1	----	Input / OutPut	0430 - 044F[H]	32	----	
02 LIO-04[-----]	01 LIO32	-----	----	1	----	Input / OutPut	0410 - 0411[H]	2	----	
03 DO-01[-----]	01 DO	-----	----	1	----	Input / 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.

2

LIO-01/LIO-02 Module

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

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.

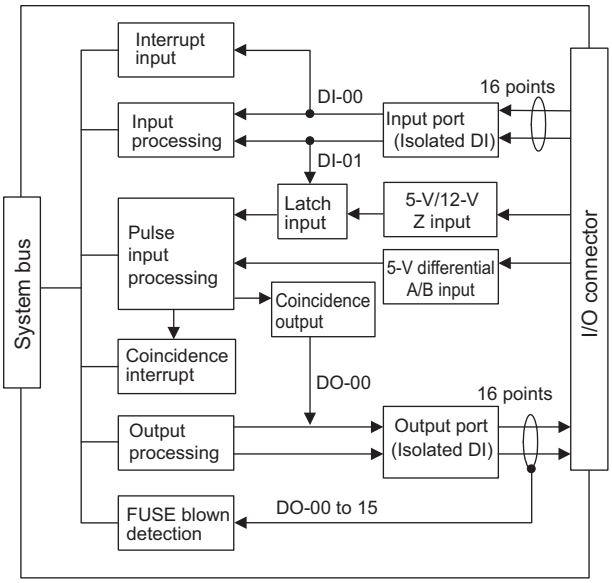
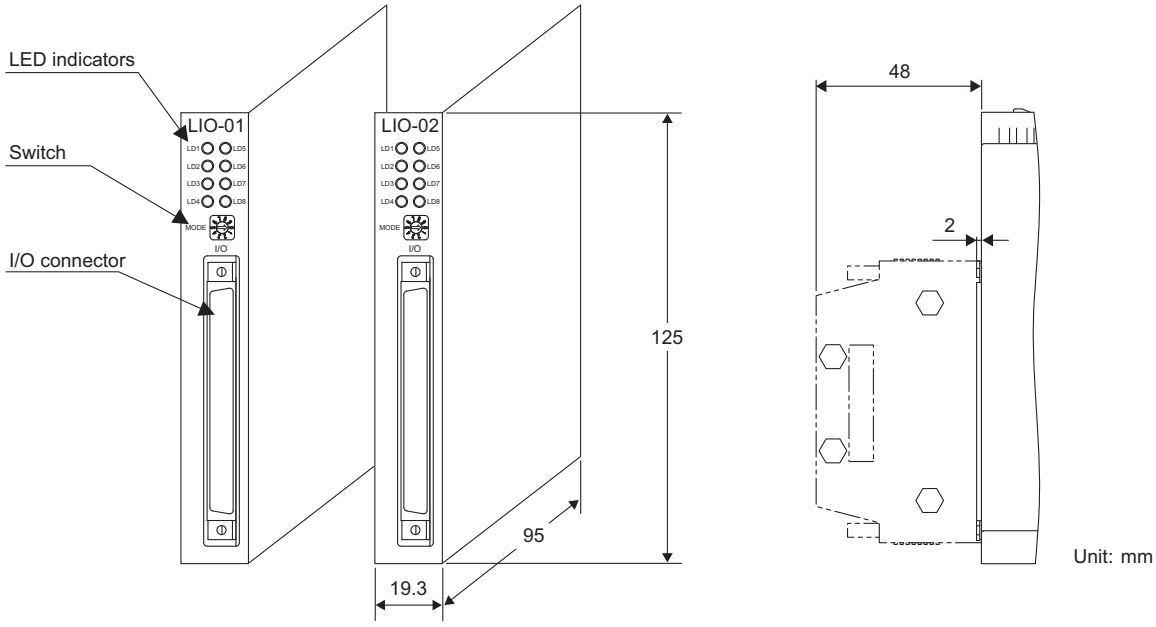


Fig. 2.1 Outline of LIO-01/LIO-02 Module Functions

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.

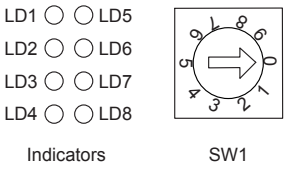
(1) Hardware Specifications

Item	Specifications	
Classification	I/O Module	
Name	LIO-01	LIO-02
Model	JAPMC-IO2300 (-E)	JAPMC-IO2301 (-E)
Digital Input	16 inputs 24 VDC, 4.1 mA, combined sink mode/source mode inputs (DI_00 also used for interrupts, DI-01 also used for pulse latch inputs)	
Digital Output	16 outputs 24 VDC transistor open-collector outputs, sink mode outputs (DO_00 also used for coincidence outputs)	16 outputs 24 VDC transistor open-collector outputs, source mode outputs (DO_00 also used for coincidence outputs)
Pulse Input	Phase A/B/Z inputs Phase AB: 5-V differential input, not isolated, max. frequency: 4 MHz Phase Z: 5-V/12-V photocoupler input Latch input Pulse latch for phase Z or DI_01.	
Connector	I/O: I/O connector	
LED Indicators	LD1 (green) LD2 (green) LD3 (green) LD4 (green) LD5 (green) LD6 (green) LD7 (green) 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: • 10 to 57 Hz with single-amplitude of 0.075 mm • 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 • 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)
	Shock Resistance	Conforming to JIS B 3502: Peak acceleration of 147 m/s^2 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



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) Set Value	LD No.	Status When Lit (Green)	LD No.	Status When Lit (Green)
0 (Board Status Indicator)	LD1	Normal (Error when not lit)	LD5	Normal (Error when not lit)
	LD2	One of the inputs D1_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 (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 (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 (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 (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 (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.

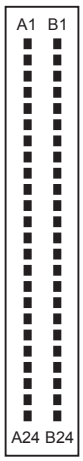
(1) Connector Model

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), FCN-361J048-AU	Fujitsu component

(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.

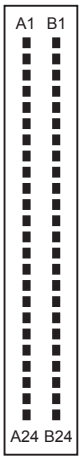
[a] LIO-01 Module Connector



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 (Single loose wire)	JEPMC-W2061-A5-E	0.5 m	 AWG28 46-core Loose wires
	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 Connector Terminal No.	Marking		Wire Color	Marking		48-pin Connector 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	– – – – Continuous	Orange	Black	– – – – Continuous	B21
A22	Red	– – – – Continuous	Gray	Black	– – – – Continuous	B22
A23	Red	– – – – Continuous	White	Black	– – – – 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, ±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. OFF: 0.5 ms max.
Number of Commons	2 (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. • 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.

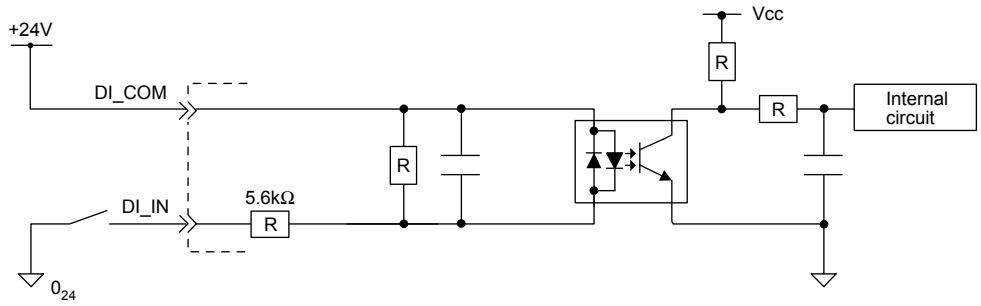


Fig. 2.2 Digital Input Circuit (Source Mode Input)

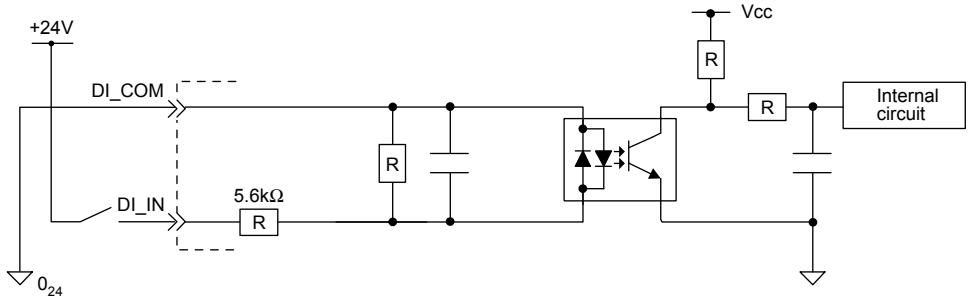


Fig. 2.3 Digital Input Circuit (Sink Mode Input)

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, ±20%	
Output Current	100 mA max.	
Leakage Current When OFF	0.1 mA max.	
ON Time/OFF Time	ON: 1 ms max. OFF: 1 ms max.	
Number of Commons	1 (16 points/common)	
Protection Circuit	Fuse 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 Replace the Module when fuse blown is detected.	
Other Functions	DO_00 is shared with counter coincidence output.	

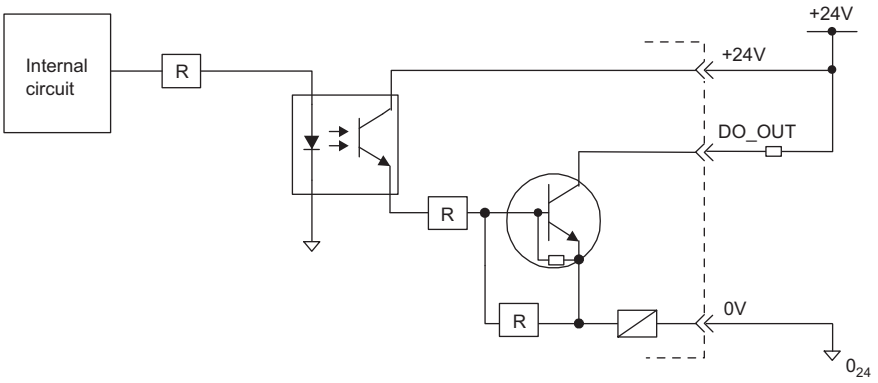


Fig. 2.4 LIO-01 Digital Output Circuit (Sink Mode Output)

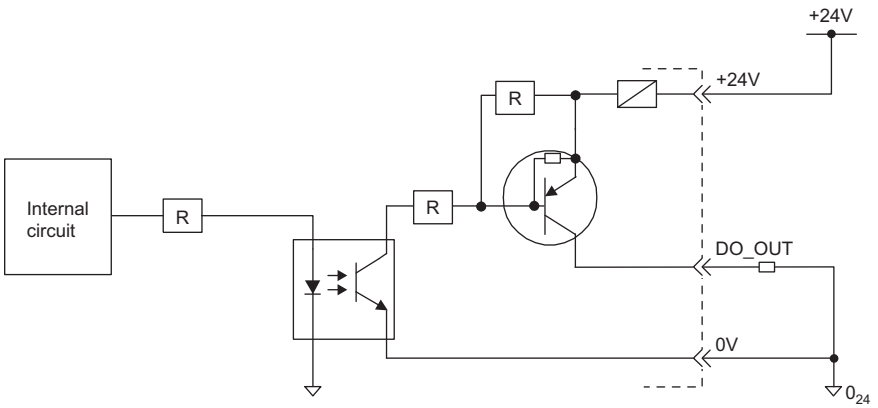


Fig. 2.5 LIO-02 Digital Output Circuit (Source Mode Output)

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 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. Response time at phase-Z input ON: 1 µs max. OFF: 1 µs max. Response time at DI_01 input ON: 0.5 ms max. OFF: 0.5 ms max.
Other Functions	Coincidence detection, counter preset

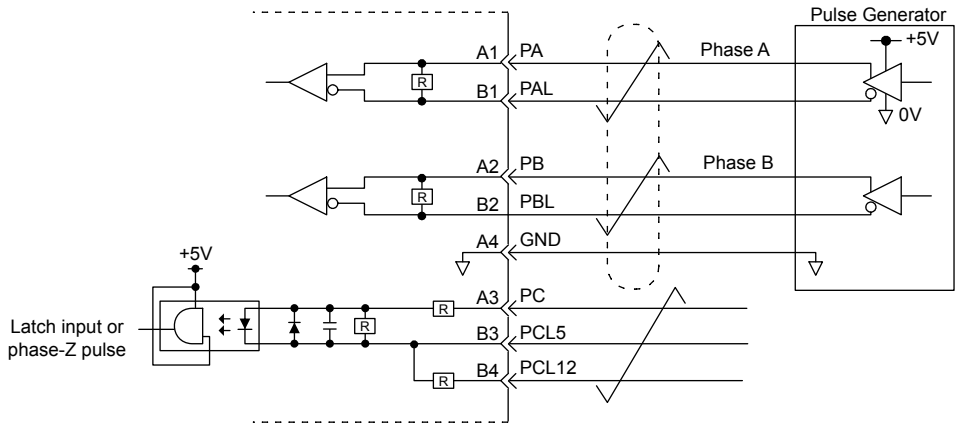
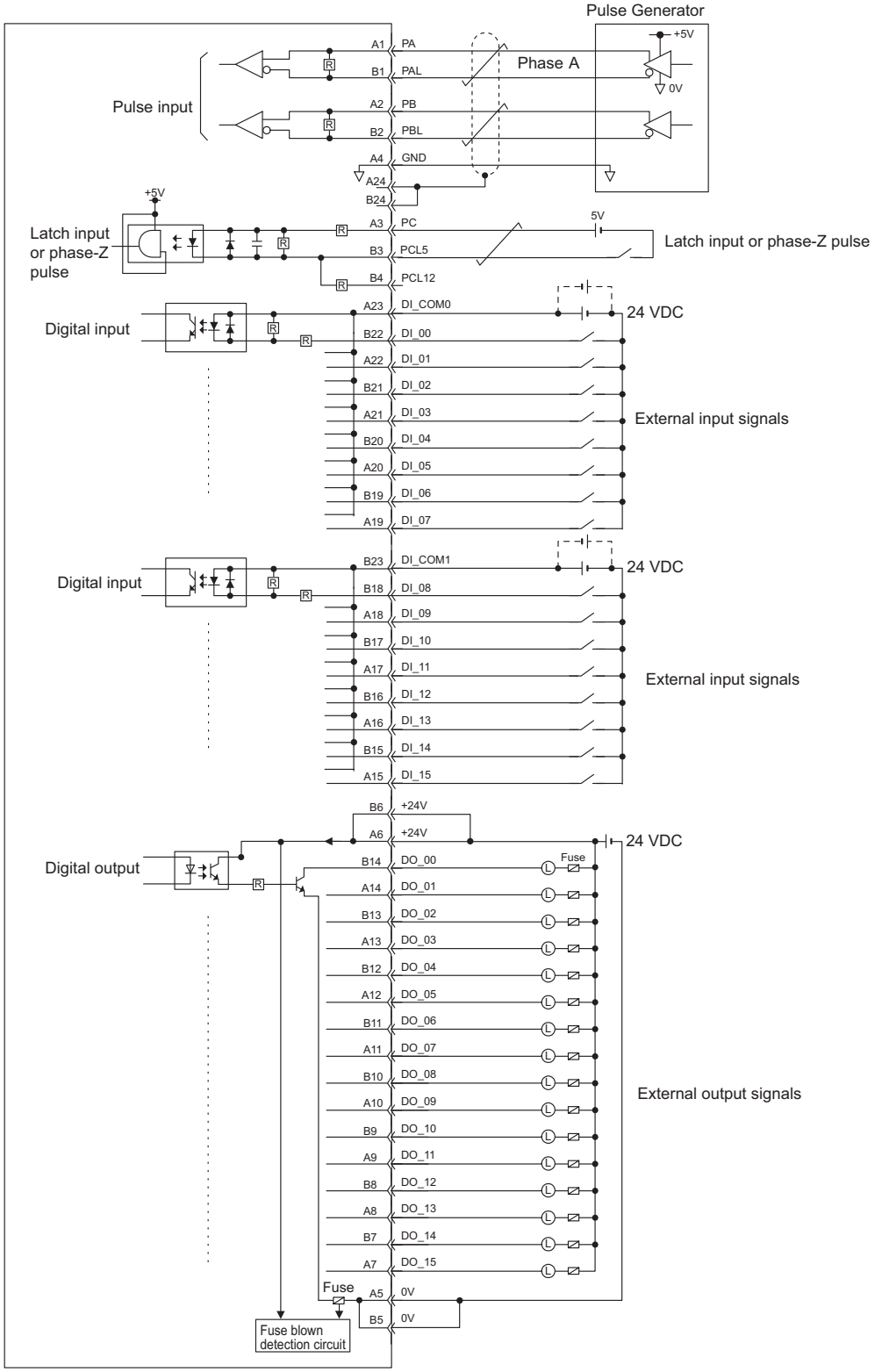


Fig. 2.6 Pulse Input Circuit

2.2.6 LIO-01/LIO-02 Module Connections

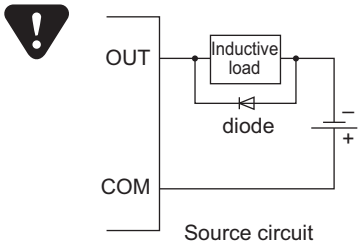
The following diagrams show connection examples for LIO-01/LIO-02 Module connectors.

(1) LIO-01 Module Connectors



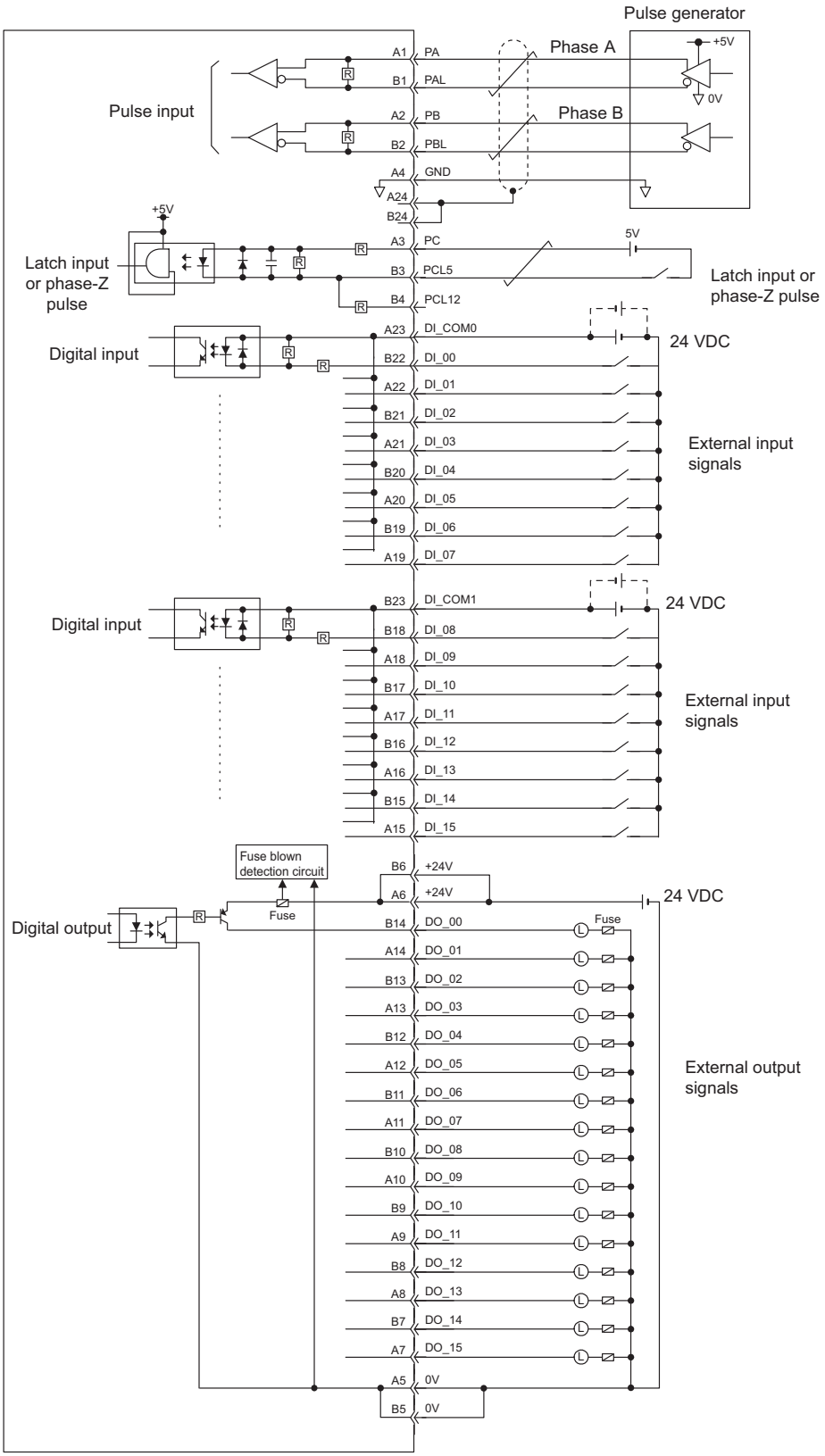
- The pins No. A5 and B5, and the pins No. A6 and B6 are internally connected. Connect them externally as well.

- 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.



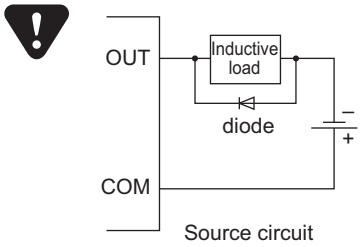
- If you connect an inductive load, connect a diode parallel to the load to absorb counter electromotive force.
  - Backward voltage: 10 times the load voltage or greater
  - Forward current: Load current or greater

(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.



- 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

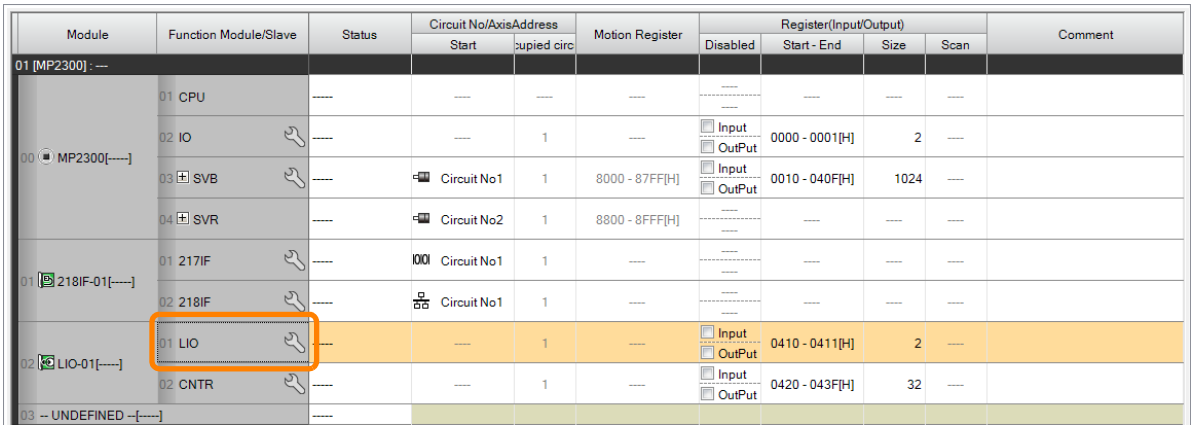
2.3 LIO-01/LIO-02 Module Details

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.

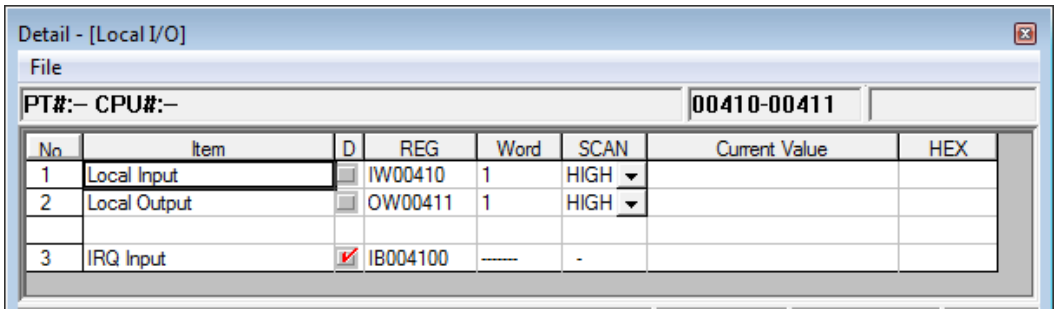


A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **Local I/O** Window will be displayed.

- 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	☐	IW00410	1	HIGH		
2	Local Output	☐	OW00411	1	HIGH		
3	IRQ Input	☑	IB004100	------	-		

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.

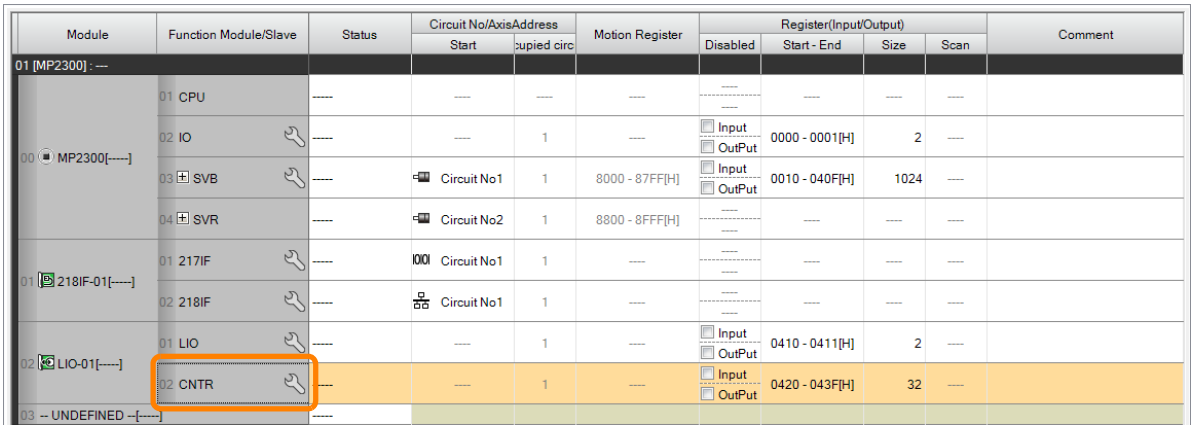
HEX : The current value of the register will be displayed in hexadecimal when online. It will not be displayed when offline.

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

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.



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.

