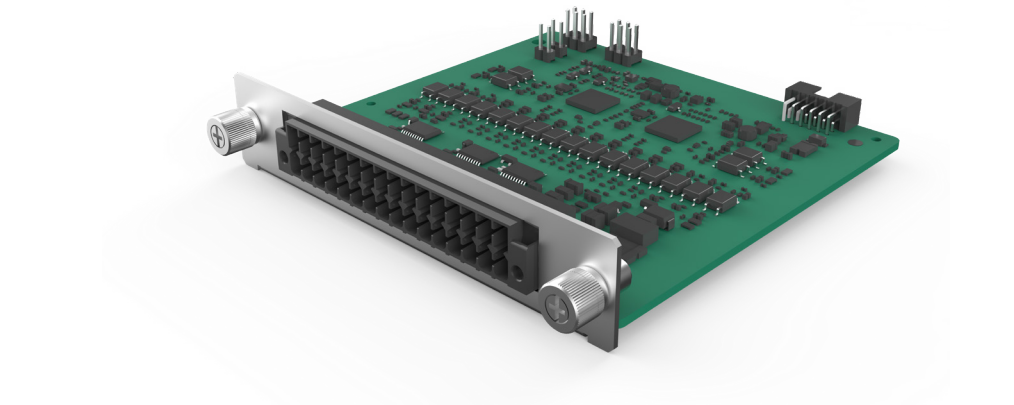




IRCB501Series

19012414A00

Functional Safety Expansion Card User Guide

Preface

Thank you for purchasing the Inovance IRCB501 series expansion card.

The IRCB501 series expansion cards are developed specifically to expand resources for robot control systems. This series includes encoder expansion cards and I/O expansion cards.

This guide provides product safety information, expansion card installation instructions, safety parameter commissioning and maintenance instructions, and other related information. Please read this guide carefully, especially if you are using this product for the first time, and make sure to understand the safety precautions. If you are an equipment manufacturer, make sure to send this guide along with your equipment to end users for future reference.

During the use of this product, you may need to consult the following guides:

Doc Name	Data Code
IRCB501 Series Robot Control Cabinet User Guide	PS00010914
IRCB501 Series High-Protection Robot Control Cabinet User Guide	PS00015334

User guides may be updated without prior notice. You may download the latest version at www.inovance.com.

1. Product Information

Expansion Card

Name	Model	Function
Robot functional safety expansion card	IRCB501-FS-01-BD	Expands the safety function for robot control cabinets

Installation Dimensions

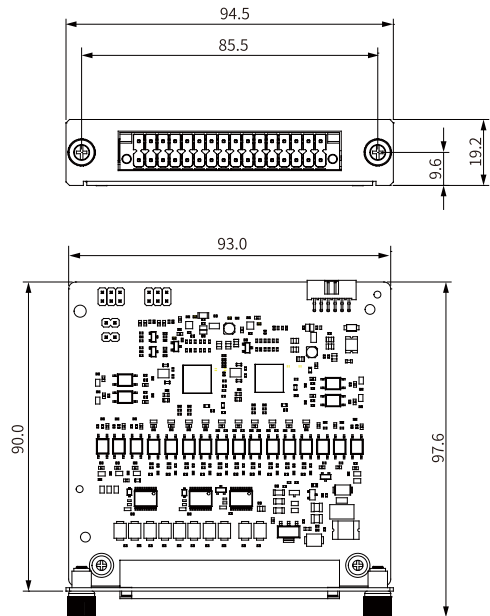


Figure 1 Dimensions of the robot functional safety expansion card (unit: mm)

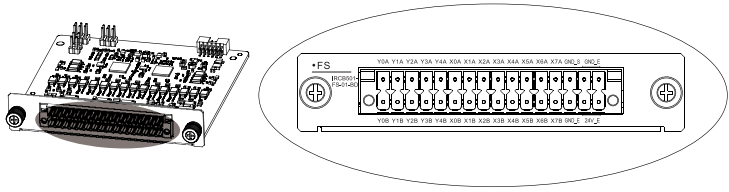


Figure 2 Dimensions of the GETV05010 wire pin (unit: mm)

