Dobot Magician V2 Extended Interface User Guide

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Preface

Purpose

This manual introduces the interface, indicator lights and I/O multiplex interface of Dobot Magician V2.

Intended Audience

This document is intended for:

- Customer
- Sales Engineer
- Installation and Commissioning Engineer
- Technical Support Engineer

Change History

Date	Change Description
2021/08/19	The first release

Symbol Conventions

The symbols that may be founded in this document are defined as follows.

Symbol	Description
⚠DANGER	Indicates a hazard with a high level of risk which, if not avoided, could result in death or serious injury
⚠WARNING	Indicates a hazard with a medium level or low level of risk which, if not avoided, could result in minor or moderate injury, robot damage
⚠NOTICE	Indicates a potentially hazardous situation which, if not avoided, can result in equipment damage, data loss, or unanticipated result
🕮NOTE	Provides additional information to emphasize or supplement important points in the main text

Contents

1. Interface Description

1.1 Interface board

Dobot Magician interface is located at the back of the base and forearm. The base interfaces are shown in Figure 1.1, and their functions are shown in Table 1.1.

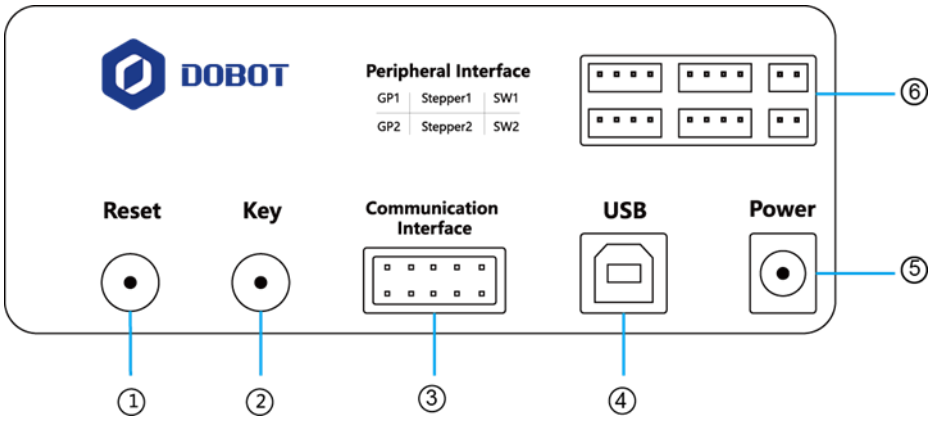

Figure 1.1 Base back Interface

Table 1.1 Description on base back Interface

No.	Description
1	Reset button: reset MCU program The base indicator turns yellow. About 5 seconds later, the base indicator turns green, indicating the reset is successful
2	Function buttons Press: execute offline procedure Press and hold for more than 2 seconds: start the homing operation
3	UART interface/I/O interface: connect Bluetooth, WIFI module; adopt Dobot protocol
4	USB interface: connect PC for communication
5	Power supply: connect power adapter
6	Peripheral interface: connect air pump, extruder, sensors and other external equipment. For details, please see Table 1.2.

The peripheral interfaces of the base are listed in Table 1.2

Table 1.2 Description on base peripheral interfaces

Interface	Description
SW1	Air pump box power interface/user-defined 12V controllable power output

SW2	User-defined 12V controllable power output
Stepper1	User-defined stepper motor interface/3D printing extruder interface (3D printing mode)/conveyor motor interface/slide motor interface
Stepper2	User-defined stepper motor interface
GP1	Air pump box control signal interface/photoelectric sensor interface/color sensor interface/user-defined general interface
GP2	User-defined general interface/color sensor interface/slide homing switch interface

The peripheral interfaces of the forearm are shown in Figure 1.2, and their functions are listed in Table 1.3.