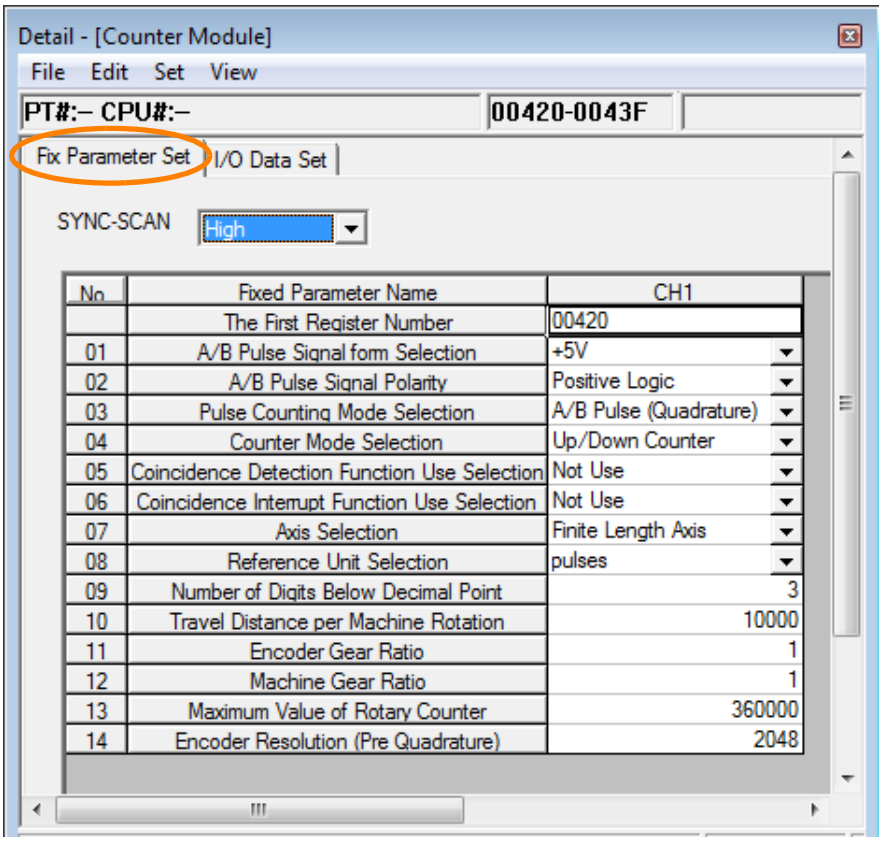


Fig. 2.7 Counter Module **Fix Parameter Set** Tab Page

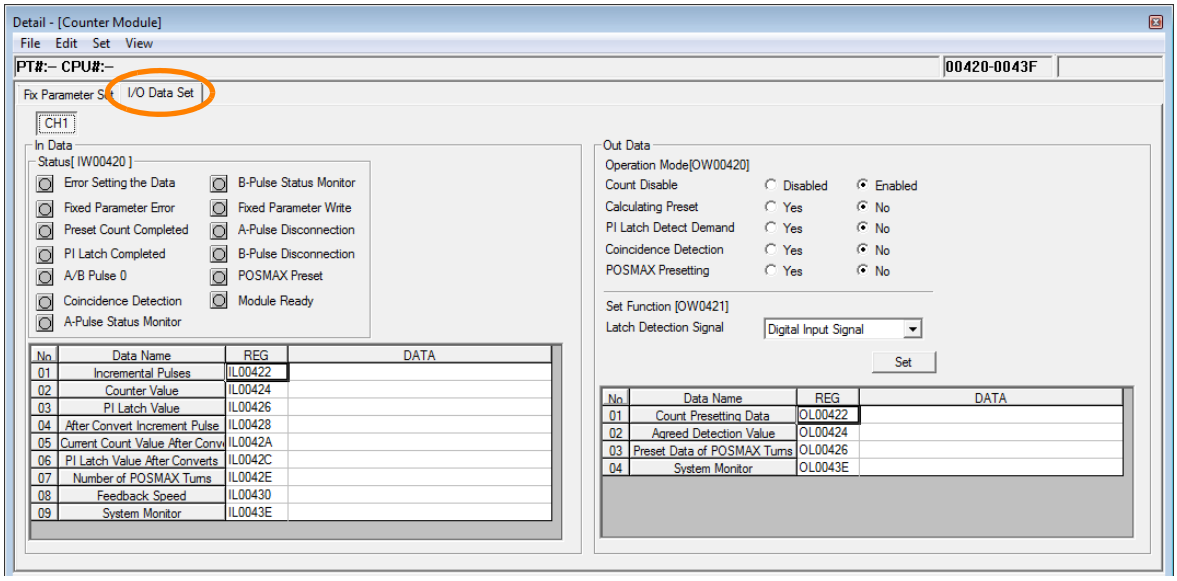


Fig. 2.8 Counter Module **I/O Data Set** Tab Page

(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 (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 (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 (differential input)
02	A/B Pulse Signal Polarity Selection*1	Select either positive or negative logic for the signal polarity of phases A and B.	1 word	Positive logic
03	Pulse Counting Mode Selection*1	Specify the pulse counting mode*1 among the following 7 equations. • Pulse and Direction • Pulse and Direction × 2 • Up/Down Counter • Up/Down Counter × 2 • A/B Pulse • A/B Pulse × 2 • A/B Pulse (Quadrature)	1 word	A/B Pulse (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*2 is to be used.	1 word	Not use
06	Coincidence Interrupt Function Use Selection	Set whether or not the coincidence interrupt function*2 is to be used. (Valid only when the coincidence detection function is set.)	1 word	Not use
07	Axis Selection	Set the axis type*3: Finite or infinite length axis.	1 word	Finite length axis
08	Reference Unit Selection	Specify the reference unit. • pulse • mm • deg • inch 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*4 for the minimum reference unit. *Example*: If the minimum reference unit is 1 μm (10^{-3}mm): Reference unit selection : mm, and Number of digits below decimal point: 3	1 word	3
10	Travel Distance per Machine Rotation *4, *5	Set the load moving amount per load axis rotation. Setting range: 1 to 2147483647 (reference unit)	2 words	10000
11	Encoder Gear Ratio*4, *5	Set the value m so that the encoder axis rotates m times when the load axis rotates n times. Setting range: 1 to 65535	1 word	1
12	Machine Gear Ratio (Load) *4, *5	Set the value n so that the encoder axis rotates m times when the load axis rotates n times. Setting range: 1 to 65535	1 word	1
13	Maximum Value of Rotary Counter (Infinite Length Axis Reset Position (POSMAX))*3	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 (Pre Quadrature) (Number of Pulses Per Encoder Rotation (before Multiplication))	Set the number of input pulses per encoder rotation. 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.

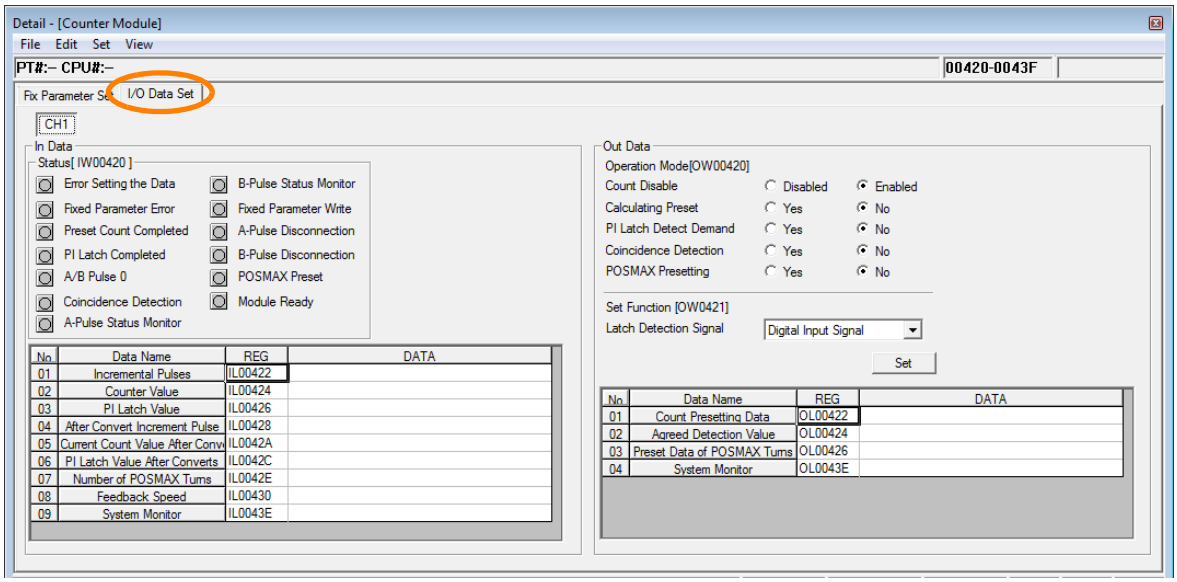
∗ 5. If pulse is selected for the parameter No. 08, parameters No. 10 to 12 are ignored.

- 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 *1	Status (Run Status) [RUNSTS]	The run status of the Counter Module is indicated for each bit. When online: ● : ON (= 1), ○ : OFF (= 0), 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	–	–	

(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 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
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 *1	Operation Mode (RUN Mode) [RUNMOD]	Bit 0	Count Disable ON (=1): Counting prohibited OFF (=0): Counting enabled (Default) Prohibits counting while the bit is ON (=1).		–	1 word
			Bit 1	Calculating Preset (Count Preset Request) ON (=1): Request preset OFF (=0): Not requested (Default) Resets the count to its preset value when the bit is turned ON (=1).		–	
			Bit 2	PI Latch Detect Demand*2 ON (=1): Request latch detection OFF (=0): Not requested (Default) Stores the counter value at the moment an external signal is input while the bit is ON (=1).		–	
			Bit 3	Coincidence Detection*3 ON (=1): Request coincidence detection OFF (=0): Not requested (Default) Sends a coincidence signal if the values of the counter and the coincidence detection setting match when the bit is turned ON (=1).		–	
			Bit 4	POSMAX Presetting (POSMAX Turns Presetting Request) ON (=1): Requests preset OFF (=0): Not requested (Default) 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. • 0000H: DI latch (discrete input) • 0002H: Z latch (phase-Z input)		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.			–	

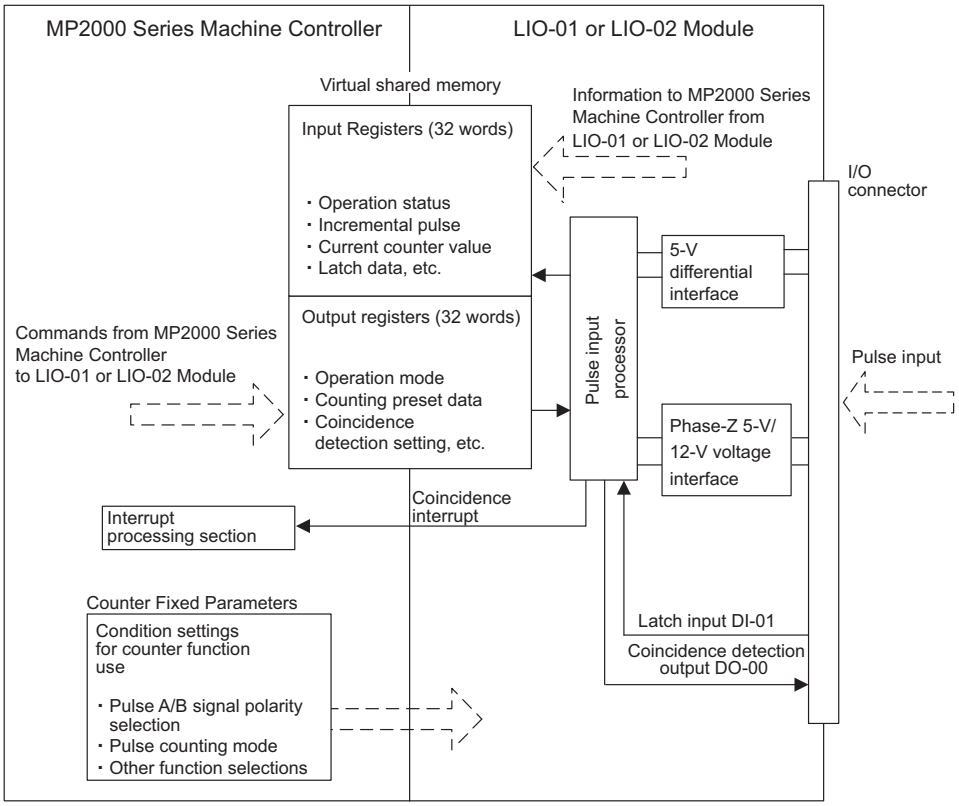
∗ 1. OW□□00 gives the register number that is displayed in **The First Register Number** cell on the **Fix Parameter Set** Tab Page + 00.

∗ 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.

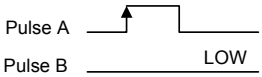
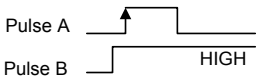
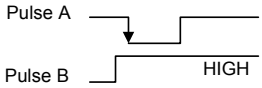
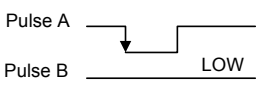
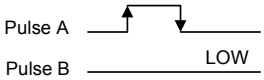
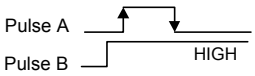
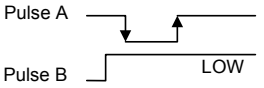
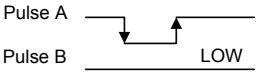
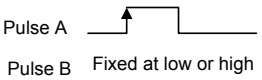
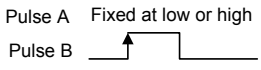
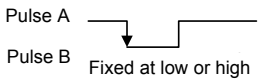
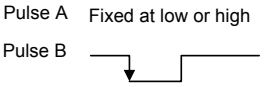
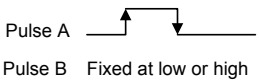
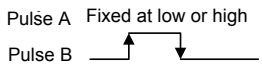
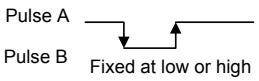
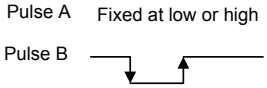
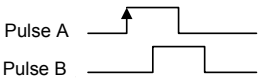
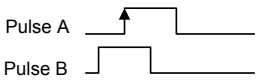
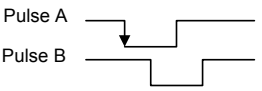
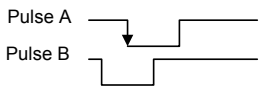
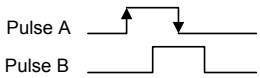
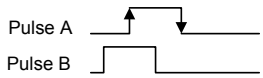
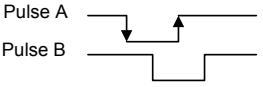
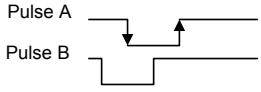
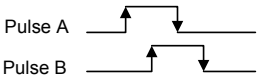
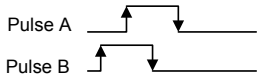
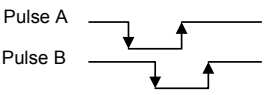
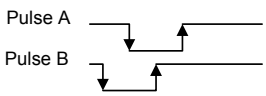


- In this section, the *fixed parameters* mean the *counter fixed parameters* if not otherwise mentioned.
- Refer to *1.3 Self-configuration* on page 1-12 to execute self-configuration of the Machine Controller before setting the fixed parameters.

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

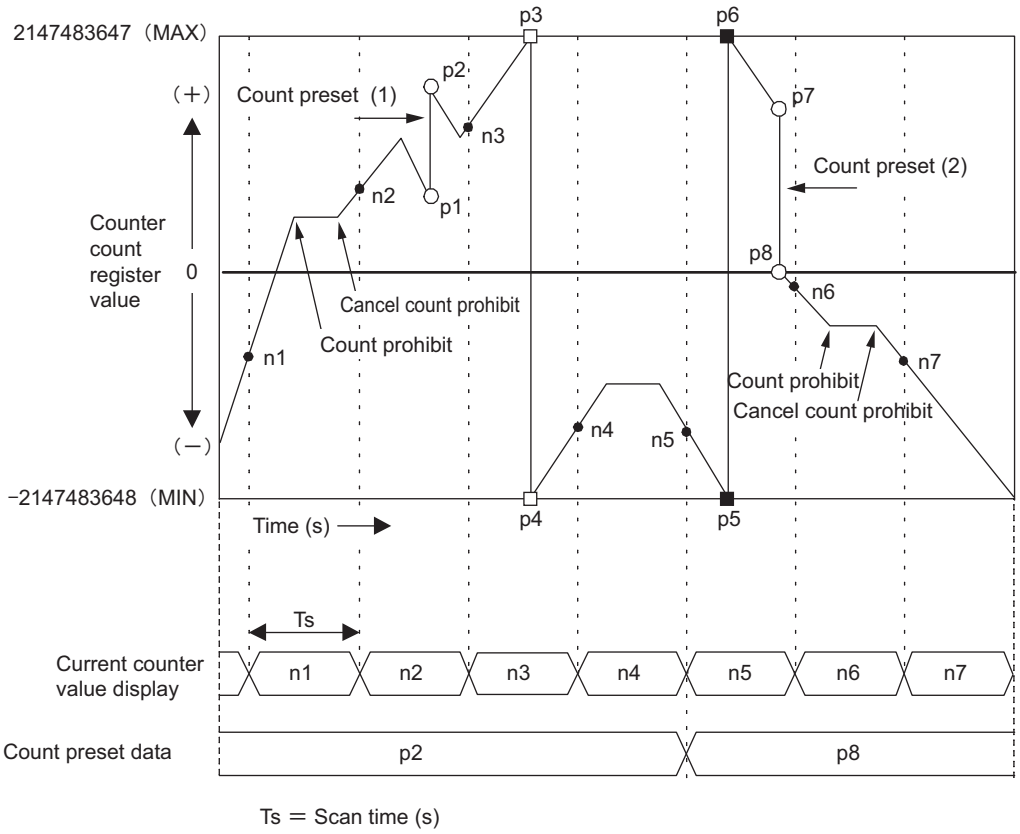
The following pulse counting modes can be selected by setting the counter fixed parameter No. 3 (Pulse Counting Mode Selection) and No.2 "A/B Pulse Signal Polarity Selection.".

Pulse Counting Mode		Polarity	Up Count (Forward)	Down Count (Reverse)
Pulse and Direction	× 1	Positive logic		
		Negative logic		
	× 2	Positive logic		
		Negative logic		
UP/DOWN Counter	× 1	Positive logic		
		Negative logic		
	× 2	Positive logic		
		Negative logic		
A/B Pulse	× 1	Positive logic		
		Negative logic		
	× 2	Positive logic		
		Negative logic		
	× 4	Positive logic		
		Negative logic		

- 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)

2.4.2 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.



Ts ＝ Scan time (s)

<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-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*.)

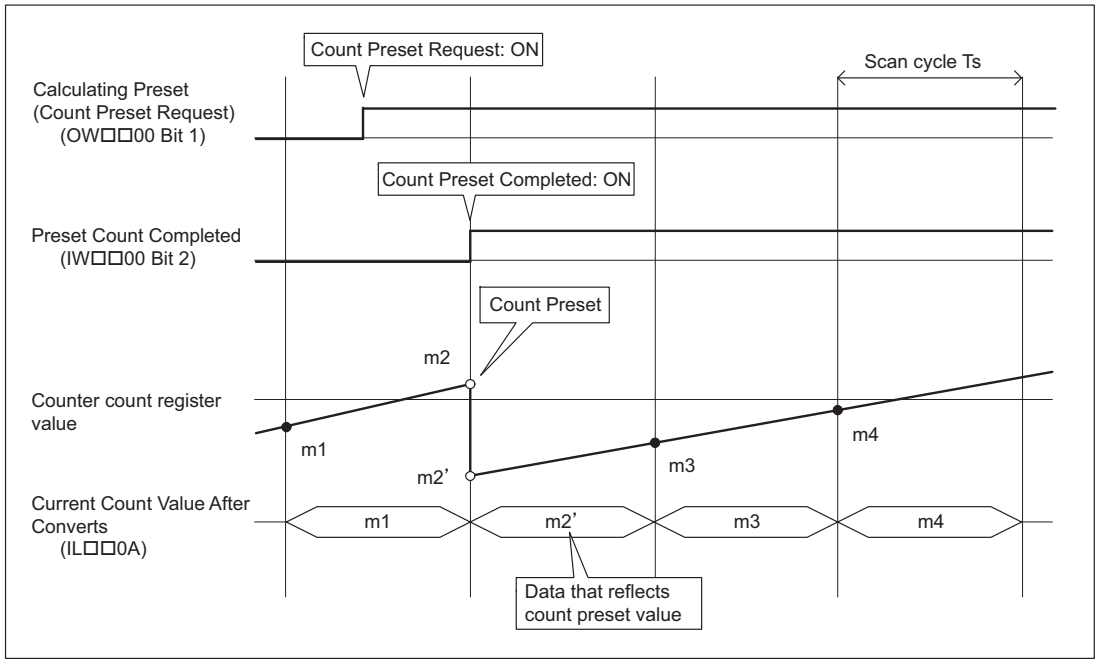


Fig. 2.9 Count Preset Completion Timing of LIO-01 or LIO-02 Module

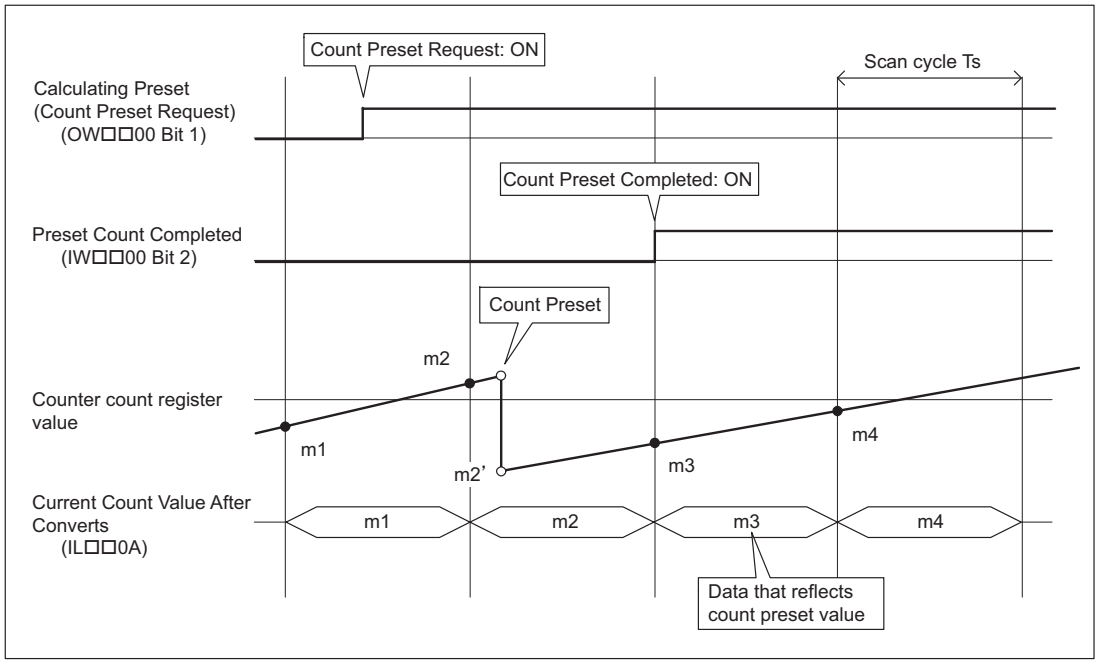


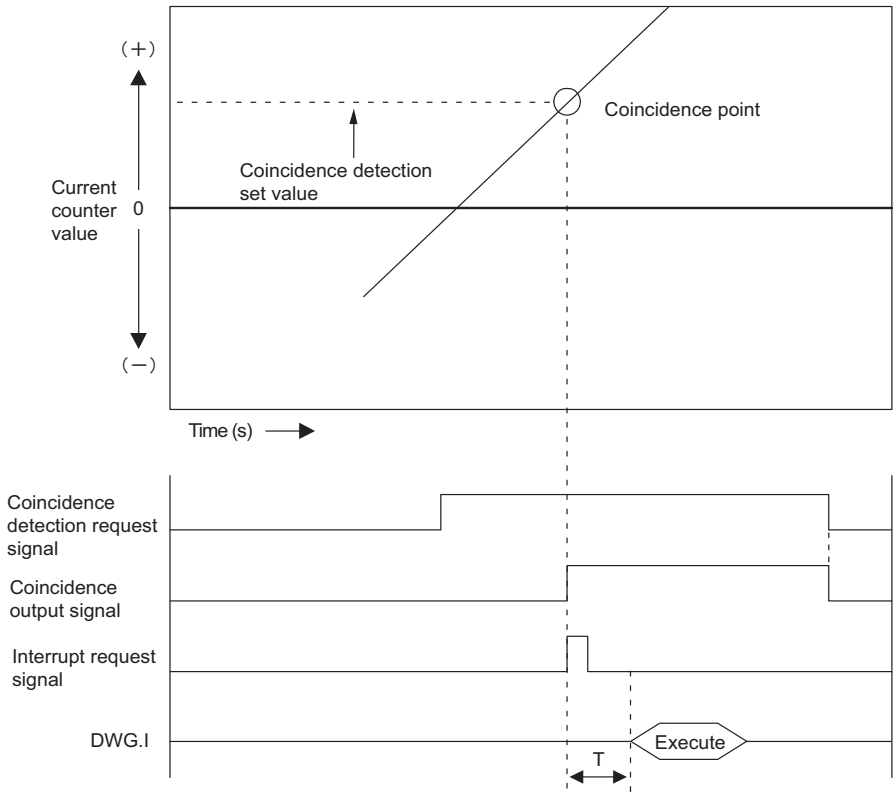
Fig. 2.10 Count Preset Completion Timing of CNTR-01 Module

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□□□□+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.