DI Terminal Assignment and Product Specifications

Meaning	I/O Number	Meaning	I/O Number	Name
X0A	DI0A	X0B	DI0B	DI for safety input
X1A	DI1A	X1B	DI1B	
X2A	DI2A	X2B	DI2B	
X3A	DI3A	X3B	DI3B	
X4A	DI4A	X4B	DI4B	
X5A	DI5A	X5B	DI5B	
X6A	DI6A	X6B	DI6B	
X7A	DI7A	X7B	DI7B	
GND_S	Common terminal of safety DI			

Item	Specifications
Channel quantity	16 (X0A to X7A, and X0B to X7B)
Input mode	Source (PNP)
Maximum input voltage	30 V
Input impedance	> 4 kΩ
Input voltage when input is ON	18 VDC to 30 VDC
Input voltage when input is OFF	0 VDC to 3 VDC
Hardware response time	ON/OFF: 250 μs/250 μs
Frequency range	1 kHz
Ambient temperature and humidity	Temperature: 0° C to 45° C; humidity: 20% to 95% RH (30° C), non-condensing
Storage temperature and humidity	Temperature: -10° C to +60° C; humidity: < 95% RH (30° C), non-condensing

DO Terminal Assignment and Product Specifications

Meaning	I/O Number	Meaning	I/O Number	Name
Y0A	DO0A	Y0B	DO0B	DO for safety output
Y1A	DO1A	Y1B	DO1B	
Y2A	DO2A	Y2B	DO2B	
Y3A	DO3A	Y3B	DO3B	
Y4A	DO4A	Y4B	DO4B	
24V_E	These terminals are used to input external power supply to the DO circuit. There is a built-in overvoltage and overcurrent protection circuit.			
GND_E				

Item	Specifications
Channel quantity	10 (Y0A to Y4A, and Y0B to Y4B)
Output mode	Sink (NPN)
Operating voltage range	0 VDC to 29 VDC
24V_E and GND_E power supply	24 V±20%, 0.2 A
Output load (resistive load)	0.4A/point
Hardware response time	< 250 μs (OFF to ON)/250 μs (ON to OFF)
Leakage current	Maximum 350 μA at 24 V
Short circuit protection	Current limiting protection (0.8 A)
Maximum output frequency	1 kHz

Note: The ambient and storage temperature and humidity requirements of the DI terminals are the same as that of the DO terminals. The ambient temperature and humidity range of the expansion card matches all robot control cabinets.

2. External Wiring

Cable Preparation

Wire pin structure:

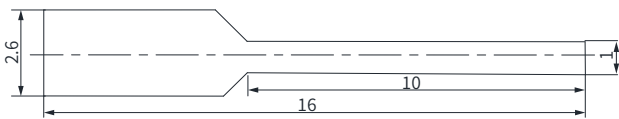


Figure 2 Dimensions of the GETV05010 wire pin (unit: mm)

Item	Description
Part code	15074039
Applicable cable size	20 AWG to 24 AWG
Color	Orange
Packing unit	Approx. 120 pcs/pack
Materials	Oxygen-free copper alloy and PVC
Surface treatment	Tin-plated
Current carrying capacity	Maximum 8 A

Recommended crimp tool: Hoop-type manual crimp tool (10 AWG to 28 AWG)



Cable preparation procedure:

- Step 1: Strip off 10 mm of the wire insulation.
- Step 2: Thread the cable through the cable marking sleeve.
- Step 3: Thread the cable conductor through the round hole of the wire pin. Crimp the wire pin with the crimping pliers recommended by the wire pin manufacturer.
- Step 4: Insert the wire pin into the corresponding hole on the I/O port terminal block. Pull back the wire pin to ensure that it is securely locked by the spring in the terminal block.