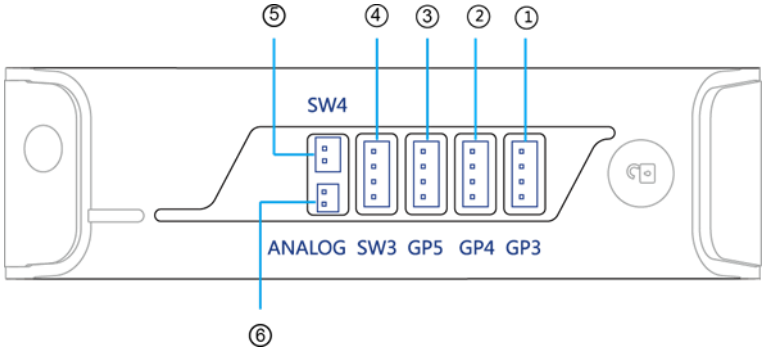

Figure 1.2 Forearm peripheral interfaces

Table 1.3 Description on forearm peripheral interface

No.	Description
1	GP3, R-axis steering gear interface/user-defined universal interface
2	GP4, automatic leveling interface/photoelectric sensor interface/color sensor interface/user-defined general interface
3	GP5, laser engraving signal interface/photoelectric sensor interface/color sensor interface/user-defined general interface
4	SW3, 3D printing heating terminal interface (3D printing mode)/user-defined 12V controllable power output
5	SW4, 3D printing heating fan (3D printing mode)/laser engraving power interface/user-defined 12V controllable power output
6	ANALOG, 3D printing thermistor interface (3D printing mode)

1.2 Indicator lights

The indicator lights of Dobot Magician are located at the base. Table 1.4 describes the state of

the lights.

Table 1.4 Description on indicator lights

State	Description
Green light is always on	The robot arm is working normally
Yellow light is always on	The robot arm is in the starting state
Blue light is always on	The robot arm is offline
Green light blinks	The robot arm is performing a homing operation or automatic leveling
Red light is always on	The robot arm is in a limit state, or the alarm is not cleared, or the connection of the 3D printing kit is wrong

1.3 Description on I/O multiplex interface

The I/O interface of Dobot Magician adopts unified addressing and most pins have multiplex functions. You can realize high and low level output and level input reading through the I/O interface to control the external devices of the robot arm.

1.3.1 Description on base I/O interface multiplexing

1.3.1.1 UART interface I/O multiplexing

The UART interface is shown in Figure 1.3, and its I/O multiplexing is described in Table 1.5.

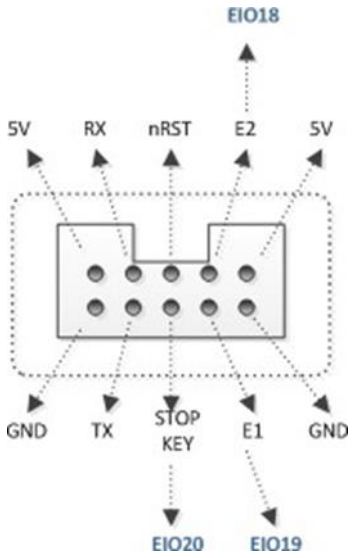

Figure 1.3 UART interface

Table 1.5 UART interface pins

Pin	Function	Pull up/pull down resistor
5V	5V/1A output	-

GND	Ground	-
E2 (EIO18)	3.3V_20mA output	No pull-up/pull down resistor
E1 (EIO19)	3.3V/5V_20mA input	To 3.3V through 1M pull-up resistor
nRST	3.3V_20mA hardware reset signal; Input only	To 3.3V through 1M pull-up resistor
STOP KEY (EIO20)	3.3V/5V_20mA input; To 3.3V through 10K pull-up resistor	To 3.3V through 10K pull-up resistor
RX	3.3V/5V_20mA input TTL level, serial port data receiving	To 3.3V through 1M pull-up resistor
TX	3.3V/5V_20mA input TTL level, serial port data sending	No pull-up/pull down resistor
5V	5V/1A output	-
GND	Ground	-

1.3.1.2 Description on peripheral interface I/O multiplexing

The base peripheral interface is shown in Figure 1.4, and its I/O multiplexing is described in Table 1.6.