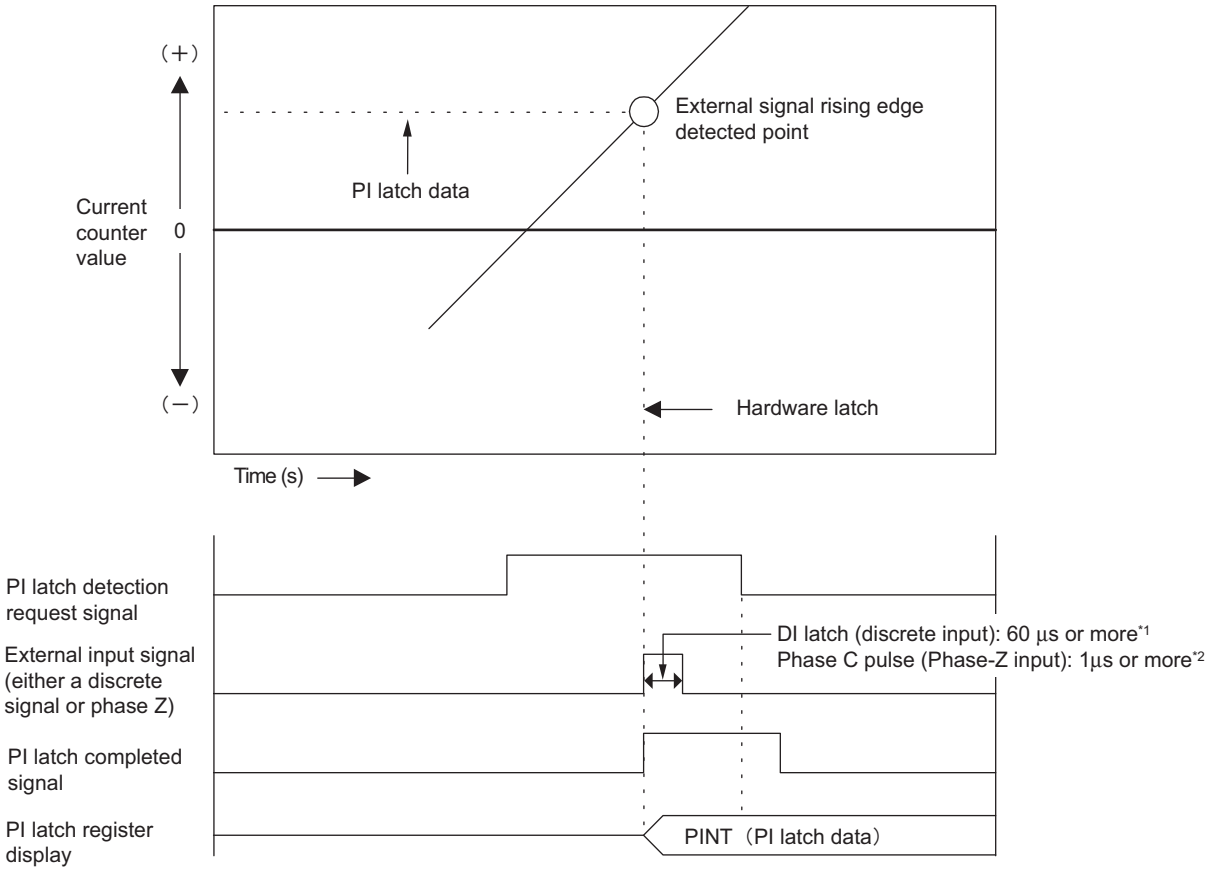


* T: Time when the coincidence point is detected to when DWG.I (interrupt drawing) starts execution (approx. 60 to 440 μs)

- 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

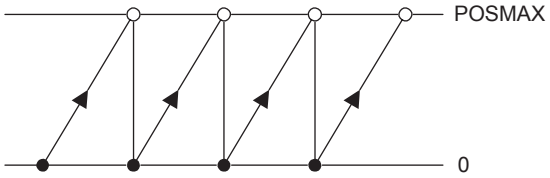
The PI latch function saves (latches) the current value to a memory register (IL□□06) on the rising edge of an external signal.
Select either a discrete input (DI latch) or phase-Z (Z latch) as the external signal.
The following graph shows the number of occurrences from when PI latch signal is output 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).

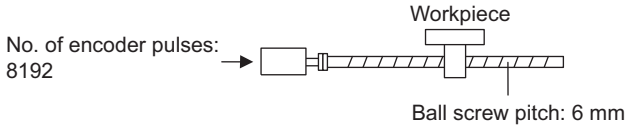


2.5 Electronic Gear Function

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 ÷ 6 = 1.666 revolutions
2048 × 4 pulses is 1 revolution. Therefore,
1.666 × 8092 = 13653 pulses
13653 pulses are input as reference pulses. The equation must be calculated at the host controller.

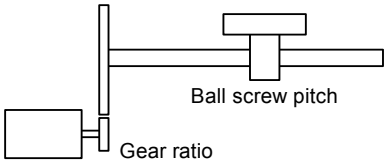
When the Electronic Gear is Used
To move a workpiece 10 mm:
Mechanical conditions and minimum reference unit are defined with electronic gear.
To move a workpiece 10 mm, the minimum reference unit is set to 1 μm. Therefore,
10 (mm) ÷ 1 (μm) = 10000
10000 is input as reference value.

2.5.2 Settings

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

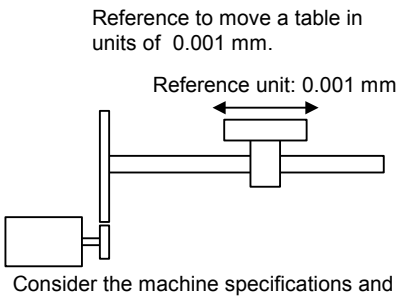
1. Confirm the machine specifications.

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).



- 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.

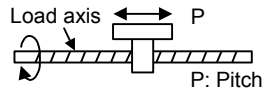
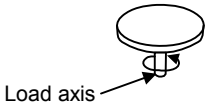
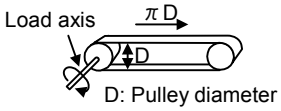
4. Find the load travel distance for each rotation of the load axis using the reference unit and set this distance to the counter fixed parameter No. 10 (Travel Distance per Machine Rotation).

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

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
 One rotation = P / Reference unit	 One rotation = 360° / Reference unit	 One rotation = πD / Reference unit

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:

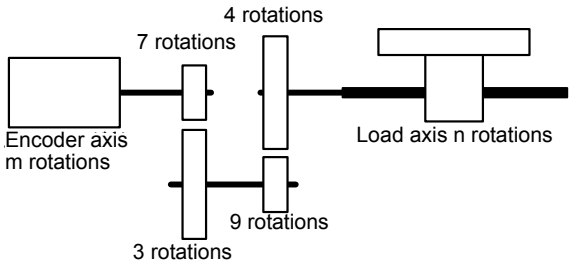
No. 11 (Encoder Gear Ratio) = m rotations

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) × (4/9) = 4/21

Therefore, set the following values:

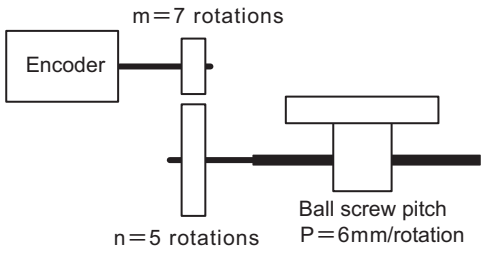
No.11 (Encoder Gear Ratio) = 4 (rotations)

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.

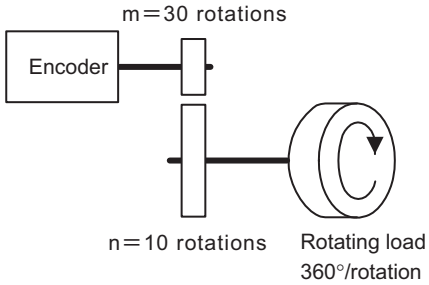
(1) Example A: Ball Screw



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 mm/0.001 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°, the setting of each parameter will be as follows:

- Moving Amount Per Machine Rotation = 360°/0.1° = 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.

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

* Ts: Scan time setting

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

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

* 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.)

3

LIO-04/LIO-05 Module

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

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.

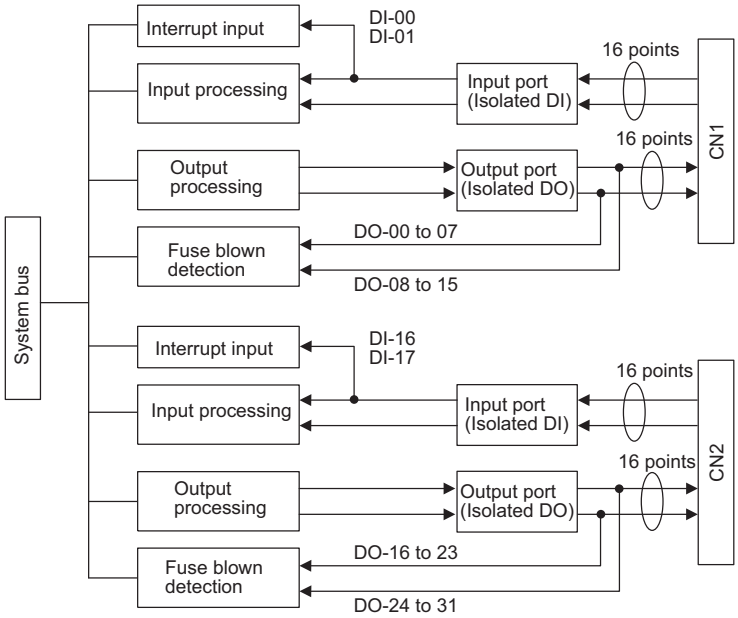
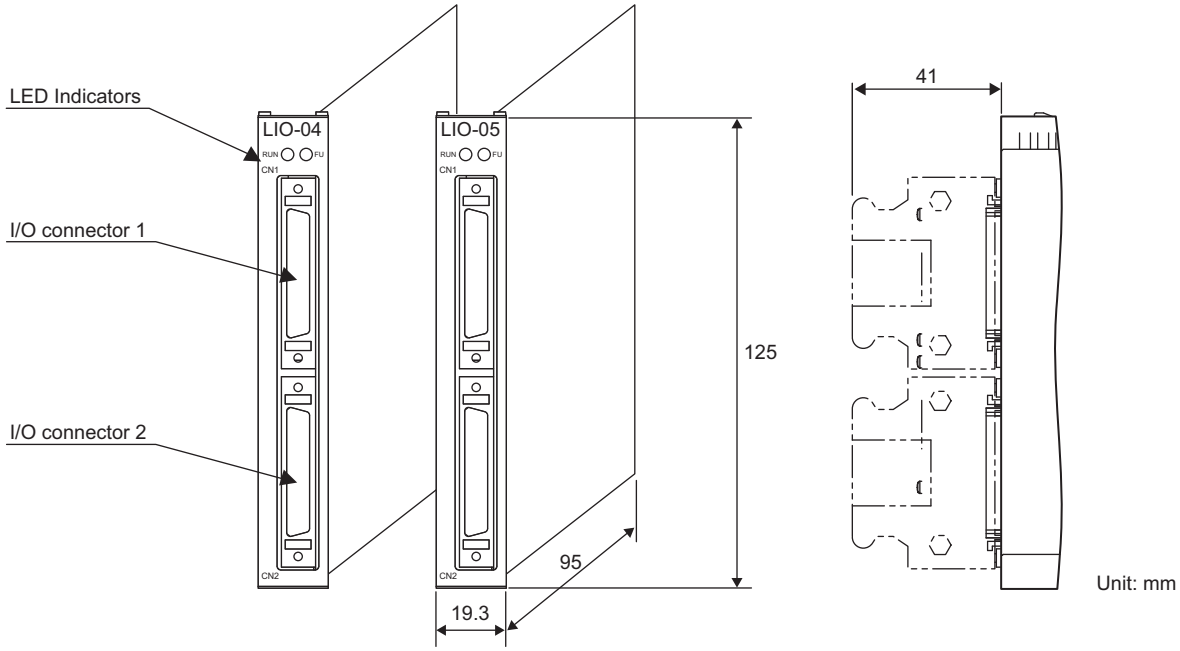


Fig. 3.1 Outline of LIO-04/LIO-05 Module Functions

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

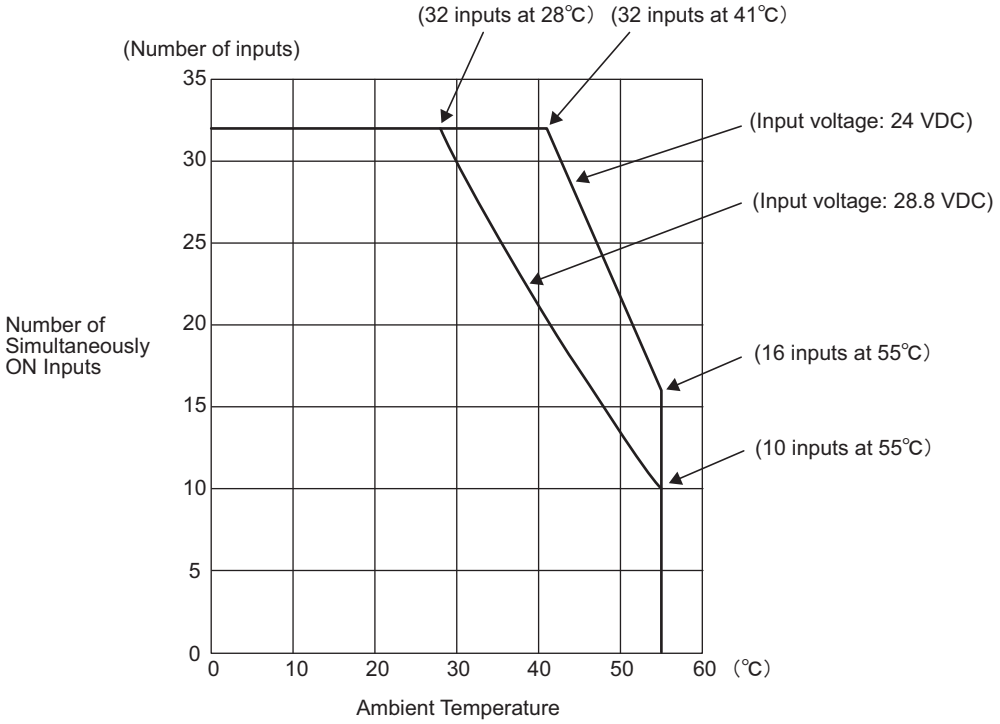
Item	Specifications	
Classification	I/O Module	
Name	LIO-04	LIO-05
Model	JAPMC-IO2303 (-E)	JAPMC-IO2304 (-E)
Digital Input	32 inputs 24 VDC±20% (+19.2 V to +28.8 V), 4.1 mA (TYP), combined sink mode/source mode inputs (DI-00, -01, -16, and -17 also used for interrupts) Number of simultaneously ON inputs: 16 (8/connector with 24 VDC), 10 (5/connector with 28.8 VDC) *For details, refer to *(3)*.	
Digital Output	32 outputs 24 VDC±20% (+19.2 V to +28.8 V), 100 mA max., transistor outputs, sink mode outputs	32 outputs 24 VDC±20% (+19.2 V to +28.8 V), 100 mA max., transistor outputs, source mode outputs
LED Indicators	RUN (green) FUSE (red)	
Connectors	CN1: I/O connector 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: • 10 to 57 Hz with single-amplitude of 0.075 mm • 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 • 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)
	Shock Resistance	Conforming to JIS B 3502: Peak acceleration of 147 m/s^2 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.



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.

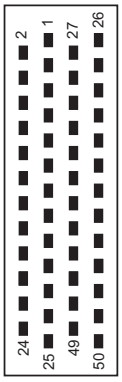
(1) Connector Model

Name	Connector Name	No. of Pins	Connector Model		
			Module Side	Cable Side	Manufacturer
External I/O Connector	CN1/CN2	50	10250-52A3PL (Conforming to RoHS)	• Connector 10150-3000PE • Shell 10350-52A0-008 (screw locking), or 10350-52F0-008 (one-touch locking)	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)



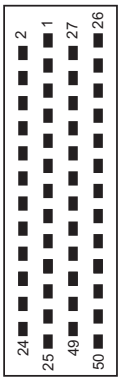
2	DI_00	1	DICOM_1	27	DI_01	26	
4	DI_04	3	DI_02	29	DI_05	28	DI_03
6	DICOM_2	5	DI_06	31		30	DI_07
8	DI_10	7	DI_08	33	DI_11	32	DI_09
10	DI_14	9	DI_12	35	DI_15	34	DI_13
12	DO_00	11		37	DO_01	36	
14		13	DO_02	39	0V_1	38	DO_03
16	DO_04	15	+24V_1	41	DO_05	40	
18		17	DO_06	43	0V_1	42	DO_07
20	DO_10	19	DO_08	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

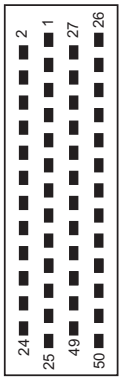
Pin No.	Signal Name	I/O	Remarks	Pin No.	Signal Name	I/O	Remarks
1	DICOM_3	P	Input common 3	26			
2	DI_16	I	Digital input 16 (shared with interrupt input)	27	DI_17	I	Digital input 17 (shared with interrupt input)
3	DI_18	I	Digital input 18	28	DI_19	I	Digital input 19
4	DI_20	I	Digital input 20	29	DI_21	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)



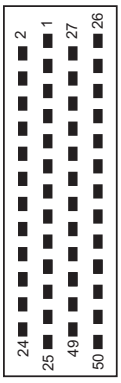
2	DI_00	1	DICOM_1	27	DI_01	26	
4	DI_04	3	DI_02	29	DI_05	28	DI_03
6	DICOM_2	5	DI_06	31		30	DI_07
8	DI_10	7	DI_08	33	DI_11	32	DI_09
10	DI_14	9	DI_12	35	DI_15	34	DI_13
12	DO_00	11		37	DO_01	36	
14		13	DO_02	39	0V_1	38	DO_03
16	DO_04	15	+24V_1	41	DO_05	40	+24V_1
18		17	DO_06	43		42	DO_07
20	DO_10	19	DO_08	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

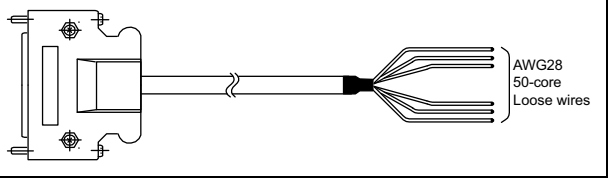
Pin No.	Signal Name	I/O	Remarks	Pin No.	Signal Name	I/O	Remarks
1	DICOM_3	P	Input common 3	26			
2	DI_16	I	Digital input 16 (shared with interrupt input)	27	DI_17	I	Digital input 17 (shared with interrupt input)
3	DI_18	I	Digital input 18	28	DI_19	I	Digital input 19
4	DI_20	I	Digital input 20	29	DI_21	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/ LIO-05 Modules (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 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

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±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. 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. DI_01, DI_16, and DI_17 are the same as DI_00.

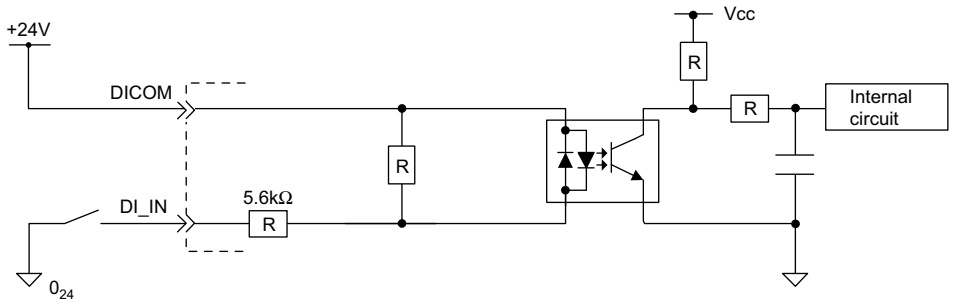


Fig. 3.2 Digital Input Circuit (Source Mode Input)

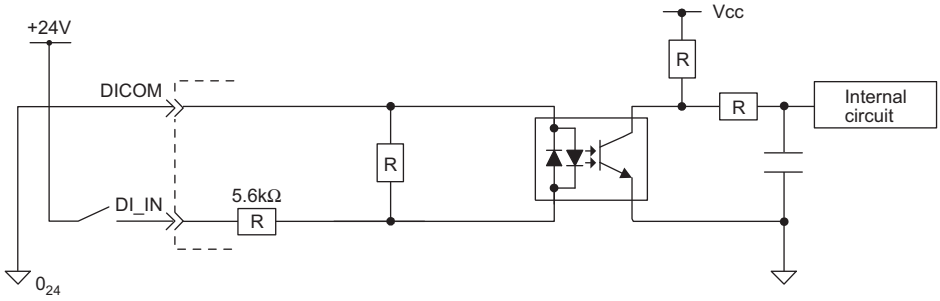


Fig. 3.3 Digital Input Circuit (Sink Mode Input)

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. OFF: 1 ms max.	
Number of Commons	4 (8 points/common)	
Protection Circuit	Fuse 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 A	
Error Detection	Fuse blown detection Replace the Module when the fuse blown is detected.	

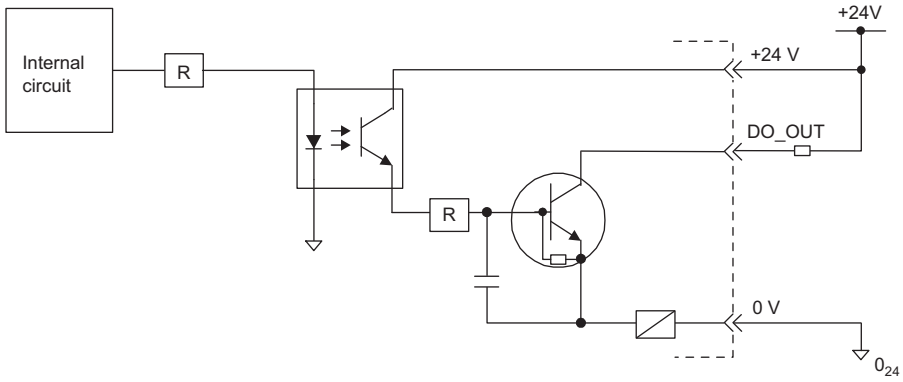


Fig. 3.4 LIO-04 Digital Output Circuit (Sink Mode Output)

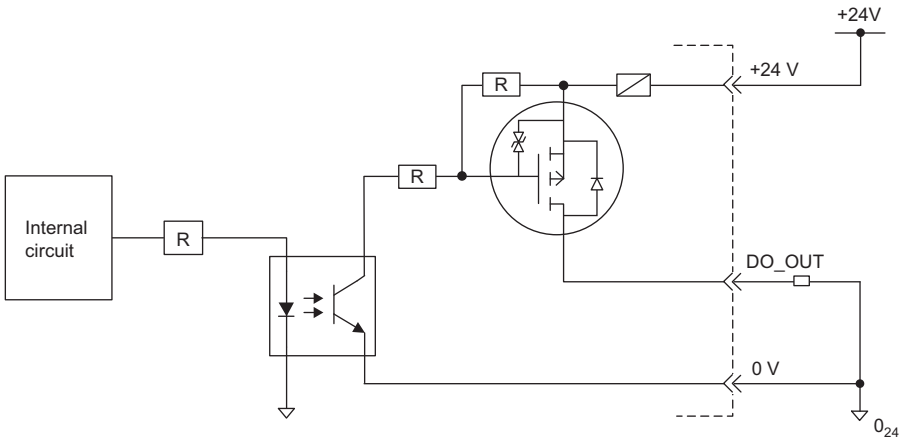
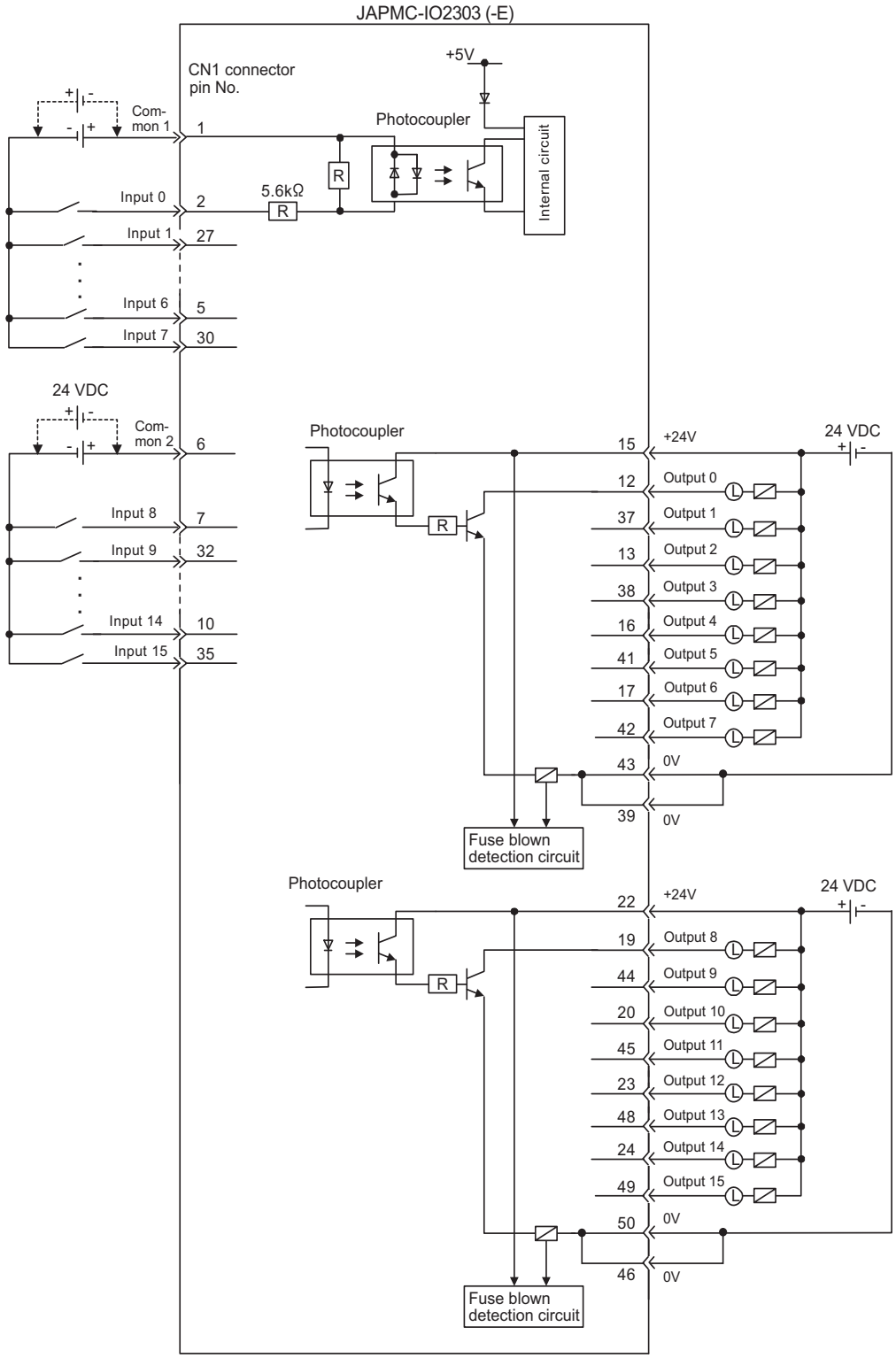


Fig. 3.5 LIO-05 Digital Output Circuit (Source Mode Output)

3.2.5 LIO-04 Module Connections

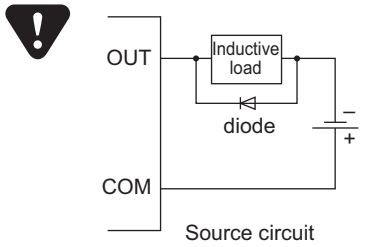
The following diagrams show connection examples for CN1/CN2 connector of the LIO-04 Module.