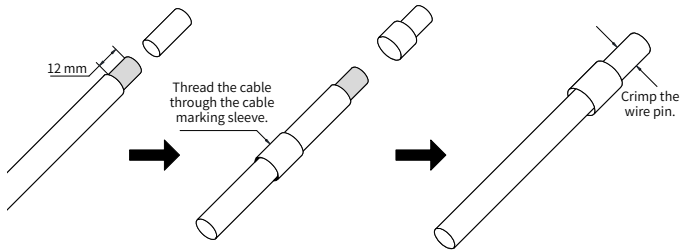


Figure 3 Cable preparation procedure

Sink Output and Source Output

NOTE

The GND_S terminal is the common terminal for the 16 DIs. When GND_S is connected to the 24V terminal, 0 V input to terminals X* A and X* B is considered invalid (internal photocoupler disconnected). Conversely, when GND_S is connected to the 0V terminal, 24 V input to terminals X* A and X* B is considered valid (internal photocoupler connected). This setup allows for the connection of PNP output I/O devices.

(1) Sink output (negative common terminal)

When the load current flows into the output (Y) terminal, the output is called sink output (or NPN output), which is low-level output.

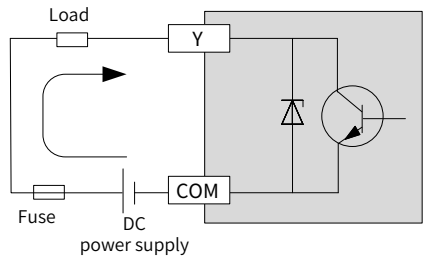


Figure 4 Sink output

(2) Source output (positive common terminal)

When the load current flows out from the output (Y) terminal, the output is called source output (or PNP output), which is high-level output.

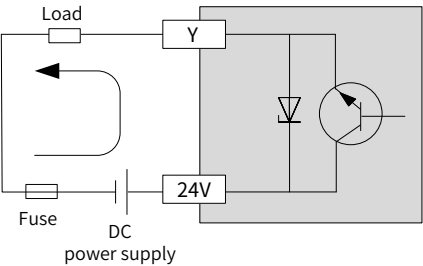


Figure 5 Source output



NOTE

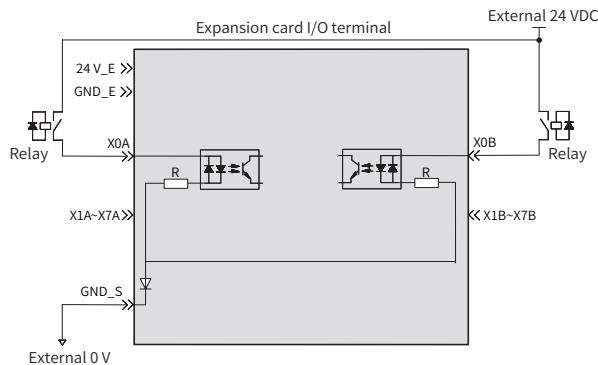
An NPN output provides a low level, while a PNP output provides a high level.

Input Wiring Diagram

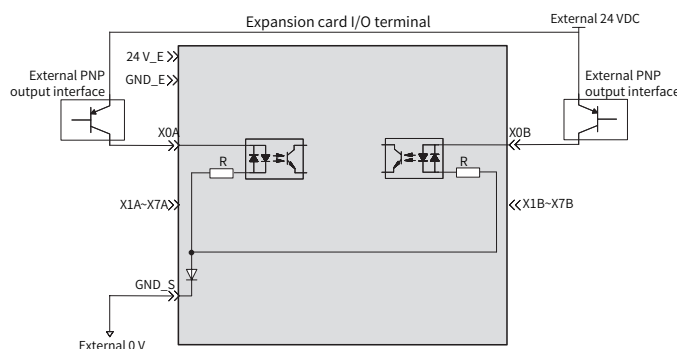
The following diagrams take X0A as an example (X1A to X7A and X0B to X7B are the same as X0A). An external 24 V power supply is used.