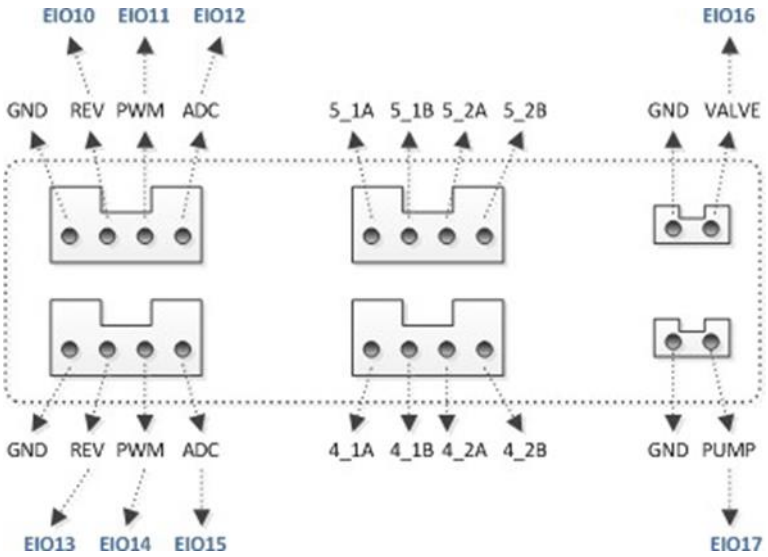

Figure 1.4 Base peripheral interface

Table 1.6 Description on peripheral interface I/O Multiplexing

Interface	Pin	Function	Pull-up/pull down resistor
SW1	VALVE (EIO16)	12V/1A output	-
	GND	Ground	-
SW2	PUMP (EIO17)	12V/1A output	-
	GND	Ground	-
Stepper1	5_1A	Default phase voltage/current: 12V/0.9A	-
	5_1B	Default phase voltage/current: 12V/0.9A	-
	5_2A	Default phase voltage/current: 12V/0.9A	-
	5_2B	Default phase voltage/current: 12V/0.9A	-
Stepper2	4_1A	Default phase voltage/current: 12V/0.9A	-
	4_1B	Default phase voltage/current: 12V/0.9A	-
	4_2A	Default phase voltage/current: 12V/0.9A	-
	4_2B	Default phase voltage/current: 12V/0.9A	-
GP1	ADC	3.3V/5V_20mA input	To 3.3V through 1M pull-up resistor
	PWM	3.3V_20mA output	No pull-up/pull down resistor
	REV	5V/1A output	-
	GND	Ground	-
GP2	ADC	3.3V_20mA output Compatible with 3.3V/5V_20mA input	To GND through 1M pull-down resistor
	PWM	3.3V_20mA output Compatible with 3.3V/5V_10mA input	To 3.3V through 1M pull-up resistor
	REV	5V/1A output	-
	GND	Ground	-

1.3.2 Description on forearm I/O interface multiplexing

The forearm peripheral interfaces are shown in Figure 1.5, and their I/O multiplexing is described in Table 1.7.