(1) CN1 Connector



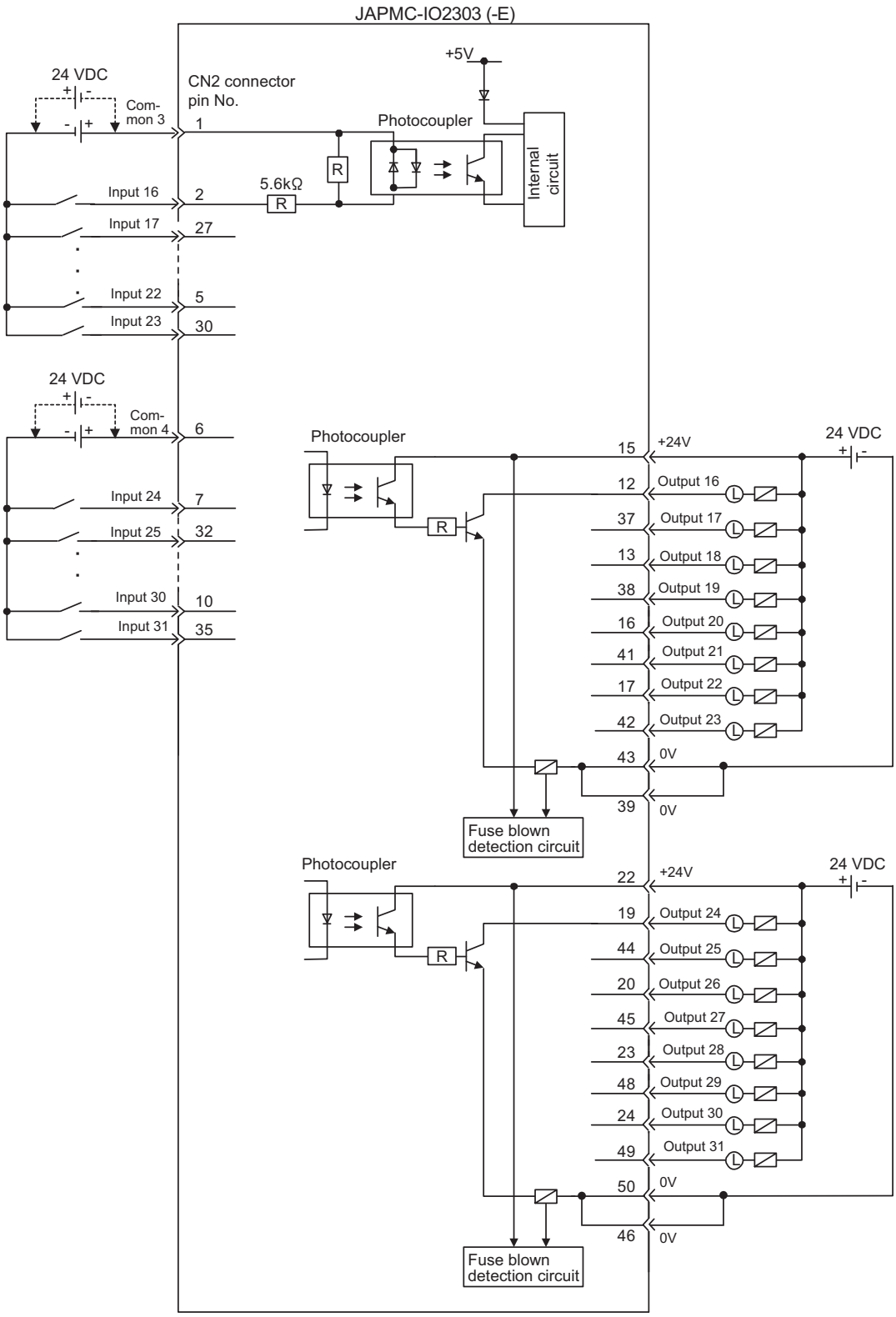
- The pins No. 39 and 43 and the pins No. 46 and 50 are internally connected. Connect them externally as well.

- 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.



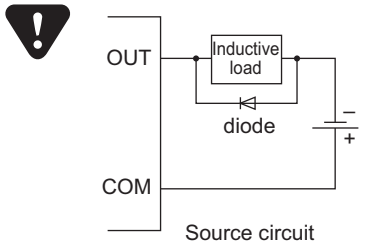
- If you connect an inductive load, connect a diode parallel to the load to absorb counter electromotive force.
  - Backward voltage: 10 times the load voltage or greater
  - Forward current: Load current or greater

(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.

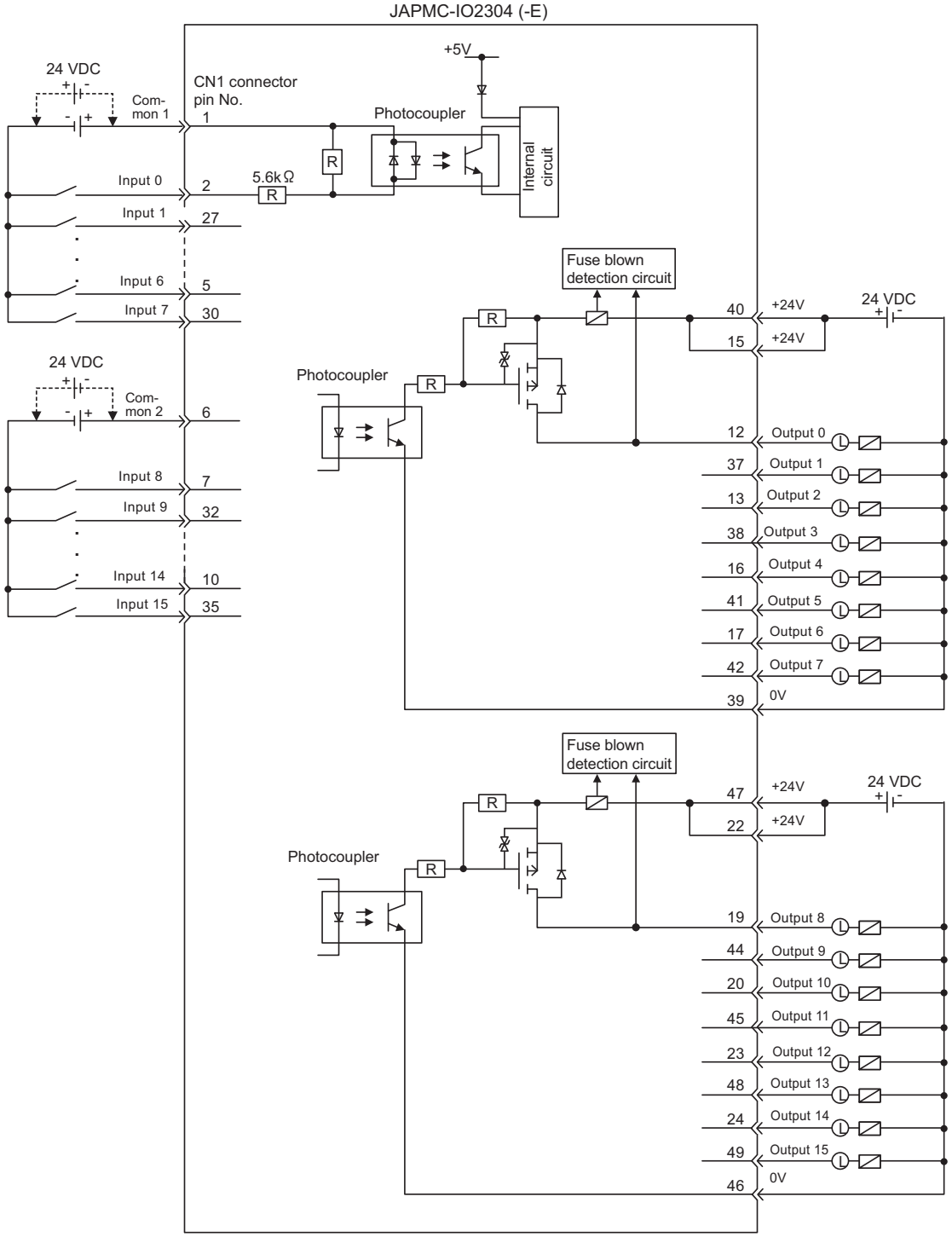


- If you connect an inductive load, connect a diode parallel to the load to absorb counter electromotive force.
  - Backward voltage: 10 times the load voltage or greater
  - Forward current: Load current or greater

3.2.6 LIO-05 Module Connections

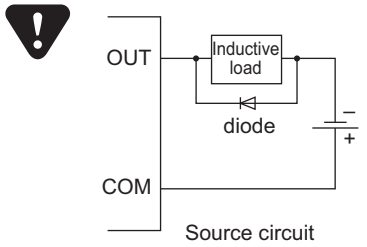
The following diagrams show connection examples for CN1/CN2 connector of the LIO-05 Module.

(1) CN1 Connector



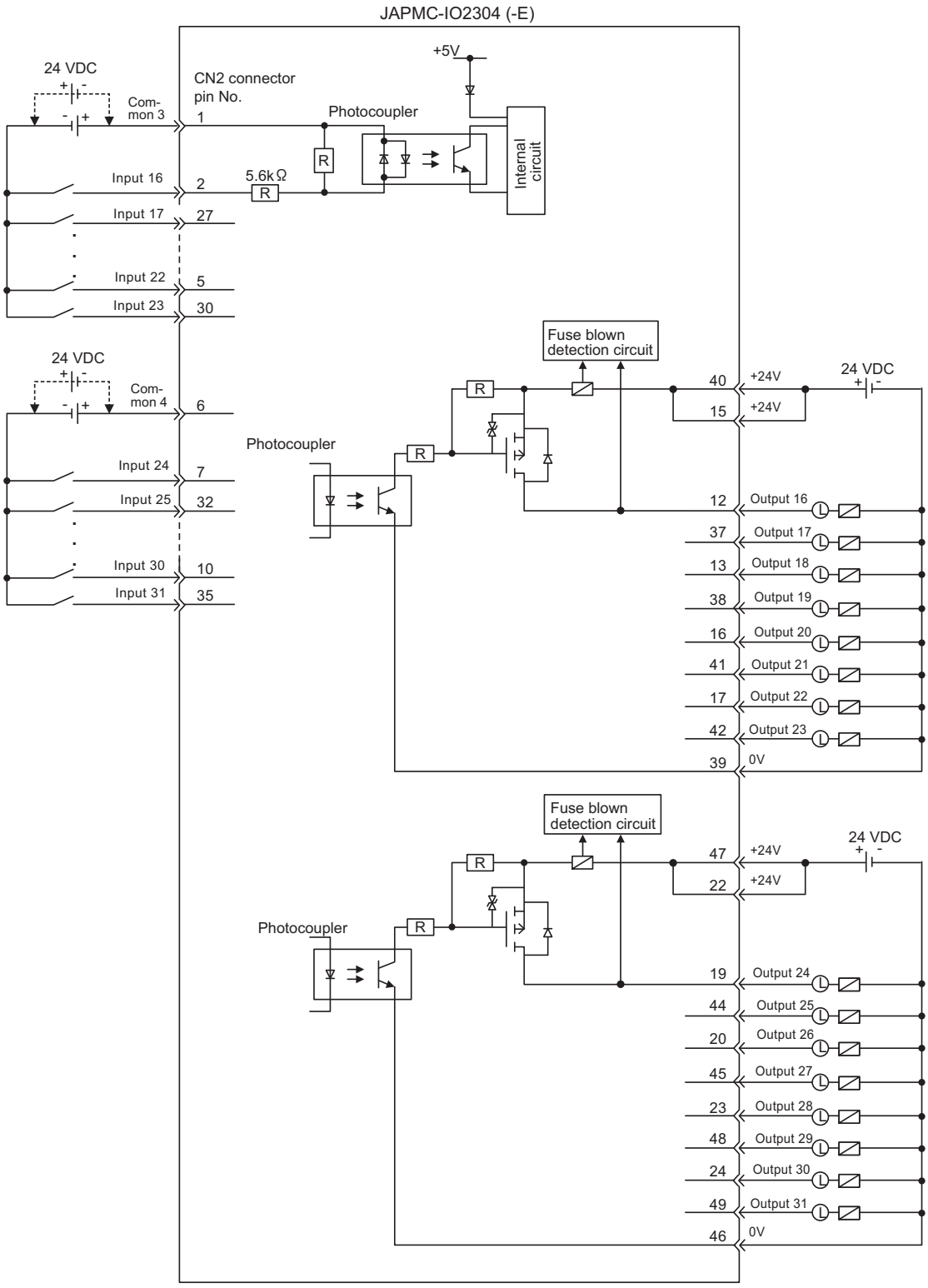
- Check the polarity of the external power supply when wiring. An adverse connection may cause a load malfunction.
- The pins No. 15 and 40 and the pins No. 22 and 47 are internally connected. Connect them externally as well.

- 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.



- 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

(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.

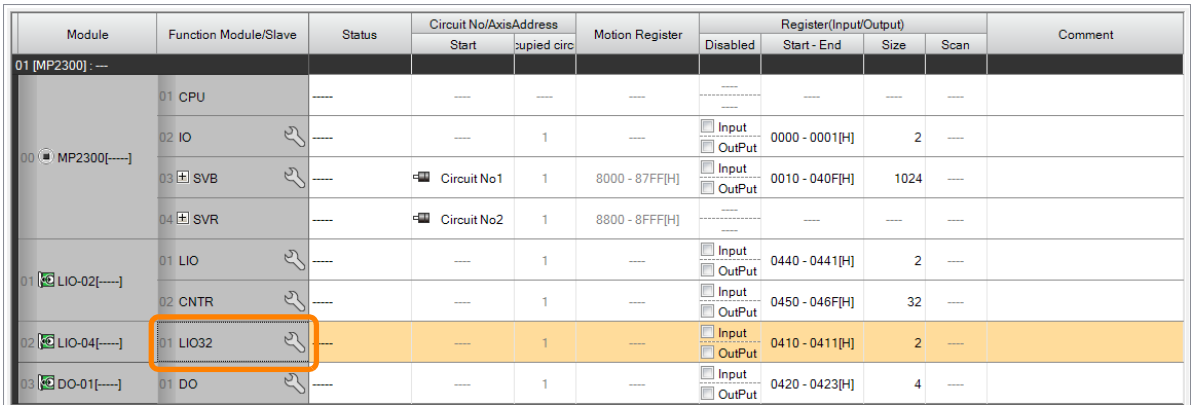
- A fuse is inserted in the output common line of the LIO-05 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.

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.

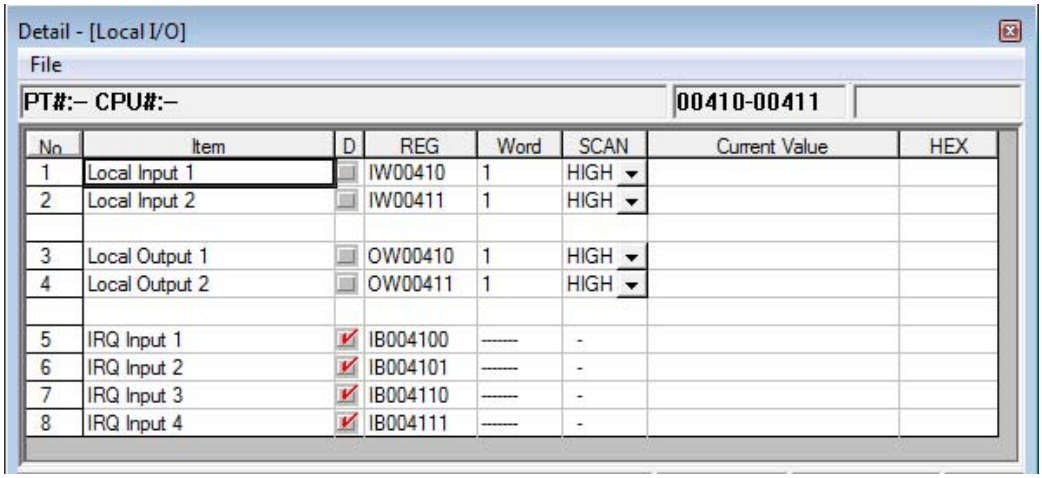


A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **Local I/O** Window will be displayed.

- 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	☐	IW00410	1	HIGH		
2	Local Input 2	☐	IW00411	1	HIGH		
3	Local Output 1	☐	OW00410	1	HIGH		
4	Local Output 2	☐	OW00411	1	HIGH		
5	IRQ Input 1	☑	IB004100	------	-		
6	IRQ Input 2	☑	IB004101	------	-		
7	IRQ Input 3	☑	IB004110	------	-		
8	IRQ Input 4	☑	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	• When Discrete Input 1 Is Enabled in the D Column Operation is performed with the SCAN set value for discrete input 1. *The SCAN set value for discrete input 2 is disabled. • When Discrete Input 1 Is Disabled in the D Column The input value for discrete input 2 is always 0.
Version 3.01 or later	Version 1.23 or later	Operation is performed with the SCAN set value for discrete input 2.

4

LIO-06 Module

This chapter describes the LIO-06 Module in detail.

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.

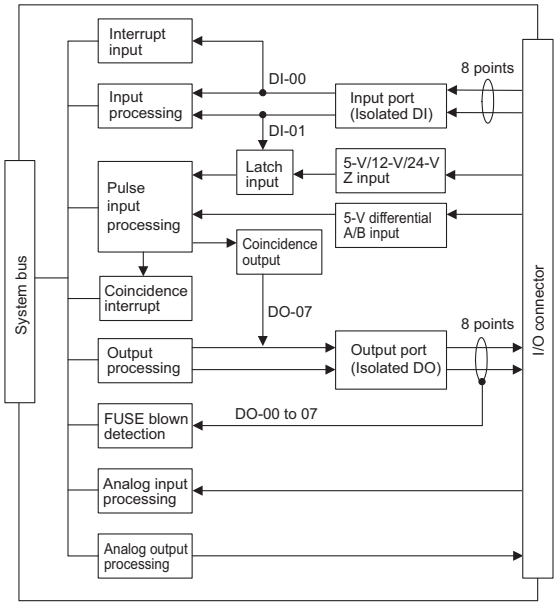
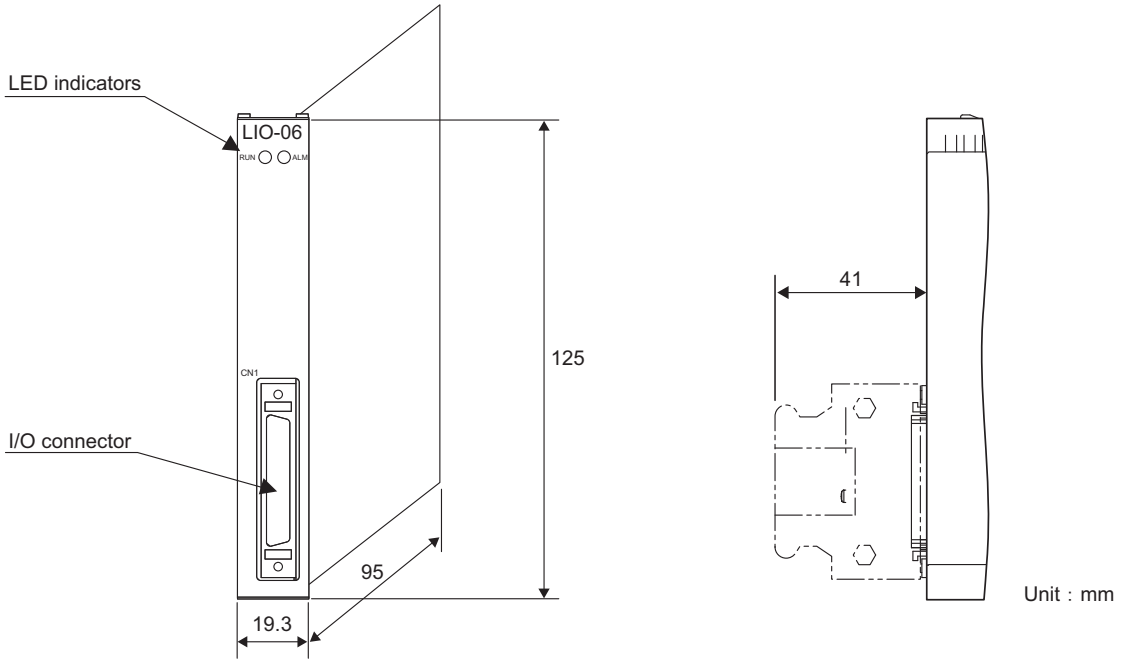


Fig. 4.1 Outline of LIO-06 Module Functions

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 24 VDC, 4.1 mA, combined sink mode/source mode inputs (DI_00 also used for interrupts, DI-01 also used for pulse latch inputs)
Digital Output	8 outputs 24 VDC transistor open-collector outputs, sink mode outputs (DO_07 also used for coincidence outputs)
Analog Input	1 channel Analog input range: -10 to +10 V Resolution: 16 bits (-31276 to +31276)
Analog Output	1 channel Analog output range: -10 to +10 V Resolution: 16 bits (-31276 to +31276)
Pulse Input	Phase A/B/Z inputs Phase AB: 5-V differential input, not isolated, max. frequency: 4 MHz Phase Z: 5-V/12-V/24-V photocoupler input Latch input Pulse latch for phase Z or DI_01.
Connector	I/O: I/O connector
LED Indicators	RUN (green) 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: • 10 to 57 Hz with single-amplitude of 0.075 mm • 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 • 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)
	Shock Resistance	Conforming to JIS B 3502: Peak acceleration of 147 m/s^2 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) • Blown fuse • ASIC error for counter/AO • Oscillator error • Phases A and B disconnection	Normal operation

4.1.5 Analog I/O Characteristics

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

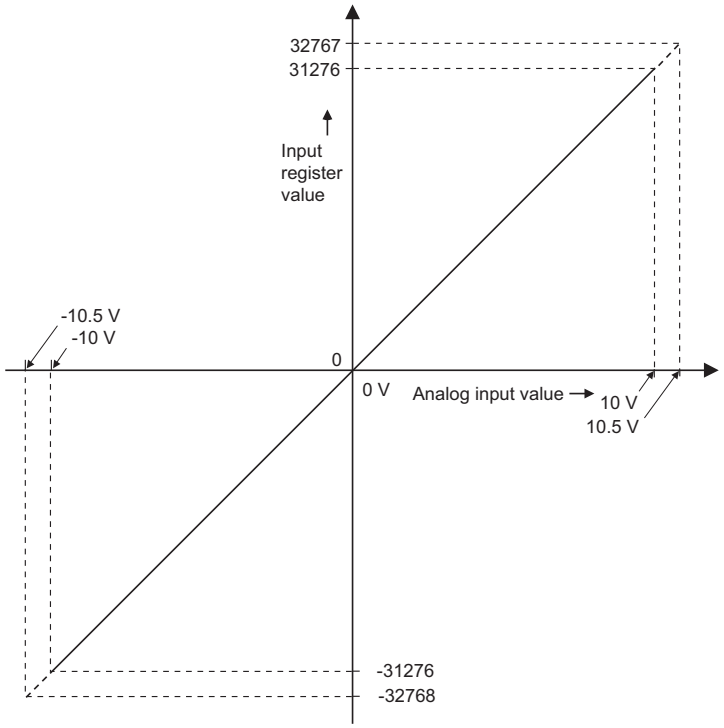
(1) Analog Input Characteristics

■ 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: ±10.0 V

■ Voltage Input Characteristics



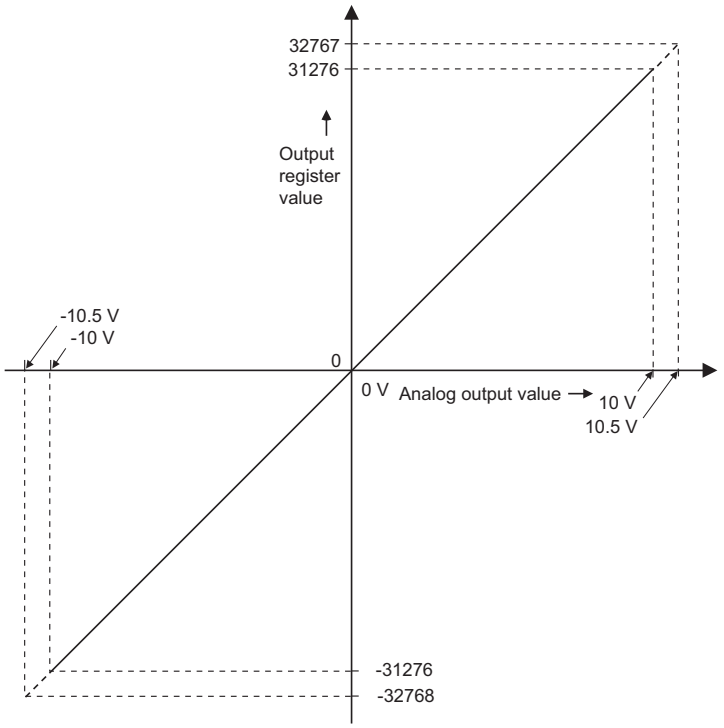
(2) Analog Output Characteristics

■ 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: ±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.

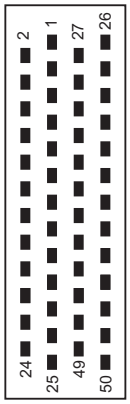
(1) Connector Model

Name	Connector Name	No of Pins	Connector Model		
			Module Side	Cable Side	Manufacturer
External I/O Connector	CN1	50	10250-52A3PL (Conforming to RoHS)	• Connector 10150-3000PE • Shell 10350-52A0-008 (Screw locking), or 10350-52F0-008 (One-touch locking)	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

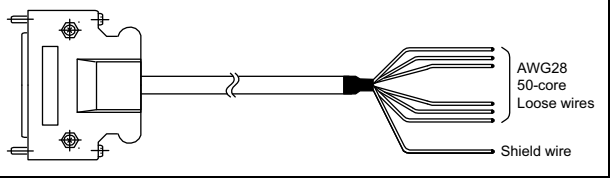
Pin No.	Signal Name	I/O	Remarks	Pin No.	Signal Name	I/O	Remarks
1	AO	O	Analog output	26	AO_GND	O	Analog output ground
2	AI	I	Analog input	27	AI_GND	I	Analog input ground
3				28			
4	PA+	I	Phase-A pulse (+)	29	PB+	I	Phase-B pulse (+)
5	PA-	I	Phase-A pulse (-)	30	PB-	I	Phase-B pulse (-)
6	GND	I	Pulse 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
				Shell		–	Shield wire

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

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 (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. OFF: 0.5 ms max.
Number of Commons	1 (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. • 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.