For functional safety requirements, the load connection needs to be in a dual-input loop, where X0_A and X0_B form a pair. If only X0_A is connected, an alarm will be triggered.

(1) When the host controller provides relay output:



(2) When the host controller provides open-collector output:



If an external 24 V power supply is used to power DIs and the DO function is not needed, you may either connect 24V_E and GND_E or leave them unconnected. If the DO function is needed, it is necessary to wire the DO terminals according to the instructions.

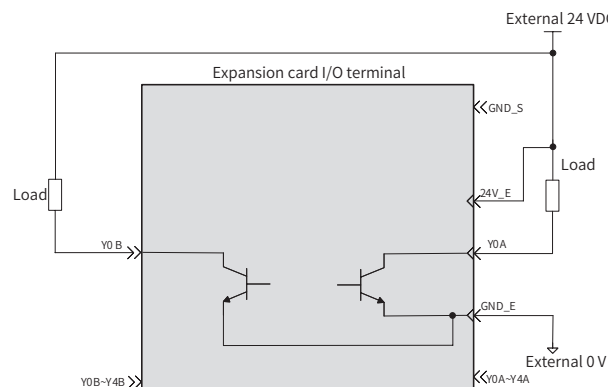


NOTE

- ◆ To ensure proper operation of the DO ports, the 24V_E and GND_E terminals must be connected to a 24 V power supply.
- ◆ When using an external 24 V power supply, connect the positive and negative poles of the external power supply to 24V_E and GND_E, respectively, through I/O terminals. Note that the maximum driving current of each channel is 0.4 A. When the output current of any single channel exceeds 0.8 A, an "overcurrent" alarm occurs.
- ◆ It is prohibited to short-circuit the output directly with the +24V terminal.
- ◆ It is prohibited to connect the output to the 0V terminal of the power supply and GND_E to the +24V terminal of the power supply.
- ◆ The voltage of the load connected to the output must be less than 29 V.

Here we take Y0A as an example (Y1A to Y4A and Y0B to Y4B are the same as Y0A). An external 24 V power supply is used.

For functional safety requirements, the load connection needs to be in a dual-input loop, where X0_A and X0_B form a pair.



Output Wiring Diagram

(1) Driving an inductive load:



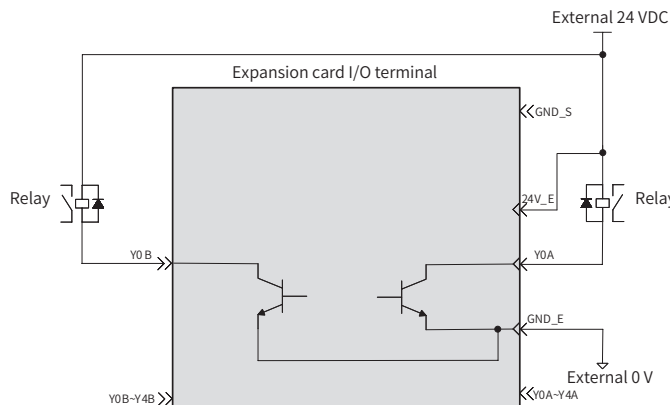
NOTE

When inductive load is applied, large back EMF is generated between contacts and arc discharge also occurs when the inductive load stops. This may result in contact failure or contact sag, shortening the contact lifetime. Therefore, you can connect a flyback diode in parallel with the load to extend the lifetime of the product.

The flyback diode must meet the following requirements:

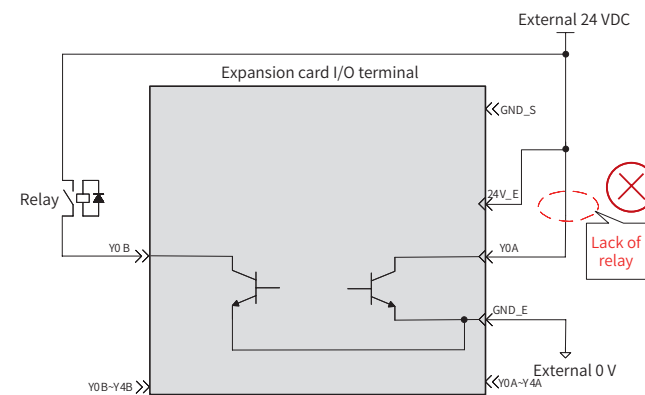
- ◆ The reverse voltage is 5 to 10 times of the load voltage.
- ◆ The forward current is larger than the load current.