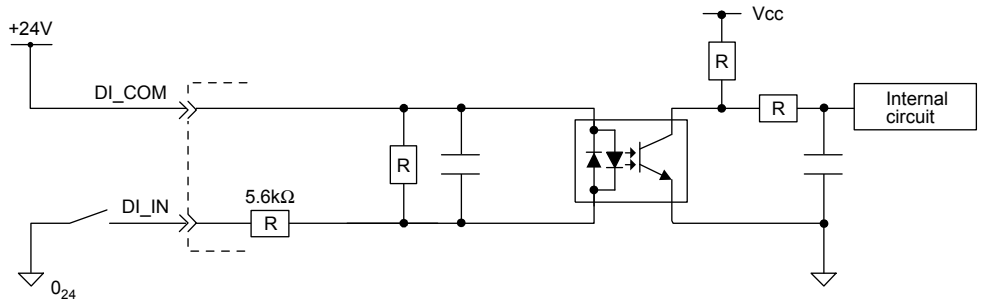


Fig. 4.2 Digital Input Circuit (Source Mode Input)

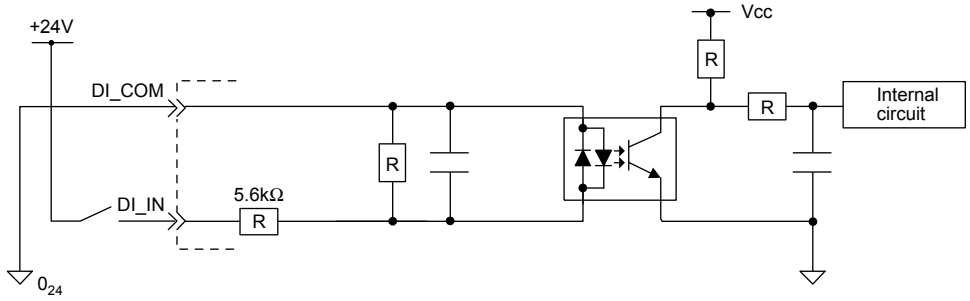


Fig. 4.3 Digital Input Circuit (Sink Mode Input)

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, ±20%
Output Current	100 mA max.
Leakage Current When OFF	0.1 mA max.
ON Time/OFF Time	ON: 0.25 ms max. OFF: 1 ms max.
Number of Commons	1 (8 points/common)
Protection Circuit	Fuse 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 Replace the Module when fuse blown is detected.
Other Functions	DO_07 is shared with counter coincidence output.

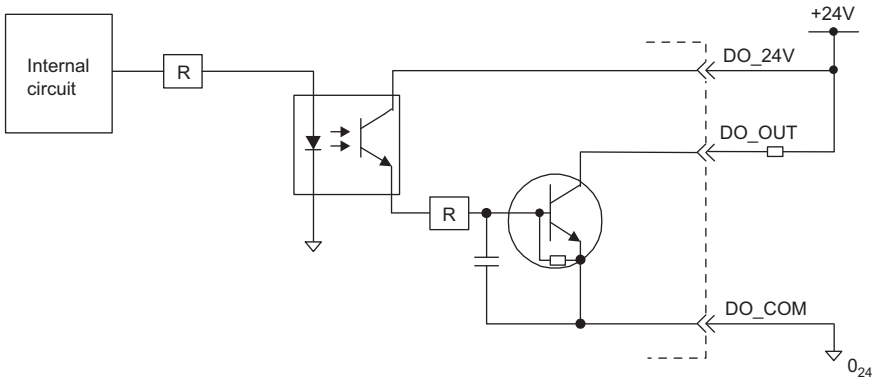


Fig. 4.4 Digital Output Circuit (Sink Mode Output)

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 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. Response time at phase-Z input ON: 1 μs max. OFF: 1 μs max. (2 μs max. at 24-V input) Response time at DI_01 input ON: 60 μs max. OFF: 0.5 ms max.
Other Functions	Coincidence detection, counter preset

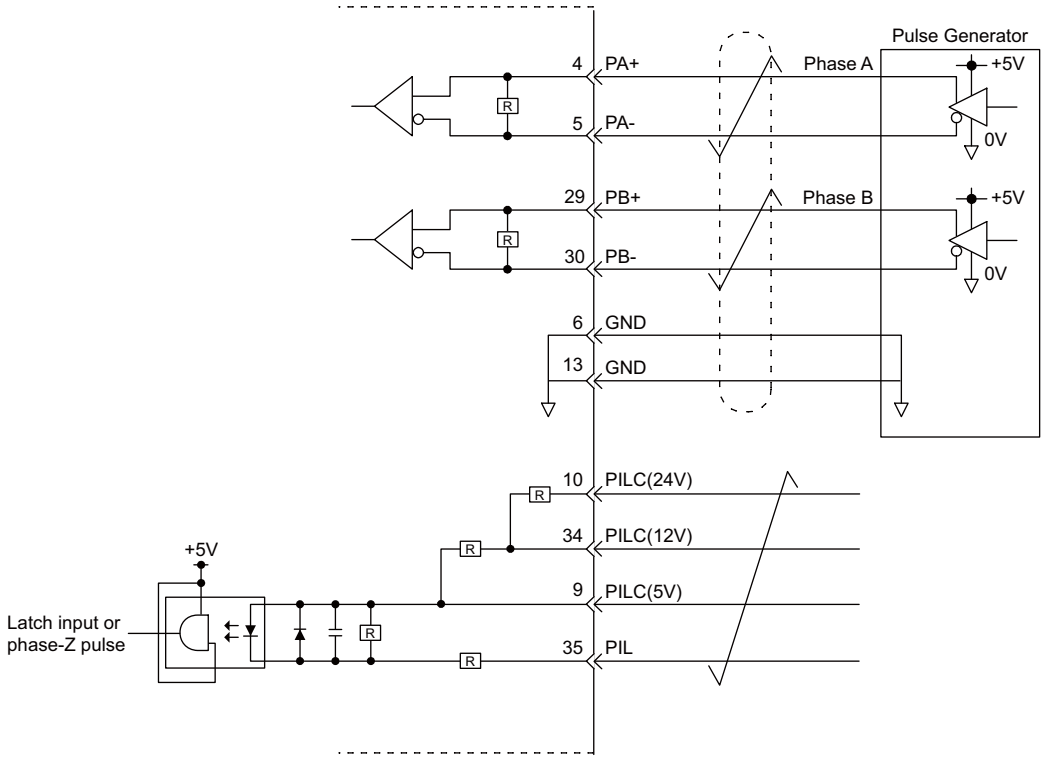
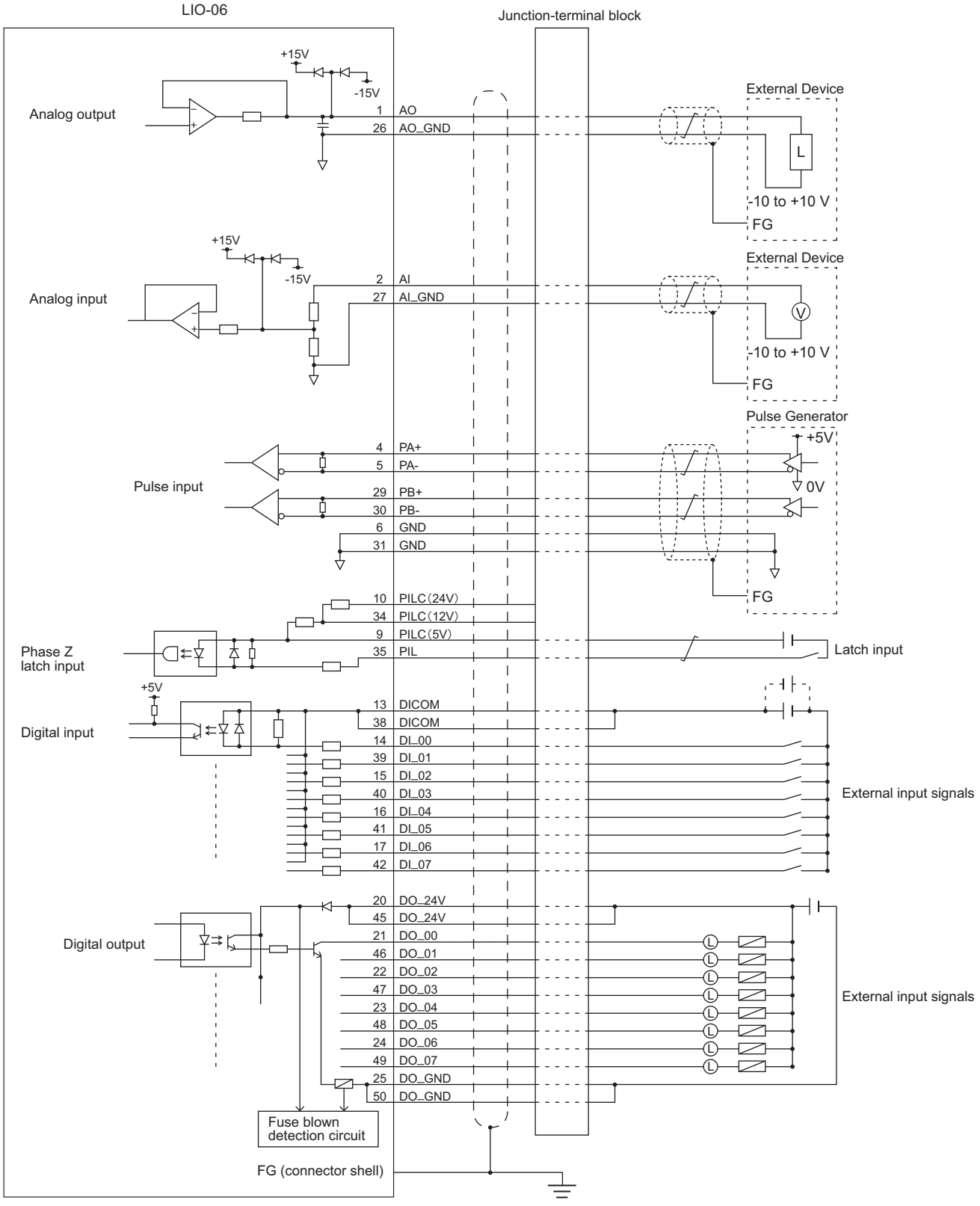


Fig. 4.5 Pulse Input Circuit

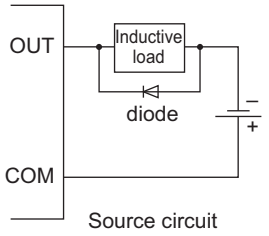
4.2.8 LIO-06 Module Connections

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.

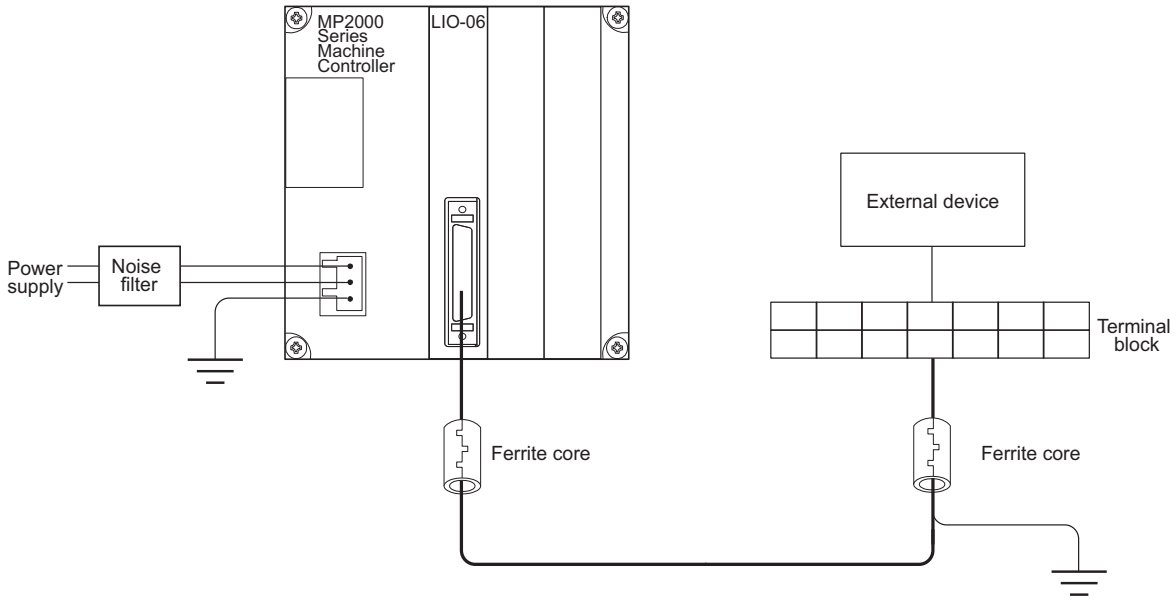
- A fuse is inserted in the output common line of the LIO-06 Module for circuit protection. However, the fuse may not be blown out in the cases such as layer shorts in outputs. To ensure the circuit protection, provide a protective element such as fuse in each output as shown in the above diagram.
- 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

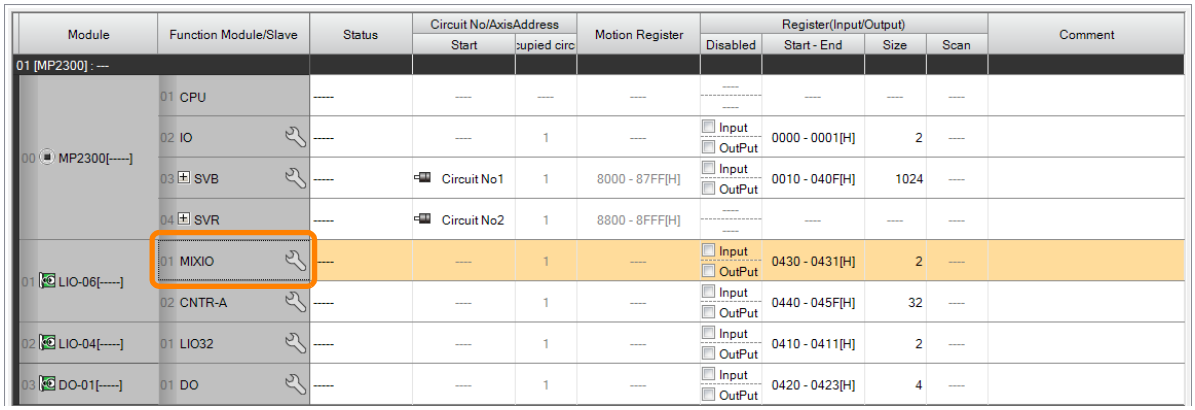
4.3 LIO-06 Module Details

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.



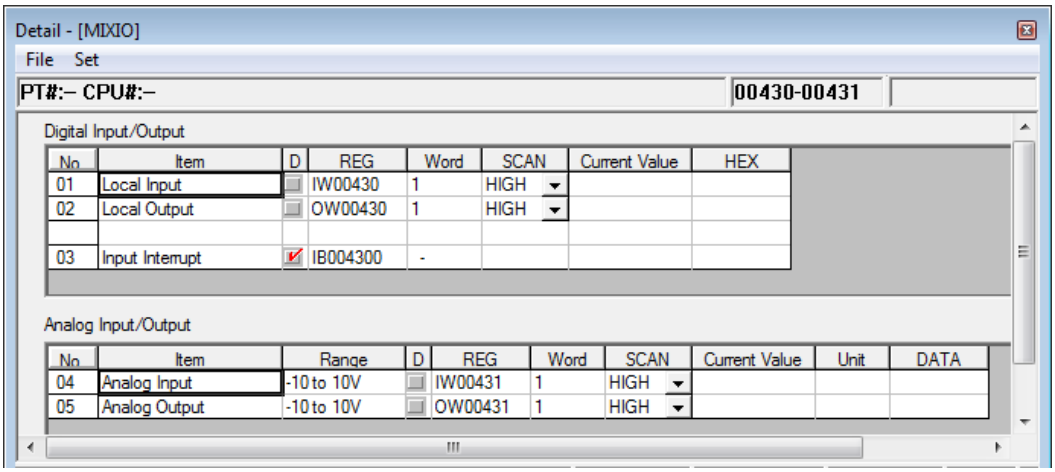
Module	Function Module/Slave	Status	Circuit No/AxisAddress Start	Circuit No/AxisAddress cupied circ	Motion Register	Register(Input/Output) Disabled	Register(Input/Output) Start - End	Register(Input/Output) Size	Register(Input/Output) Scan	Comment
01 [MP2300] : ---										
	01 CPU	-----	----	----	----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

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]

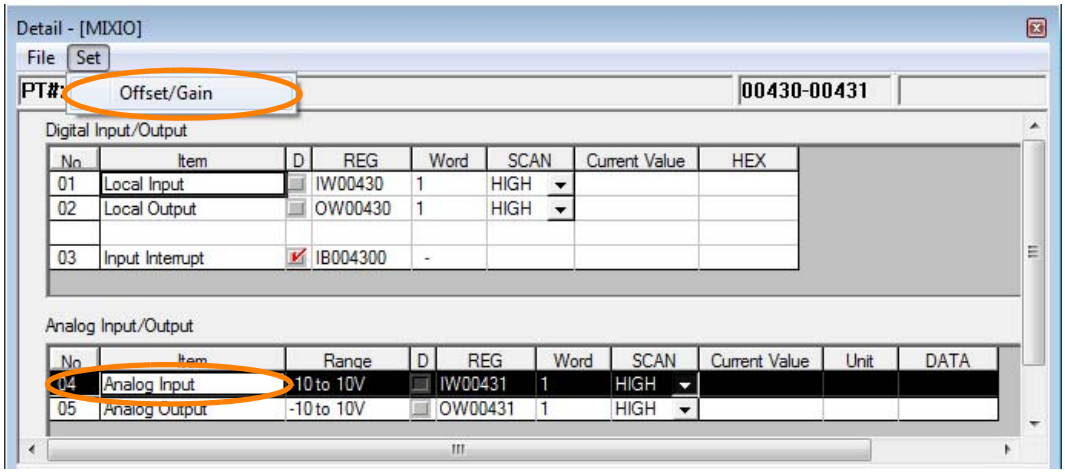
After changing the MIXIO configuration, save the definition data by selecting ***Online – Save to Flash*** from the main menu.

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.

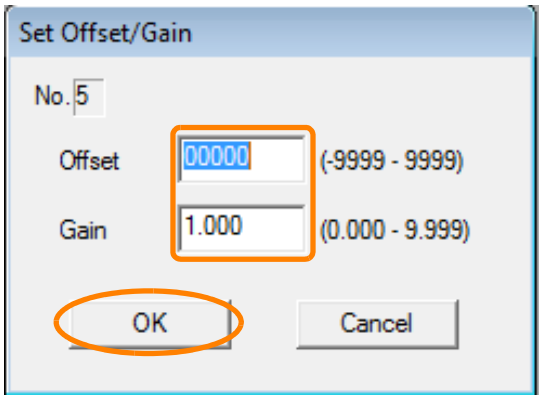
(1) Input Offset/Gain

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.

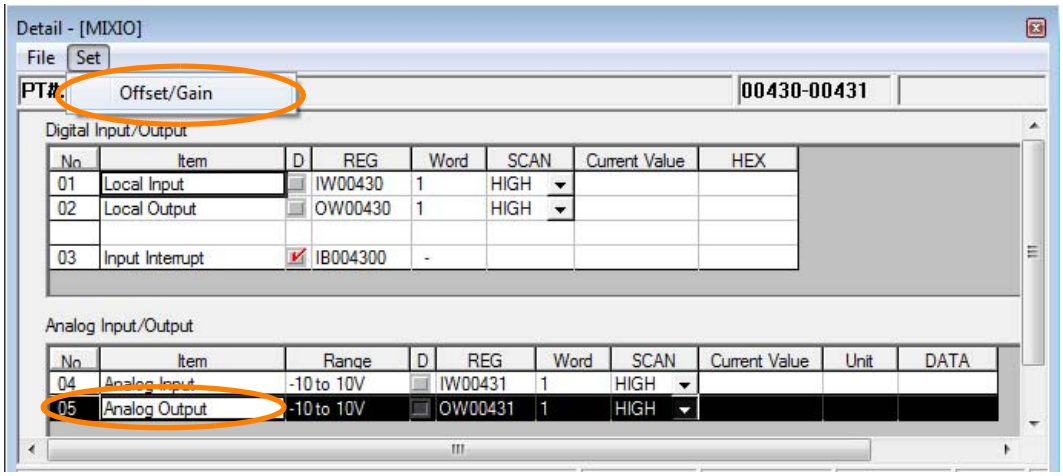
(2) Output Offset/Gain

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.

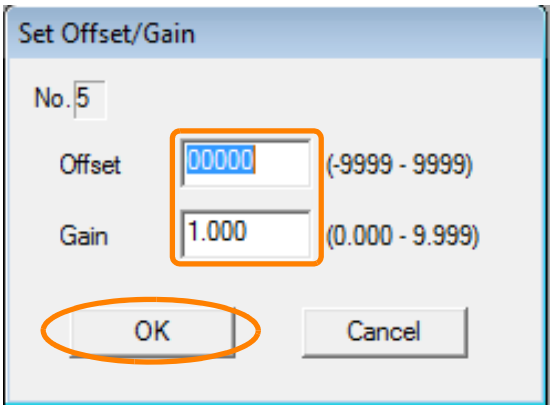
Offset value = Output voltage 1 × (-3127.6) (round off below decimal point)

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,
  Gain = 10.0 ÷ 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.
  Gain = REG1 ÷ 31276.0 (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.

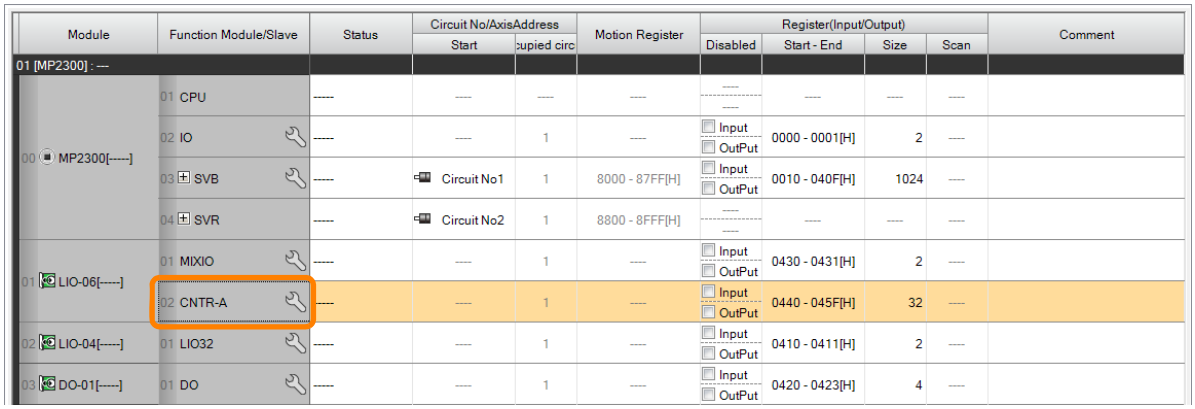
8. Save the offset/gain value to the **MIXIO** Window by selecting ***Online - Save to Flash*** from the main menu.

- The offset/gain adapted value will be stored in the offset/gain output register (O register):
  Output register = (Output voltage - Offset) ÷ 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.



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.