Correct wiring:

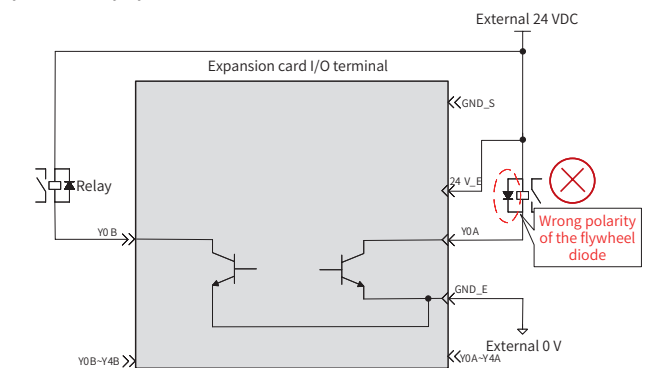


Incorrect wiring:

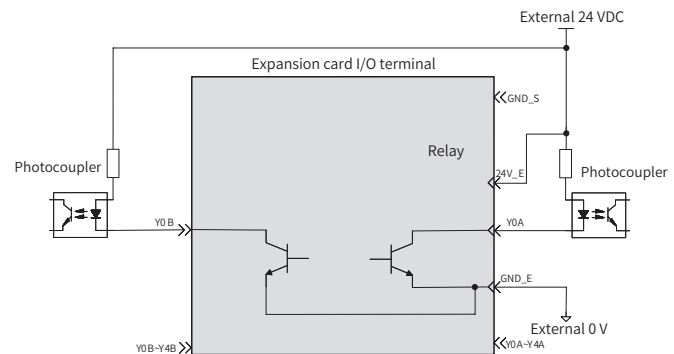
① Lack of a relay in either or both circuits:



② Incorrect polarity of the relay flywheel diode in either or both circuits:



(2) Driving a photocoupler load:



INOVANCE Warranty Agreement

- ◆ Inovance provides a 12-month free warranty service to the product from the date of factory shipment. The free warranty service covers free repairs and replacements in the case of product failure or damage caused by defects of the product under normal use conditions.
- ◆ Paid warranty service will be provided in the following scenarios:
 - a) The warranty period for the product on site has expired.
 - b) Damage is caused by improper operations violating the user guide of the product.
 - c) Damage is caused by inadequate protection measures in harsh environments, such as severe dust, humidity, and high temperatures.
 - d) Damage is caused by natural disasters, such as lightning, fire, floods, and earthquakes.
 - e) Damage is caused by peripheral equipment faults, such as poor wiring, water ingress, and abnormal voltages.
 - f) Additional support is required for equipment commissioning and installation.
 - g) New features, modifications, program changes, application issues, and selection errors.
- ◆ If the equipment is faulty or damaged, fill in the Warranty Card correctly and in detail.
- ◆ The maintenance fee will be charged according to the latest Maintenance Price List of Inovance.
- ◆ The Warranty Card is not re-issuable. Keep the card well and present it to the maintenance personnel during maintenance.
- ◆ If there is any problem during the service, contact Inovance's agent or Inovance directly.
- ◆ Inovance reserves the rights for explanation of this agreement.

INOVANCE Robot Warranty Card

Customer info.	Company add.:	
	Company name:	Contact:
	Post code:	Tel.:
Product info.	Product model:	
	Barcode (paste the barcode here):	
	Agent:	
Fault	Fault description:	
Recorded by:		

Suzhou Inovance Technology Co., Ltd.
Technical Service Center

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