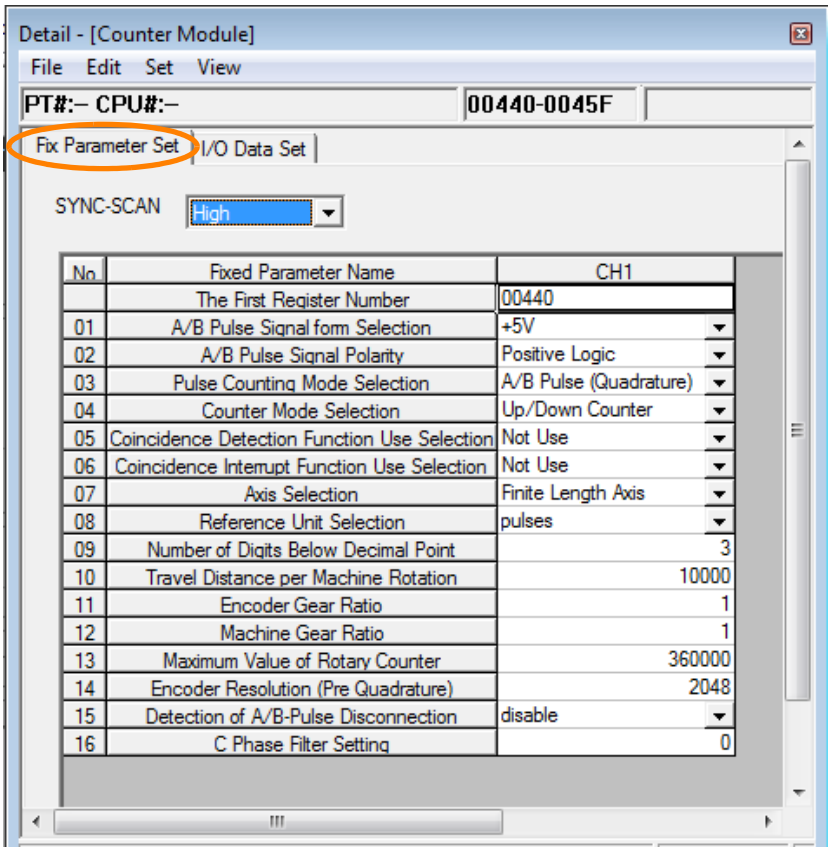


Fig. 4.6 Counter Module **Fix Parameter Set** Tab Page

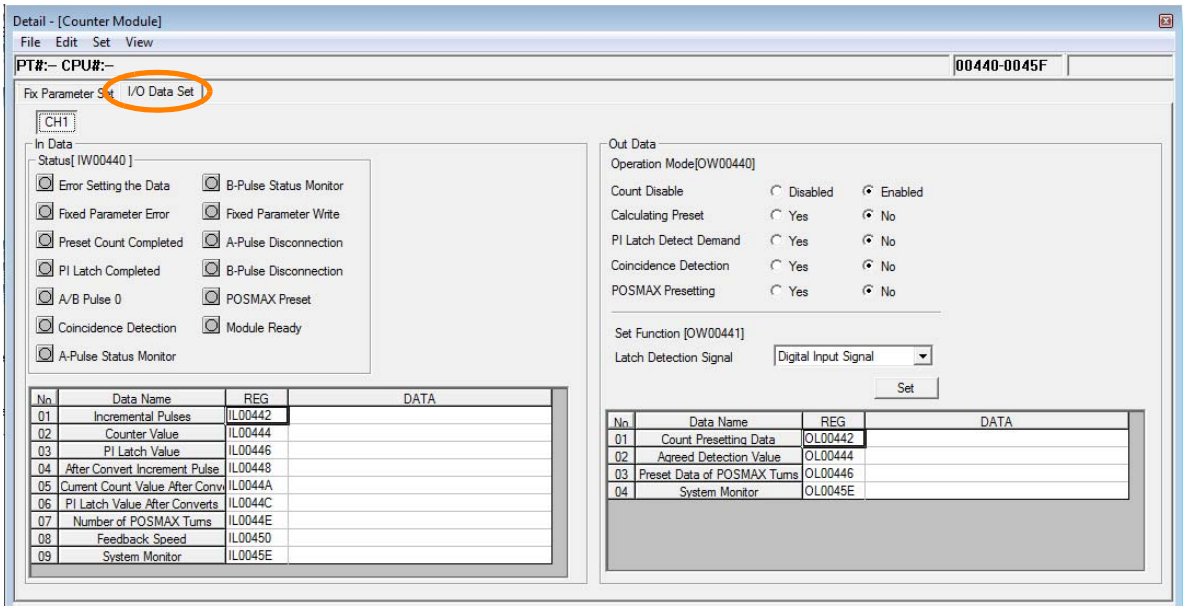


Fig. 4.7 Counter Module **I/O Data Set** Tab Page

(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 (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 (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 (differential input)
02	A/B Pulse Signal Polarity Selection*1	Select either positive or negative logic for the signal polarity of phases A and B.	1 word	Positive logic
03	Pulse Counting Mode Selection*1	Specify the pulse counting mode*1 among the following 7 equations. • Pulse and Direction • Pulse and Direction ∗ 2 • Up/Down Counter • Up/Down Counter ∗ 2 • A/B Pulse • A/B Pulse ∗ 2 • A/B Pulse (Quadrature)	1 word	A/B Pulse (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*2 is to be used.	1 word	Not use
06	Coincidence Interrupt Function Use Selection	Set whether or not the coincidence interrupt function*2 is to be used. (Valid only when the coincidence detection function is set.)	1 word	Not use
07	Axis Selection	Set the axis type*3: Finite or infinite length axis.	1 word	Finite length axis
08	Reference Unit Selection	Specify the reference unit. • pulse • mm • deg • inch 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*4 for the minimum reference unit. *Example*: If the minimum reference unit is 1 μm (10^{-3}mm): Reference unit selection : mm, and Number of digits below decimal point: 3	1 word	3
10	Travel Distance per Machine Rotation *4, *5	Set the load moving amount per load axis rotation. Setting range: 1 to 2147483647 (reference unit)	2 words	10000
11	Encoder Gear Ratio*4, *5	Set the value m so that the encoder axis rotates m times when the load axis rotates n times. Setting range: 1 to 65535	1 word	1
12	Machine Gear Ratio (Load) *4, *5	Set the value n so that the encoder axis rotates m times when the load axis rotates n times. Setting range: 1 to 65535	1 word	1
13	Maximum Value of Rotary Counter (Infinite Length Axis Reset Position (POSMAX))*3	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 (Pre Quadrature) (Number of Pulses Per Encoder Rotation (before Multiplication))	Set the number of input pulses per encoder rotation. Setting range: 1 to 2147483647 (pulse/rev)	2 words	2048
15	Detection of A/B-pulse Disconnection	Select whether or not the phase A/B disconnection detection is enabled or not.	1 word	disable

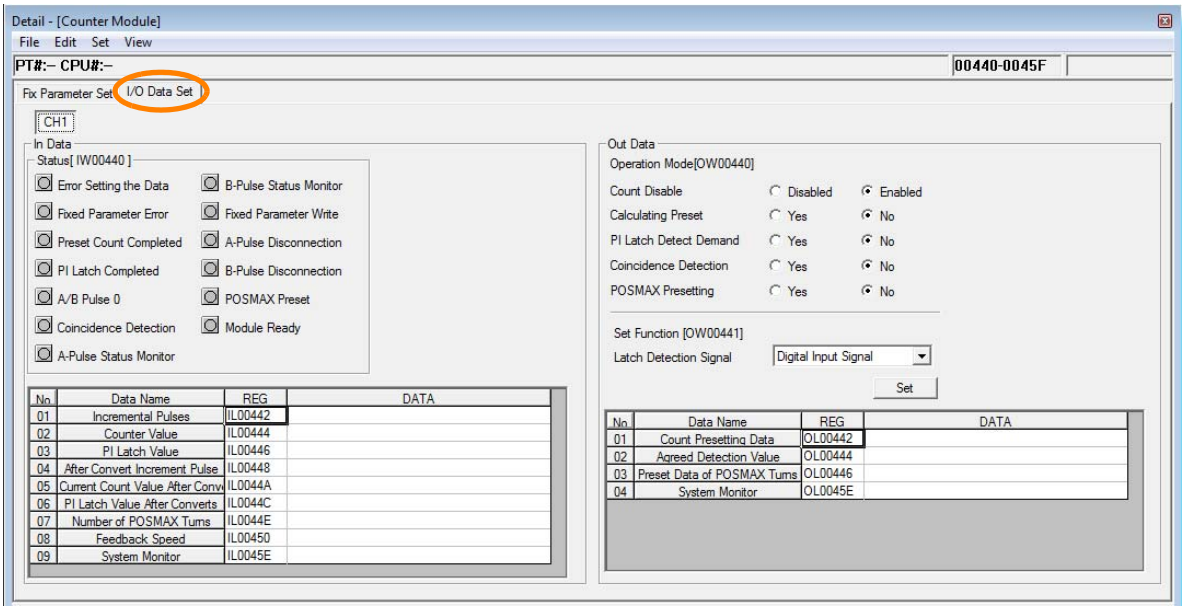
∗ 1. For details, refer to *4.4.1 Pulse Counting Modes* on page 4-27.
∗ 2. For details, refer to *4.4.3 Coincidence Output and Coincidence Interrupt Functions* on page 4-30.
∗ 3. For details, refer to *4.4.5 Axis Type Selection* on page 4-32.
∗ 4. For details, refer to *4.5 Electronic Gear Function* 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 *1	Status (Run Status) [RUNSTS]	The run status of the Counter Module is indicated for each bit. When online: ● : ON (= 1), ○ : OFF (= 0), 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 *1	Operation Mode (RUN Mode) [RUNMOD]	Bit 0	Count Disable ON (=1): Counting prohibited OFF (=0): Counting enabled (Default) Prohibits counting while the bit is ON (=1).		–	1 word
			Bit 1	Calculating Preset (Count Preset Request) ON (=1): Request preset OFF (=0): Not requested (Default) Resets the count to its preset value when the bit is turned ON (=1).		–	
			Bit 2	PI Latch Detect Demand*2 ON (=1): Request latch detection OFF (=0): Not requested (Default) Stores the counter value at the moment an external signal is input while the bit is ON (=1).		–	
			Bit 3	Coincidence Detection*3 ON (=1): Request coincidence detection OFF (=0): Not requested (Default) Sends a coincidence signal if the values of the counter and the coincidence detection setting match when the bit is turned ON (=1).		–	
			Bit 4	POSMAX Presetting (POSMAX Turns Presetting Request) ON (=1): Requests preset OFF (=0): Not requested (Default) 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. • 0001H: DI latch (discrete input) • 0002H: Z latch (phase-Z input)		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.			–	

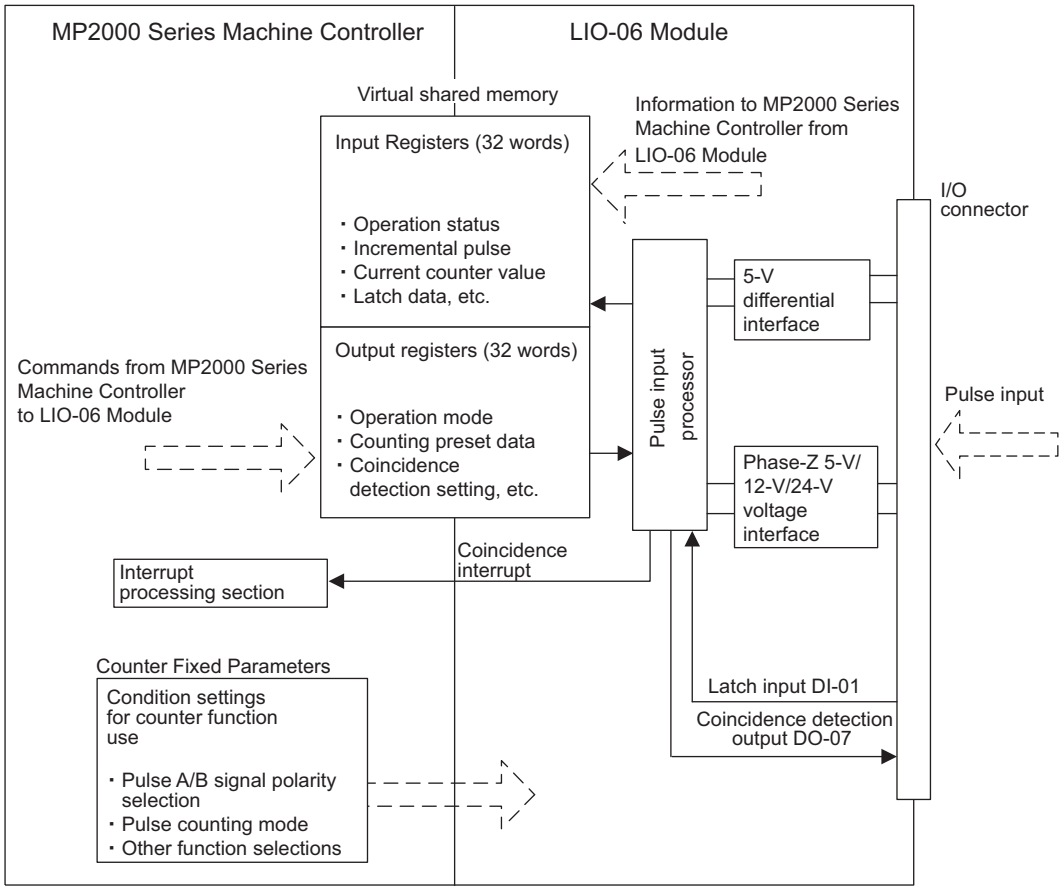
∗ 1. OW□□00 gives the register number that is displayed in **The First Register Number** cell on the **Fix Parameter Set** Tab Page + 00.

∗ 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.

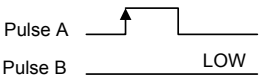
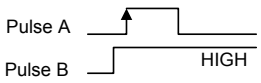
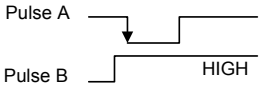
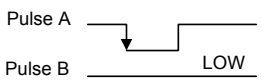
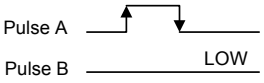
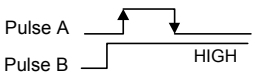
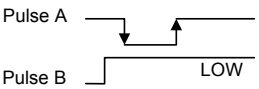
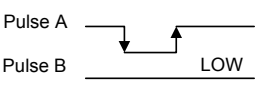
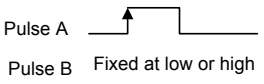
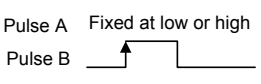
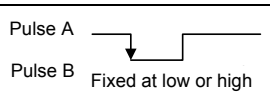
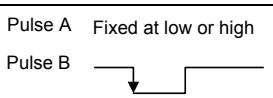
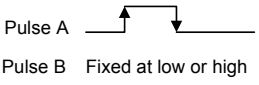
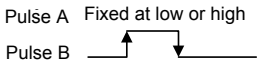
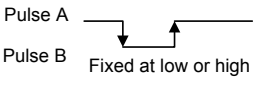
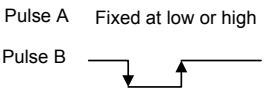
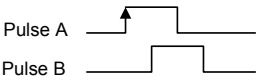
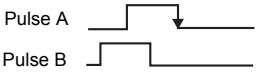
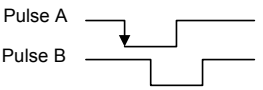
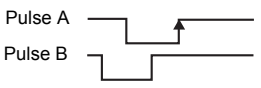
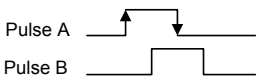
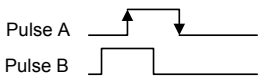
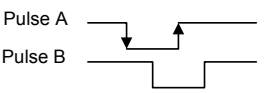
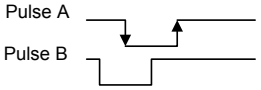
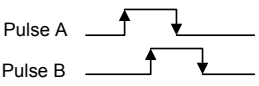
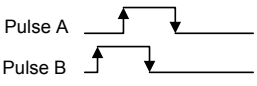
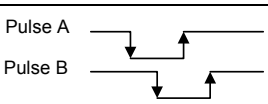
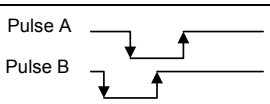


- In this section, the *fixed parameters* mean the *counter fixed parameters* if not otherwise mentioned.
- Refer to *1.3 Self-configuration* on page 1-12 to execute self-configuration of the Machine Controller before setting the fixed parameters.

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."

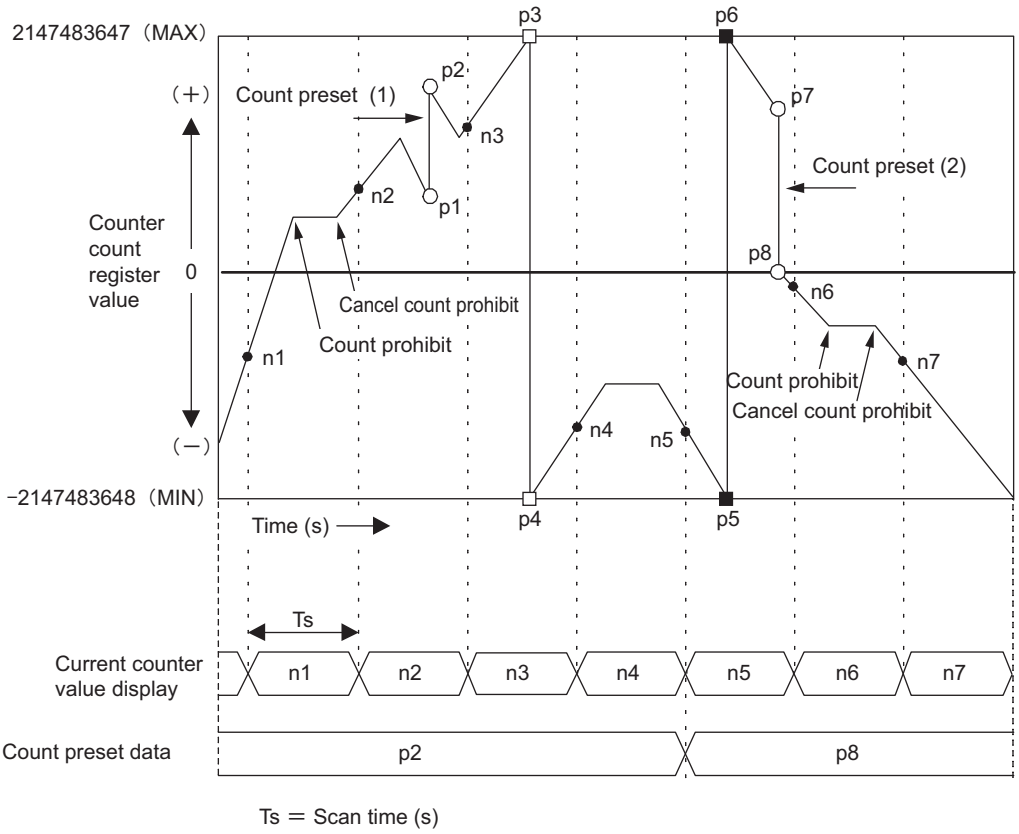
Pulse Counting Mode		Polarity	Up Count (Forward)	Down Count (Reverse)
Pulse and Direction*	× 1	Positive logic		
		Negative logic		
	× 2	Positive logic		
		Negative logic		
UP/DOWN Counter	× 1	Positive logic		
		Negative logic		
	× 2	Positive logic		
		Negative logic		
A/B Pulse	× 1	Positive logic		
		Negative logic		
	× 2	Positive logic		
		Negative logic		
	× 4	Positive logic		
		Negative logic		

* 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.



Ts = Scan time (s)

<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*.)

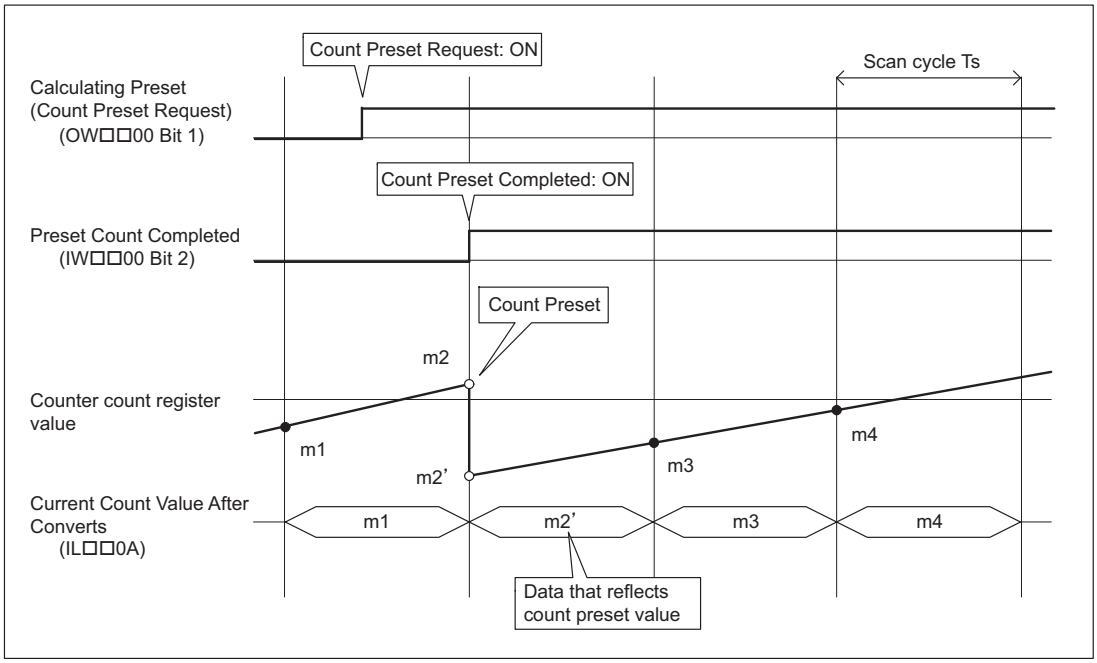


Fig. 4.8 Count Preset Completion Timing of LIO-06 Module

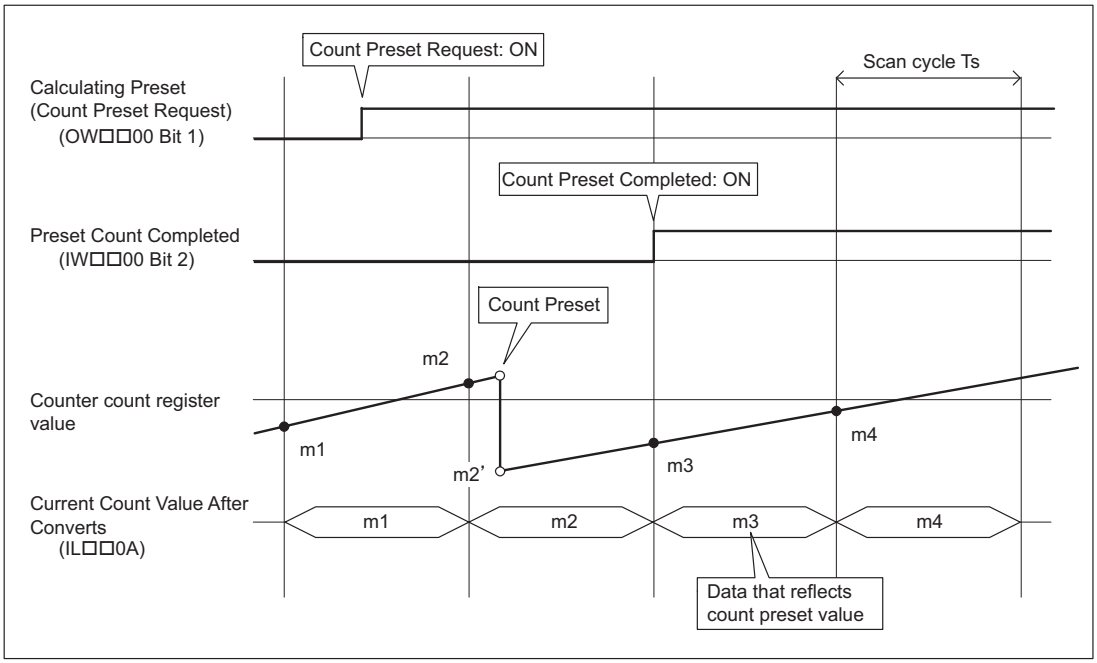


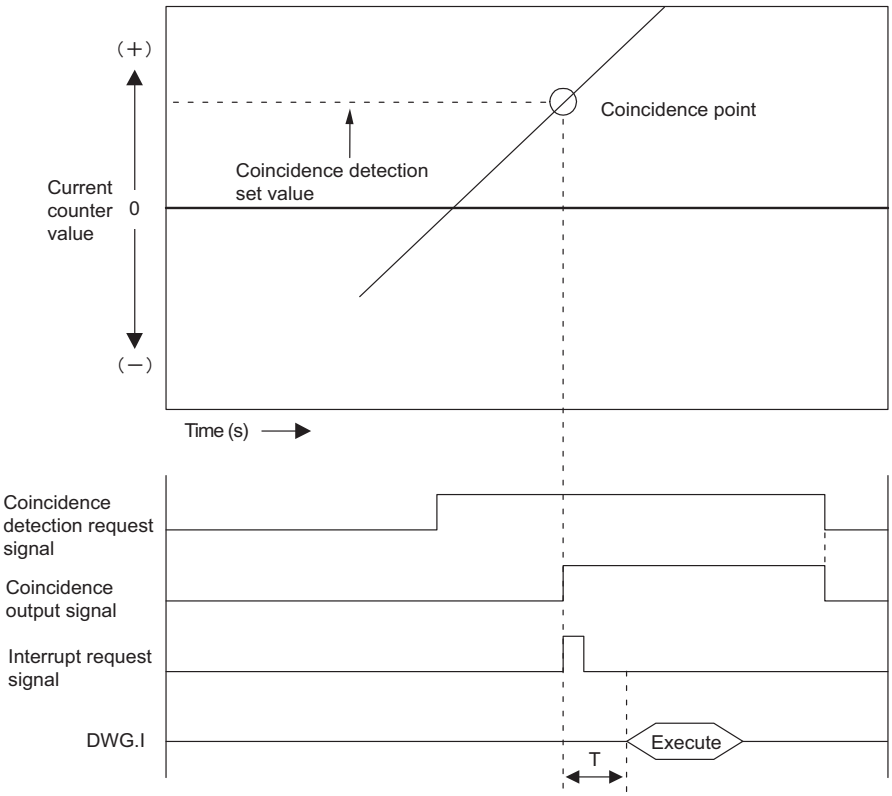
Fig. 4.9 Count Preset Completion Timing of CNTR-01 Module

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□□□□+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.

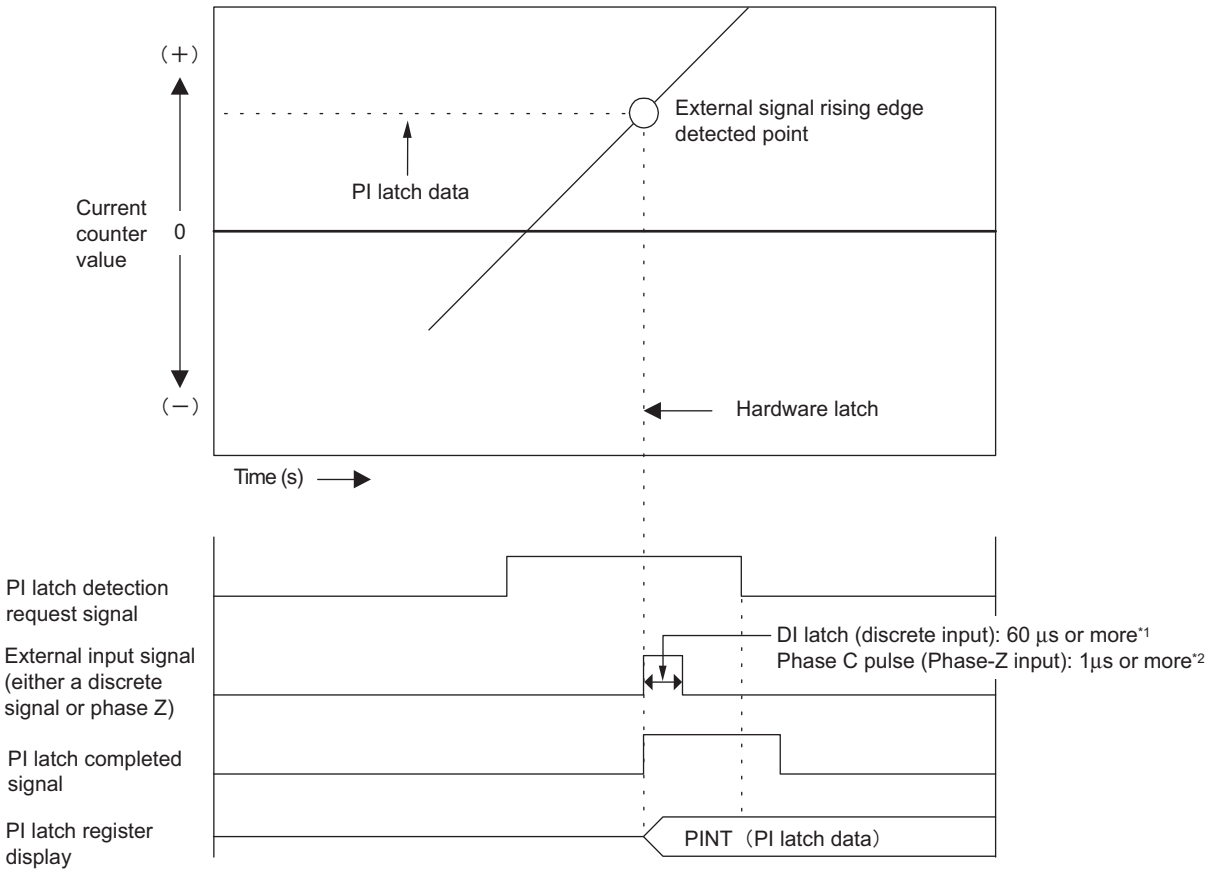


* T: Time when the coincidence point is detected to when DWG.I (interrupt drawing) starts execution (approx. 60 to 440 μs)

- 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.

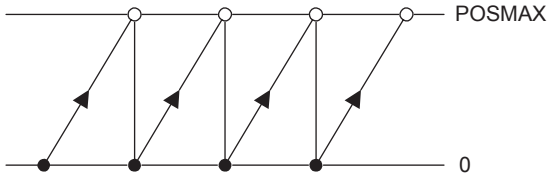


∗1. When discrete input is changed from ON to OFF, the next ON signal cannot be received unless at least 500 μs passes after the change.

∗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).

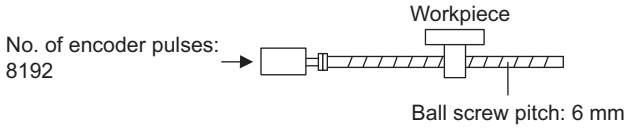


4.5 Electronic Gear Function

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 ÷ 6 = 1.666 revolutions
2048 × 4 pulses is 1 revolution. Therefore,
1.666 × 8092 = 13653 pulses
13653 pulses are input as reference pulses. The equation must be calculated at the host controller.

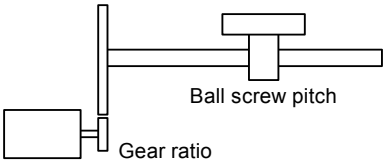
When the Electronic Gear is Used
To move a workpiece 10 mm:
Mechanical conditions and minimum reference unit are defined with electronic gear.
To move a workpiece 10 mm, the minimum reference unit is set to 1 μm. Therefore,
10 (mm) ÷ 1 (μm) = 10000
10000 is input as reference value.

4.5.2 Settings

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

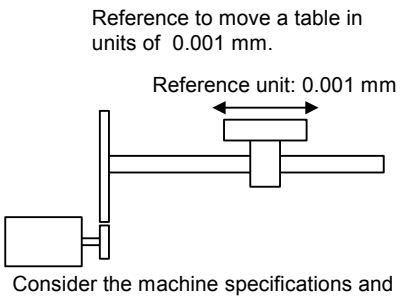
1. Confirm the machine specifications.

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).



- 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.

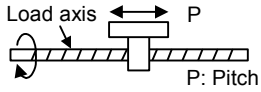
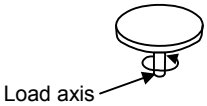
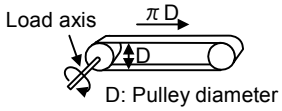
4. Find the load travel distance for each rotation of the load axis using the reference unit and set this distance to the counter fixed parameter No. 10 (Travel Distance per Machine Rotation).

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

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
 One rotation = $\frac{P}{\text{Reference unit}}$	 One rotation = $\frac{360^\circ}{\text{Reference unit}}$	 One rotation = $\frac{\pi D}{\text{Reference unit}}$

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:

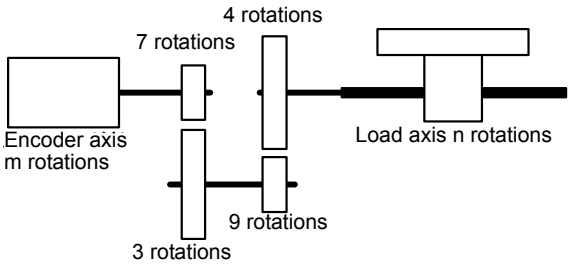
No. 11 (Encoder Gear Ratio) = m rotations

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) × (4/9) = 4/21

Therefore, set the following values:

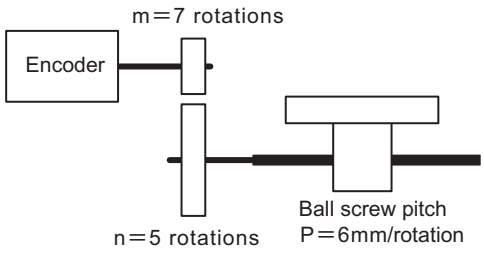
No.11 (Encoder Gear Ratio) = 4 (rotations)

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.

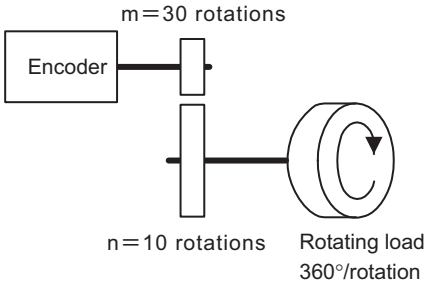
(1) Example A: Ball Screw



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 mm/0.001 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°, the setting of each parameter will be as follows:

- Moving Amount Per Machine Rotation = 360°/0.1° = 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.

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

* Ts: Scan time setting

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

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

* 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.)

5

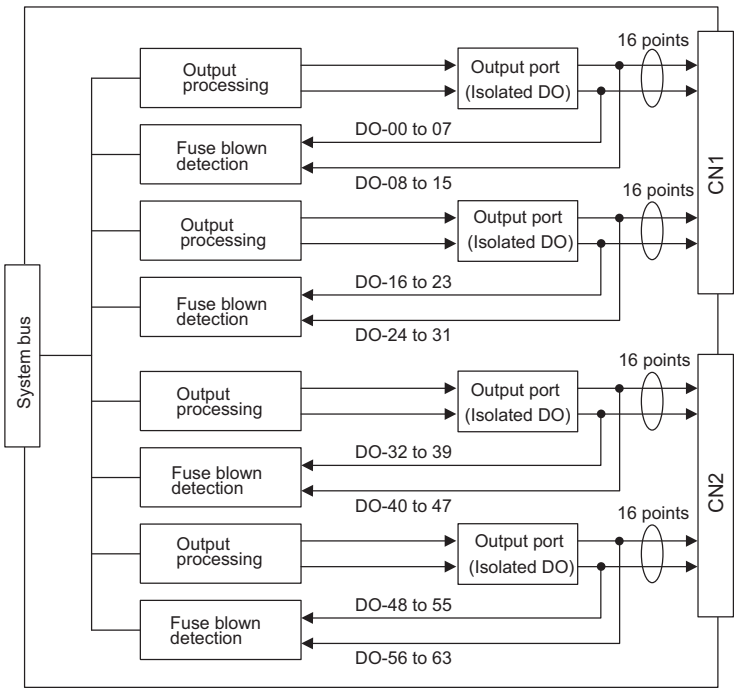
DO-01 Module

This chapter describes DO-01 Module in detail.

5.1 Outline of DO-01 Module

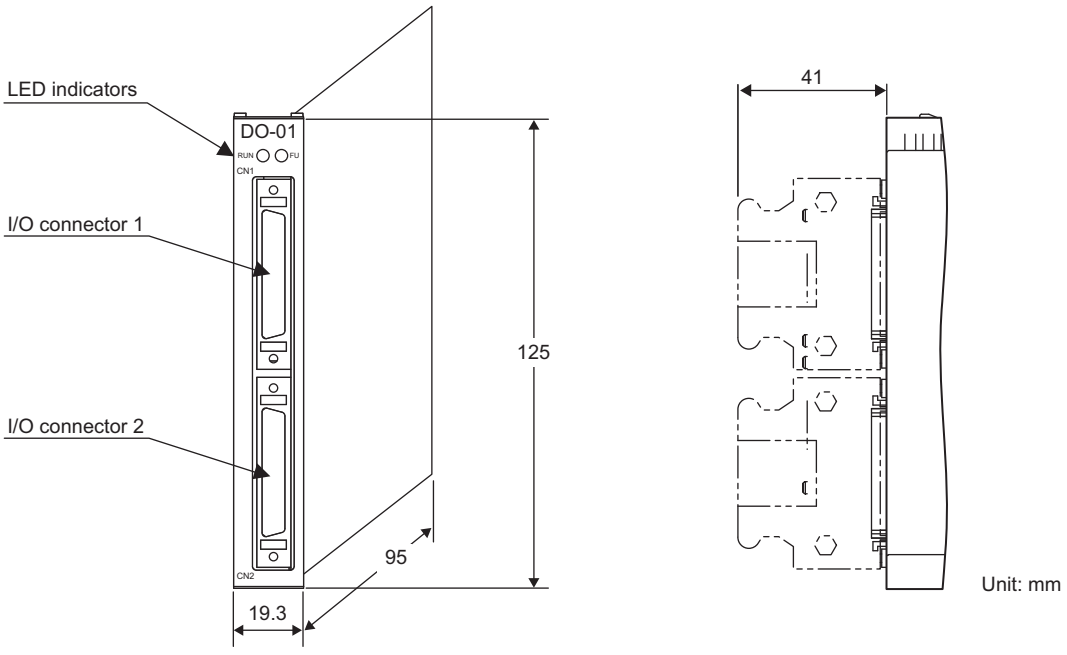
5.1.1 Outline of Functions

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 External power supply voltage: 24 VDC±20% (+19.2 V to +28.8 V) Output current: 100 mA max.
Connectors	CN1: Output connector CN2: Output connector
LED Indicators	RUN (green) 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: • 10 to 57 Hz with single-amplitude of 0.075 mm • 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 • 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)
	Shock Resistance	Conforming to JIS B 3502: Peak acceleration of 147 m/s^2 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.

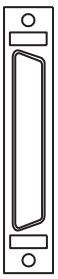
Indicator	Color	When Lit	When Unlit
RUN	Green	Normal operation	Error occurrence
FUSE	Red	One or some of the output protection fuses is blown out.	Output protection fuses are normal.

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

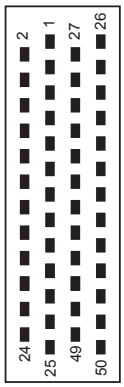


Name	Connector Name	No of Pins	Connector Model		
			Module Side	Cable Side	Manufacturer
External I/O Connector	CN1/CN2	50	10250-52A3PL (Conforming to RoHS)	• Connector 10150-3000PE • Shell 10350-52A0-008 (Screw locking), or 10350-52F0-008 (One-touch locking)	3M Japan Limited

(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)



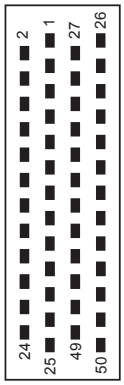
2	DO_00	1	+24V_1	27	DO_01	26	0V_1
4	DO_04	3	DO_02	29	DO_15	28	DO_03
6	0V_1	5	DO_06	31	0V_1	30	DO_07
8	DO_08	7	+24V_2	33	DO_09	32	0V_2
10	DO_12	9	DO_10	35	DO_13	34	DO_11
12	0V_2	11	DO_14	37	0V_2	36	DO_15
14	DO_16	13	+24V_3	39	DO_17	38	0V_3
16	DO_20	15	DO_18	41	DO_21	40	DO_19
18	0V_3	17	DO_22	43	0V_3	42	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	27	DO_33	26	0V_5
4	DO_36	3	DO_34	29	DO_37	28	DO_35
6	0V_5	5	DO_38	31	0V_5	30	DO_39
8	DO_40	7	+24V_6	33	DO_41	32	0V_6
10	DO_44	9	DO_42	35	DO_45	34	DO_43
12	0V_6	11	DO_46	37	0V_6	36	DO_47
14	DO_48	13	+24V_7	39	DO_49	38	0V_7
16	DO_52	15	DO_50	41	DO_53	40	DO_51
18	0V_7	17	DO_54	43	0V_7	42	DO_55
20	DO_56	19	+24V_8	45	DO_57	44	0V_8
22	DO_60	21	DO_58	47	DO_61	46	DO_59
24	0V_8	23	DO_62	49	0V_8	48	DO_63
		25				50	

■ CN2 Connector Details

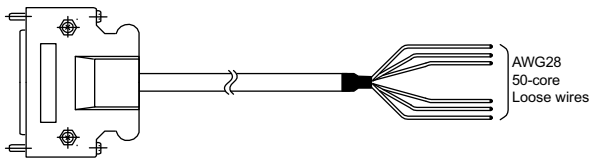
Pin No.	Signal Name	I/O	Remarks	Pin No.	Signal Name	I/O	Remarks
1	+24V-5	P	+24-V power supply 5	26	0V-5	P	Common ground 5
2	DO-32	O	Digital output 32	27	DO-33	O	Digital output 33
3	DO-34	O	Digital output 34	28	DO-035	O	Digital output 35
4	DO-36	O	Digital output 36	29	DO-037	O	Digital output 37
5	DO-38	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 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

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. OFF: 1 ms max.
Number of Commons	8 (8 points/common)
Protection Circuit	Fuse connected to each common line
Fuse Rating	1 A
Error Detection	Fuse blown detection Replace the Module when the fuse blown is detected.

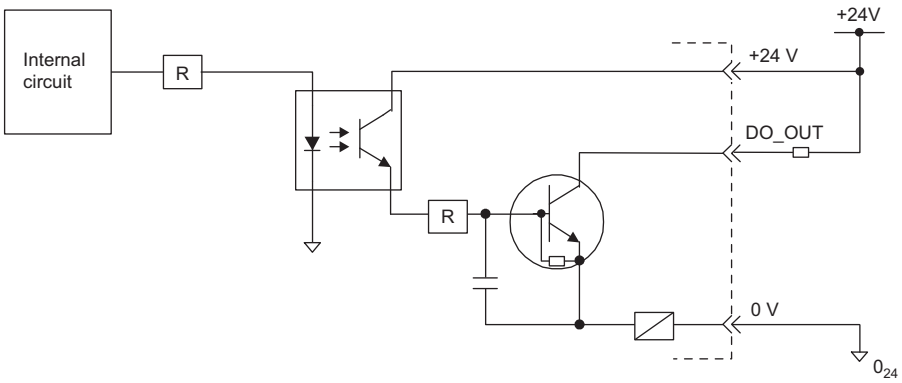
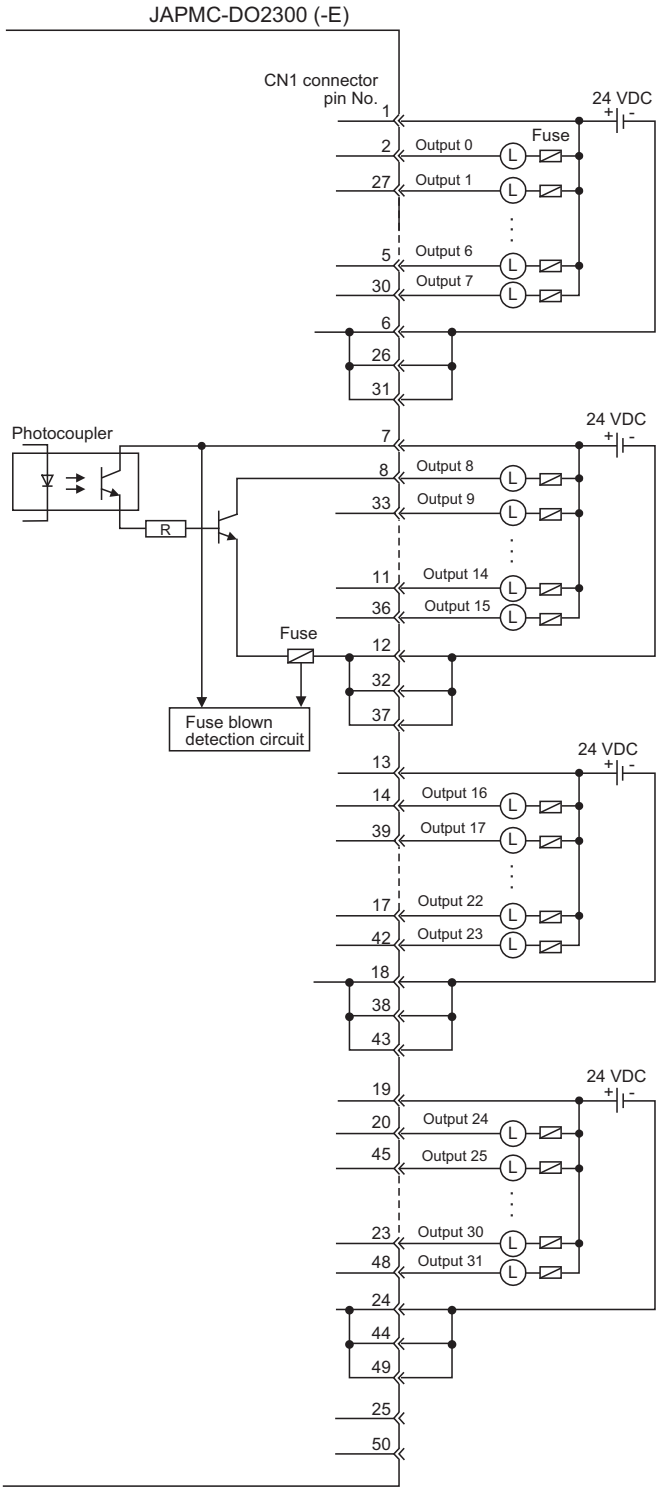


Fig. 5.1 DO-01 Digital Output Circuit (Sink Mode Output)

5.2.4 DO-01 Module Connections

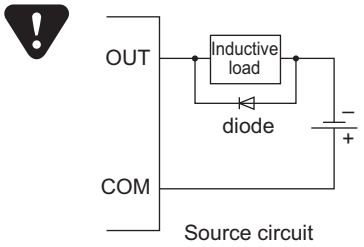
The following diagrams show connection examples for CN1/CN2 connector of the DO-01 Module.

(1) CN1 Connector



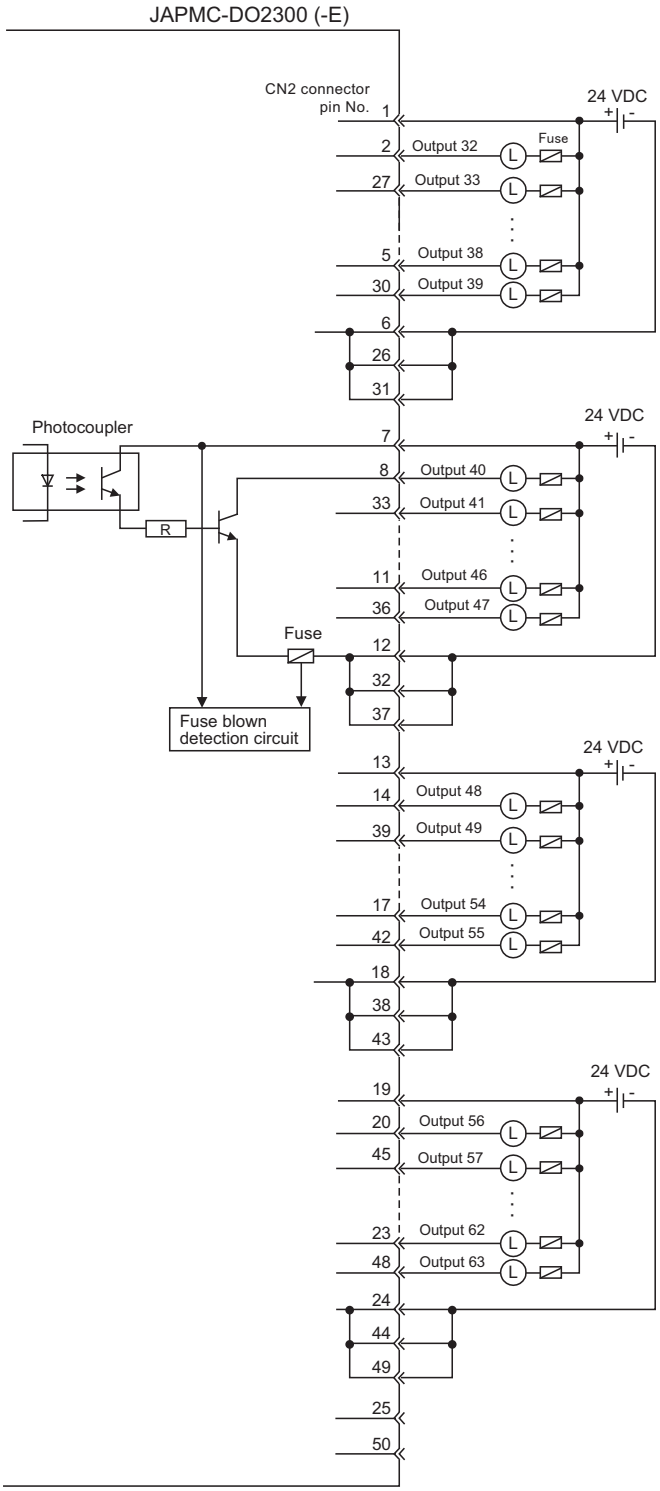
- The pins No. 6, 26, and 31, the pins 12, 32, and 37, the pins 18, 38, and 43, and the pins No. 24, 44, and 49 are internally connected. Connect them externally as well.

- 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.



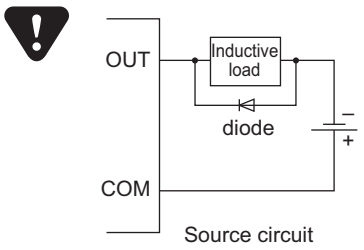
- If you connect an inductive load, connect a diode parallel to the load to absorb counter electromotive force.
  - Backward voltage: 10 times the load voltage or greater
  - Forward current: Load current or greater

(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.



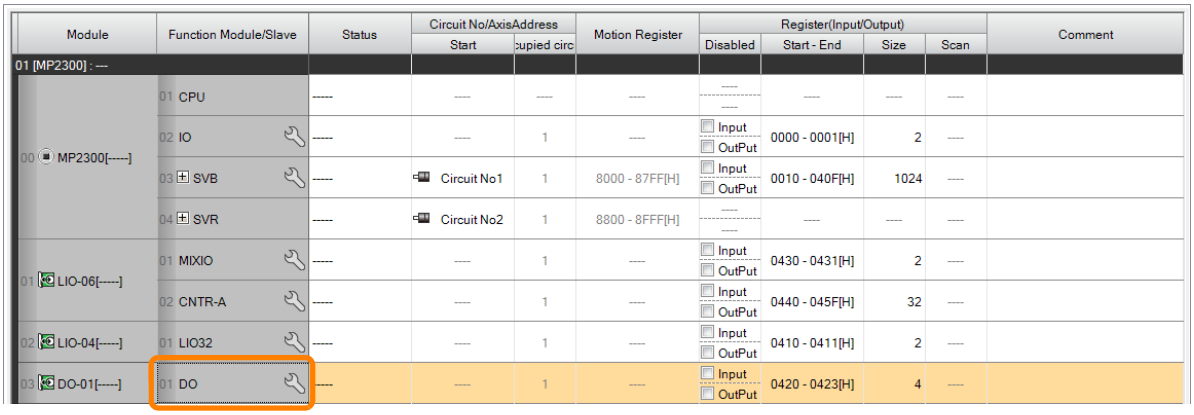
- If you connect an inductive load, connect a diode parallel to the load to absorb counter electromotive force.
  - Backward voltage: 10 times the load voltage or greater
  - Forward current: Load current or greater

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.

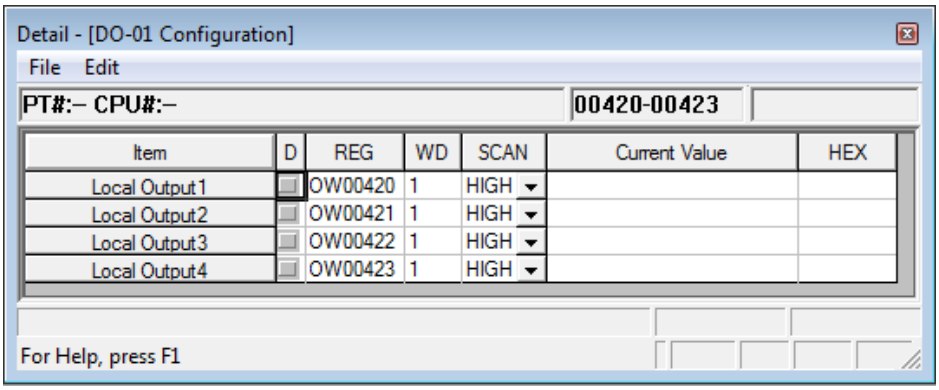


A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **DO-01 Configuration** Window will be displayed.

- 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.



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.

6

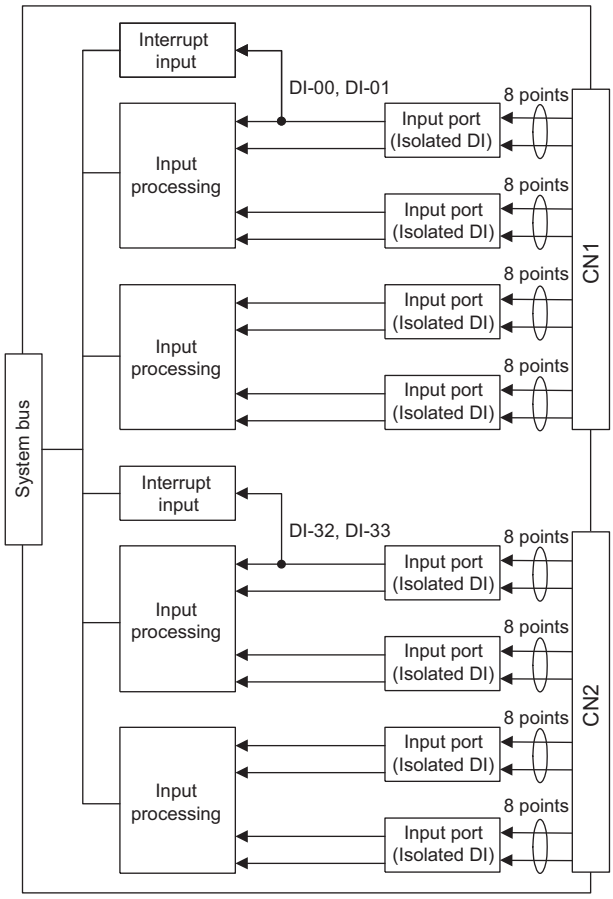
DI-01 Module

This chapter describes DI-01 Module in detail.

6.1 Outline of DI-01 Module

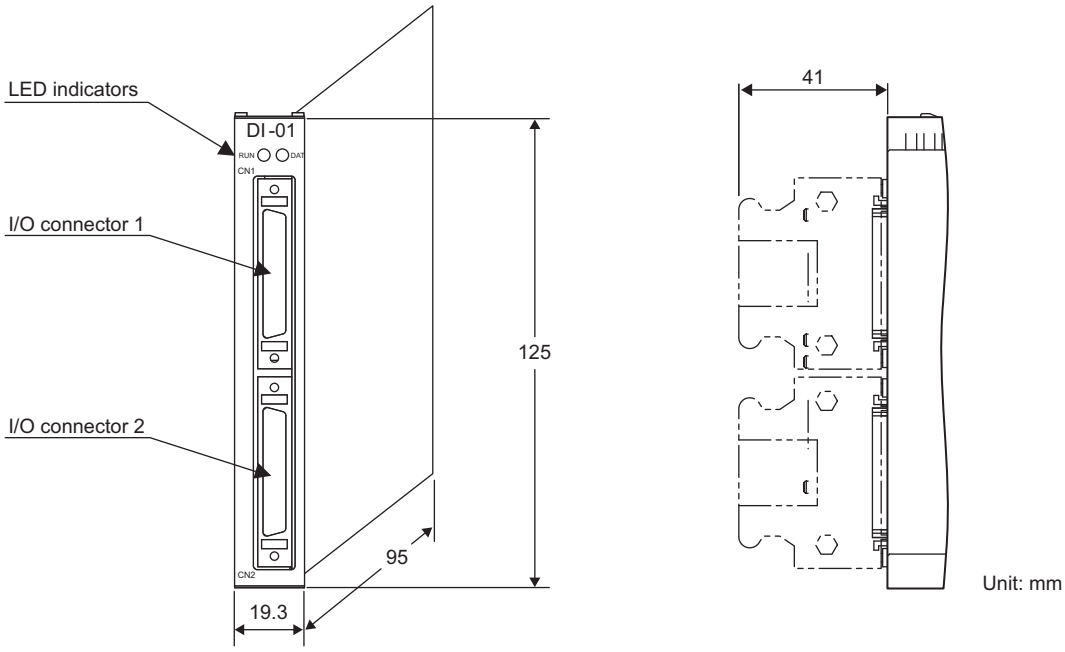
6.1.1 Outline of Functions

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.



Unit: mm

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 24 VDC ± 20% (+19.2 V to +28.8 V), 4.1 mA (TYP), combined sink mode/ source mode inputs (DI-00, -01, -32, and -33 also used for interrupts) Number of simultaneously ON inputs: 10 (with 24 VDC), 7 (with 28.8 VDC) For details on the number of simultaneously ON inputs, refer to *(3) Number of Simultaneously ON Inputs - Ambient Temperature Characteristics* on page 6-4.
Connectors	CN1: Input connector CN2: Input connector
LED Indicators	RUN (green) DAT (green)
Current Consumption	500 mA max.
Dimensions (mm)	125 × 95 (H× D)
Mass	170 g

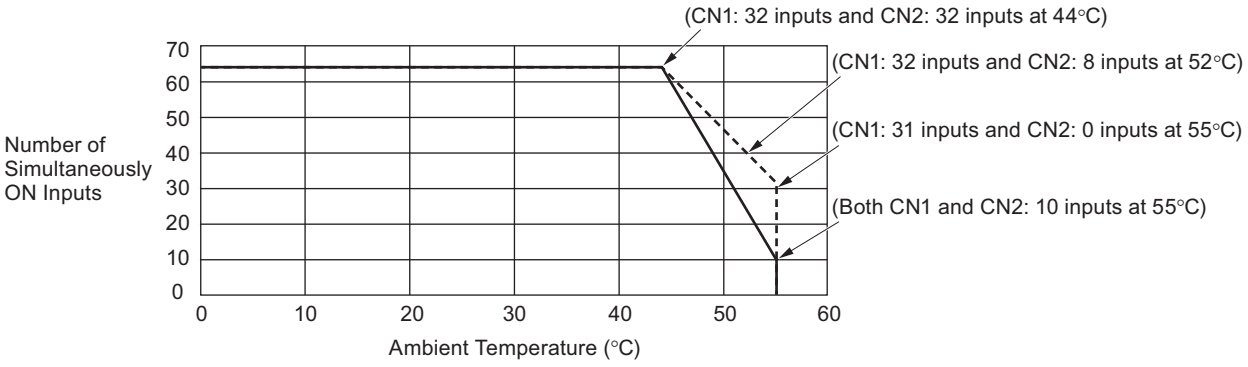
(2) Environmental Conditions

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: • 10 to 57 Hz with single-amplitude of 0.075 mm • 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 • 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)
	Shock Resistance	Conforming to JIS B 3502: Peak acceleration of 147 m/s^2 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

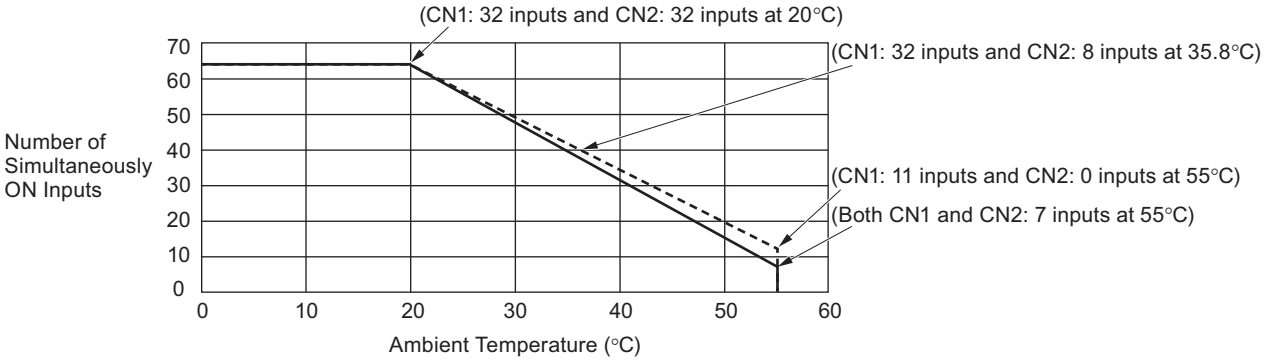
The following graph shows the number of inputs that can be simultaneously ON depending on the ambient temperature.

■ 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.

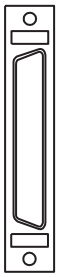
Indicator	Color	When Lit	When Unlit
RUN	Green	Normal operation	Error occurrence
DAT	Green	One or some of the DI signals is input.	No DI signals are input.

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

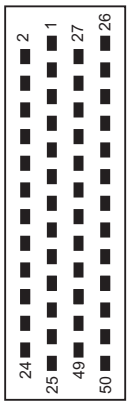


Name	Connector Name	No of Pins	Connector Model		
			Module Side	Cable Side	Manufacturer
External I/O Connector	CN1/CN2	50	10250-52A3PL (Conforming to RoHS)	• Connector 10150-3000PE • Shell 10350-52A0-008 (Screw locking), or 10350-52F0-008 (One-touch locking)	3M Japan Limited

(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)



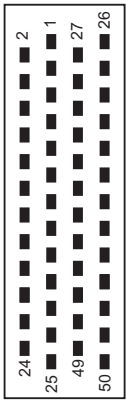
2	DI_00	1	COM_1	27	DI_01	26	
4	DI_04	3	DI_02	29	DI_05	28	DI_03
6		5	DI_06	31		30	DI_07
8	DI_08	7	COM_2	33	DI_09	32	
10	DI_12	9	DI_10	35	DI_13	34	DI_11
12		11	DI_14	37		36	DI_15
14	DI_16	13	COM_3	39	DI_17	38	
16	DI_20	15	DI_18	41	DI_21	40	DI_19
18		17	DI_22	43		42	DI_23
20	DI_24	19	COM_4	45	DI_25	44	
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)



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

■ CN2 Connector Details

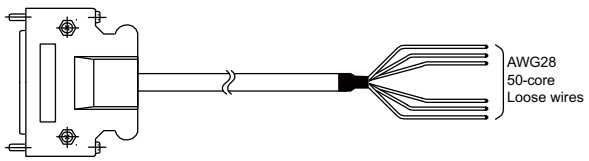
Pin No.	Signal Name	I/O	Remarks	Pin No.	Signal Name	I/O	Remarks
1	COM_5	P	Input common 5	26			
2	DI_32	I	Digital input 32 (shared with interrupt input)	27	DI_33	I	Digital input 33 (shared with interrupt input)
3	DI_34	I	Digital input 34	28	DI_35	I	Digital input 35
4	DI_36	I	Digital input 36	29	DI_37	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. DI_01, DI_32, and DI_33 are the same as DI_00.

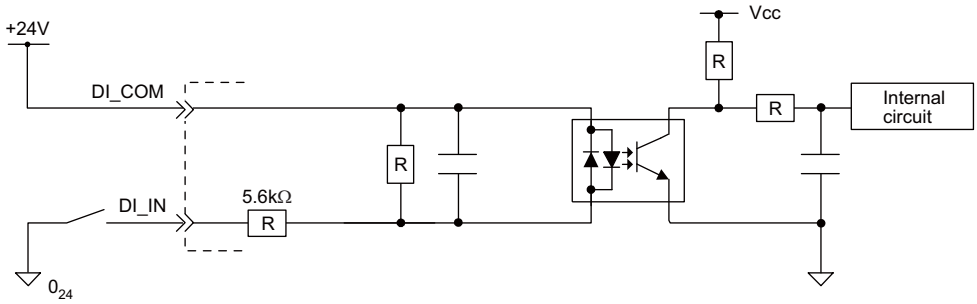


Fig. 6.1 Digital Input Circuit (Source Mode Input)

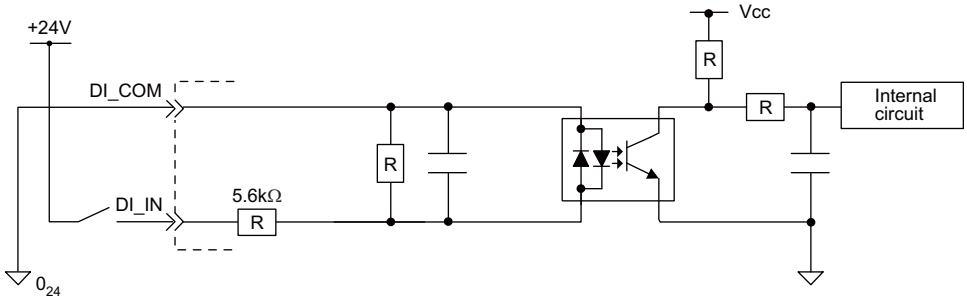
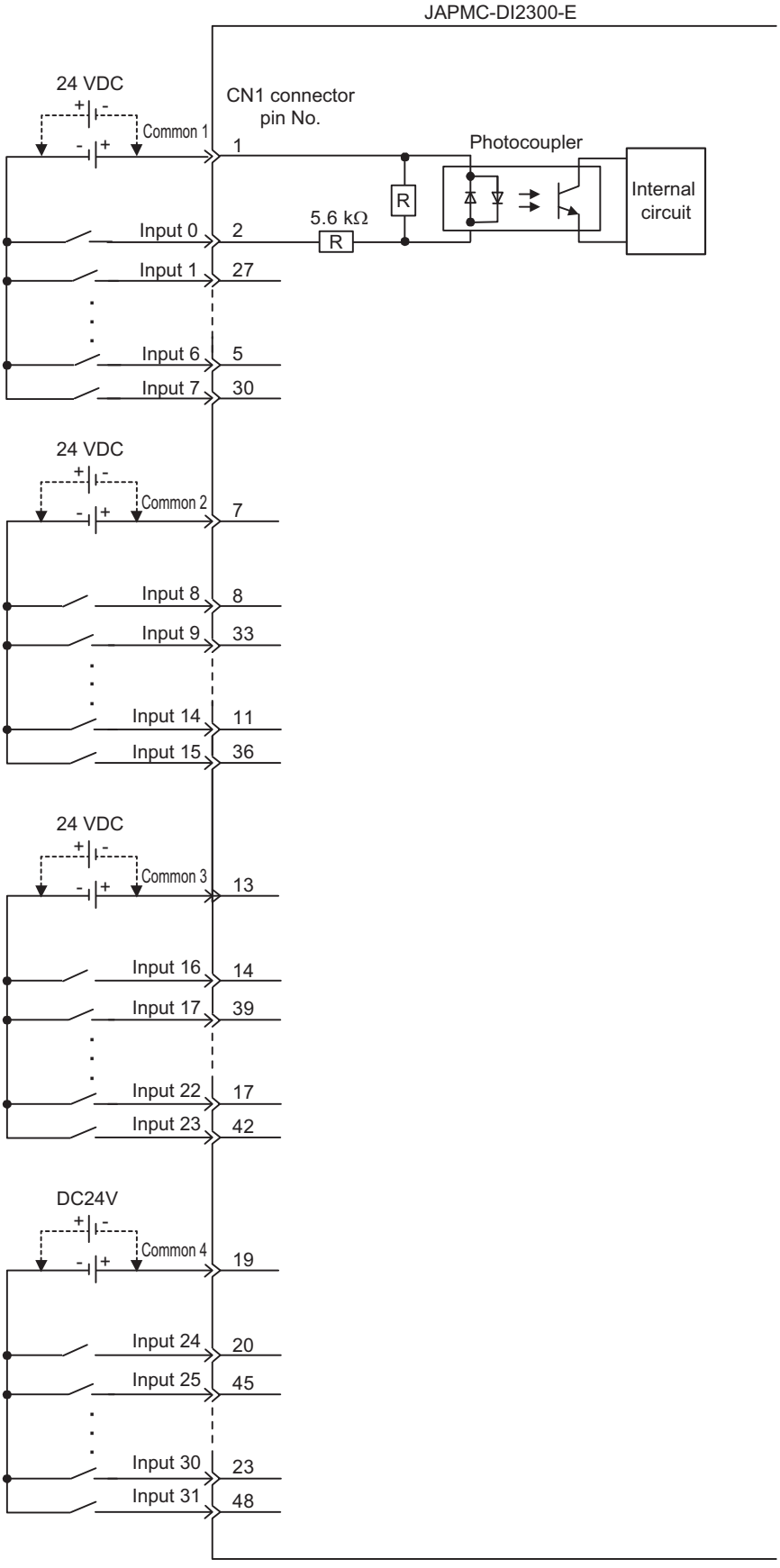


Fig. 6.2 Digital Input Circuit (Sink Mode Input)

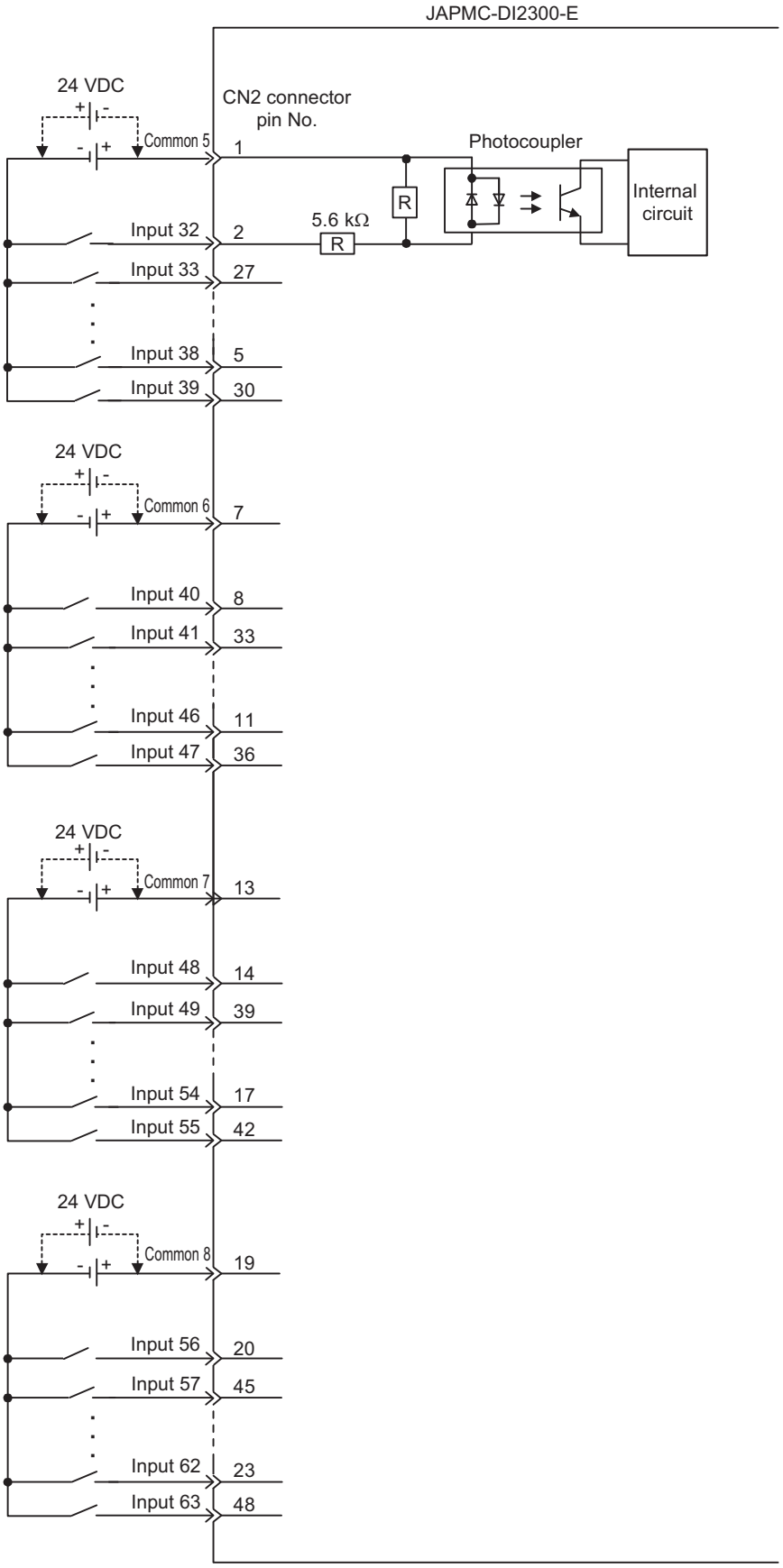
6.2.4 DI-01 Module Connections

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

(1) CN1 Connector



(2) CN2 Connector

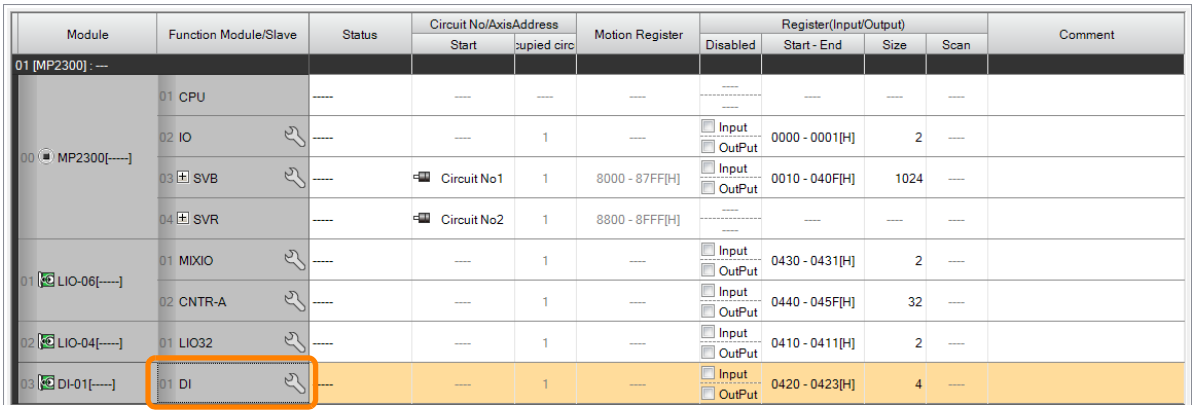


6.3 DI-01 Module Details

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.

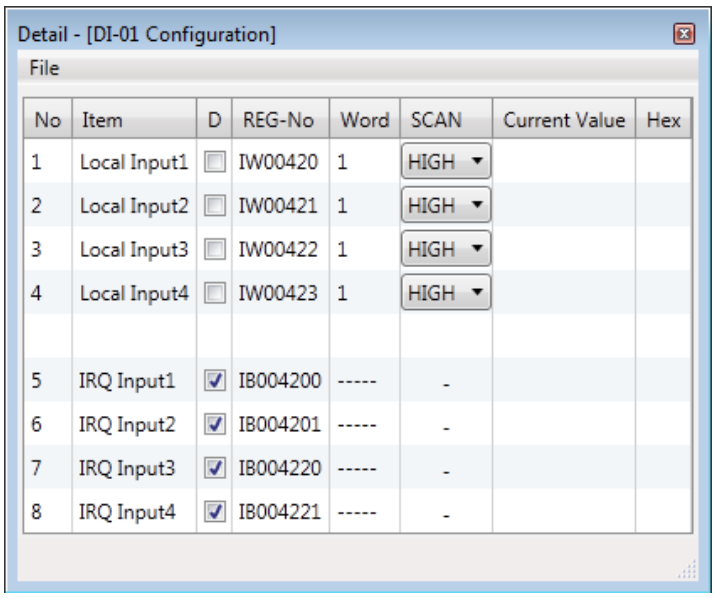


A confirmation box for creating a new file will be displayed. Click the **OK** Button. The **DI-01 Configuration** Window will be displayed.

- 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	☐	IW00420	1	HIGH		
2	Local Input2	☐	IW00421	1	HIGH		
3	Local Input3	☐	IW00422	1	HIGH		
4	Local Input4	☐	IW00423	1	HIGH		
5	IRQ Input1	☑	IB004200	-----	-		
6	IRQ Input2	☑	IB004201	-----	-		
7	IRQ Input3	☑	IB004220	-----	-		
8	IRQ Input4	☑	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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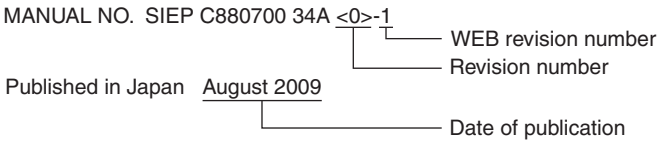
Revision History

The date of publication, revision number, and web revision number are given at the bottom right of the back cover. Refer to the following example.



Date of Publication	Rev. No.	WEB Rev. No.	Section	Revised Contents
April 2020	<12>	1	2.2.2, 3.2.2, 5.2.2, 6.2.2	Partly revised
December 2019		0	Preface, 1.1.2	Partly revised
			Chapter 6	Newly added
			Back cover	Revision: Address
December 2018	<11>	0	Back cover	Revision: Address
February 2018	<10>	0	2.1.3 (2), 3.1.3 (2), 4.1.3 (2), 5.1.3 (2)	Revision: Pollution Level, Noise Resistance
November 2017	<9>	0	–	Printed version of the manual that is available on the web (web version: SIEP C880700 34F<8>-2)
			Back cover	Revision: Address
February 2017	<8>	2	3.3.2	Revision: Hardware models for which restrictions apply
January 2017		1	3.3.2	Addition: Restrictions for local I/O definitions for the LIO-04 or LIO-05 Module.
			Back cover	Revision: Address
November 2016		0	–	Printed version of the manual that is available on the web (web version: SIEP C880700 34F<7>-1)
November 2015	<7>	1	3.2.1 (1), 4.2.1 (1), 5.2.1 (1)	Revision: Sumitomo 3M Corporation → 3M Japan Limited
			4.1.3 (1)	Revision: DI_07 → DO_07
October 2015		0	–	Printed version of the manual that is available on the web (web version: SIEP C880700 34E<6>-1)
September 2015	<6>	1	Front cover	Revision: Format
			2.2.1 (2), 2.2.4, 2.2.6, 3.2.5, 3.2.6,	Revision: Description of signal name of module connector
			Back cover	Revision: Format and address
November 2014		0	–	Printed version of the user's manual that is available on the web (web version: SIEP C880700 34D<5>-1)
			Back cover	Revision: Address
July 2014	<5>	1	2.2.6 (1), (2), 3.2.5 (1), (2), 3.2.6, 4.2.8, 5.2.4 (1), (2)	Addition: Precautions for connecting diode
July 2013		0	Back cover	Revision: Address
December 2012	<4>	0	Back cover	Revision: Address
January 2012	<3>	0	–	SIEP C880700 34C<2>-2, available on the Web.
			Back cover	Revision: Address
November 2011	<2>	2	2.3.2 (4)	Revision: Output Data Details DI latch setting of OW□□01 0001H→0000H
September 2011		1	2.2.1 (1)	Revision: I/O connector model
June 2011		0	–	SIEP C880700 34B<1>-1, available on the Web.
December 2010	<1>	1	2.4.1, 4.4.1	Addition: Description of parameter setting
November 2010		0	–	SIEP C880700 34A<0>-4, available on the Web.
			Front cover	Revision: Format
			Back cover	Revision: Address, format

Date of Publication	Rev. No.	WEB Rev. No.	Section	Revised Contents
June 2010	<0>	4	2.2.2 (1), 3.2.2 (1), 4.2.2 (1), 5.2.2 (1)	Revision: Information on external appearance of standard cable
			3.2.1 (2), (3)	Revision: CN2 connector details
			3.3.2	Addition: Description of register number
December 2009		3	3.2.1 (1), 4.2.1 (1), 5.2.1 (1)	Revision: Connector model at cable side
			3.2.1 (1), 5.2.1 (1)	Addition: Description of RoHS
September 2009		2	Preface	Addition: Warranty
			Back cover	Revision: Address
August 2009		1	Preface, 1.1.1, 1.1.2, 1.2.1, 1.2.2, 1.3.1, 1.4.2	Addition: Information on MP2310 Module
			2.2.6 (2)	Revision: Names of external output signals
			3.1.2	Revision: Connectors name of LIO-04 module
			4.2.8	Revision: Description of voltages of external devices
			Back cover	Revision: Address
February 2008	–	–	–	First edition

Machine Controller MP2000 Series

I/O Module
USER'S MANUAL

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