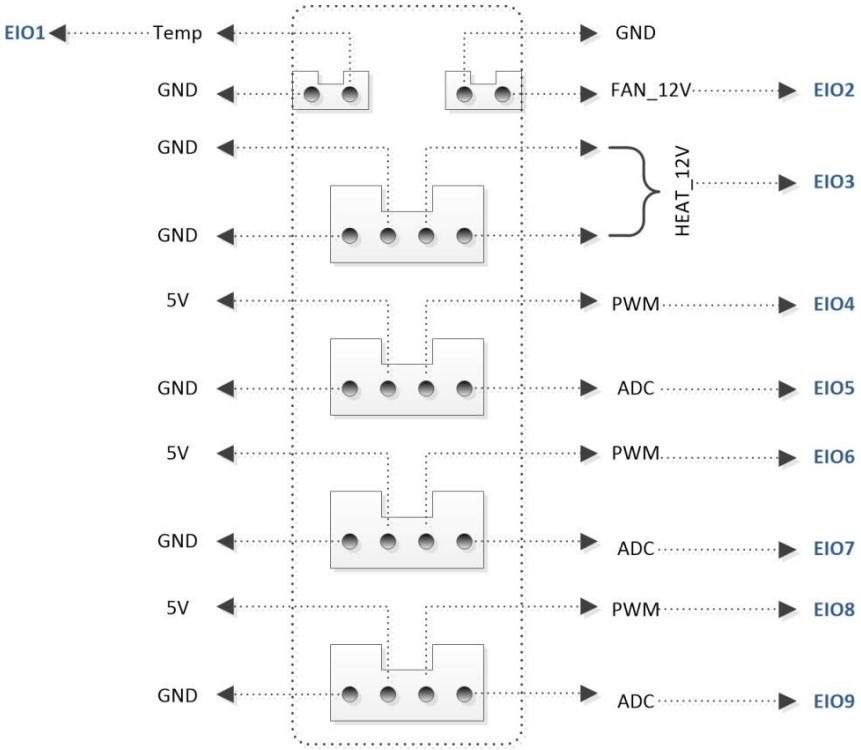

Figure 1.5 Forearm peripheral interface

Table 1.7 Description on peripheral interface I/O Multiplexing

Interface	Pin	Function	Pull-up/pull down resistor
ANALOG	Temp (EIO1)	Temperature acquisition signal	To 3.3V through 4.7K resistor
	GND	Ground	-
SW4	FAN_12V (EIO2)	Fan power supply: 12V/1A	-
	GND	Ground	-
SW3	HEAT_12V (EIO3)	Heating wire power supply: 12V/3A	
	GND	Ground	-
	GND	Ground	-
GP5	ADC (EIO4)	Compatible with 3.3V/5V_20mA input	To 3.3V through 1M pull-up resistor
	PWM (EIO5)	3.3V_20Ma output	No pull-up/pull down resistor
	5V	5V/1A output	-

	GND	Ground	-
GP4	ADC (EIO6)	Compatible with 3.3V/5V_20mA input	To 3.3V through 1M pull-up resistor
	PWM (EIO7)	3.3V_20mA output	No pull-up/pull down resistor
	5V	5V/1A output	-
	GND	Ground	-
GP3	ADC (EIO8)	Compatible with 3.3V/5V_20mA input	To GND through 1M pull-down resistor
	PWM (EIO9)	3.3V_20mA output	No pull-up/pull down resistor
	5V	5V/1A output	-
	GND	Ground	-

2. Connecting with PLC Through I/O

This chapter introduces available I/O of robot arm, selection of level conversion board and PLC connection.

2.1 Available I/O of robot arm

As it is not convenient to connect the forearm interface of Dobot Magician with PLC, the forearm interface is not recommended. This section mainly introduces the interfaces that are easy to use.

2.1.1 GP1 interface

GP1 interface is located at the base, as shown in the red box in Figure 2.1.

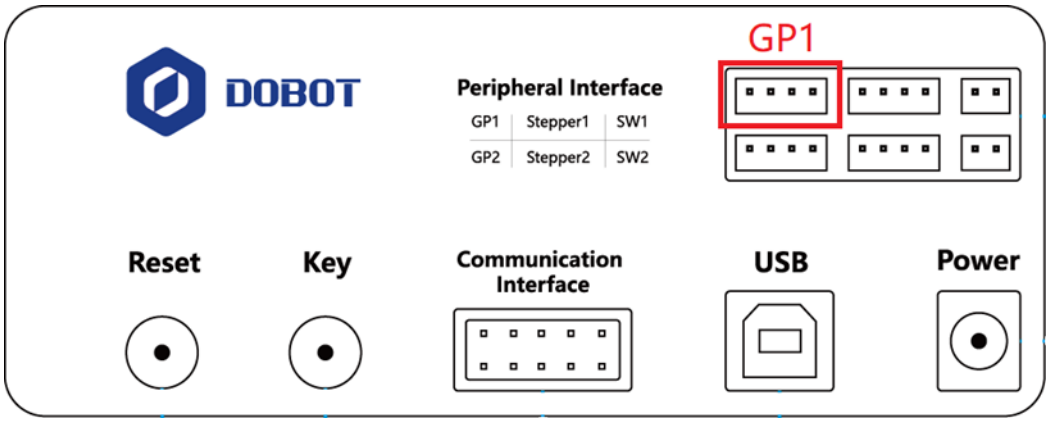

Figure 2.1 GP1 diagram

The four pins of the interface are (from left to right):

GND: universal ground (negative);

EIO10: 5V output, the default value is 0V;

EIO11: 3.3V output, low level by default;

EIO12: 3.3V input, high level by default.

When the end tools are set as sucker and gripper, the interface is controlled by the system to open the air pump and other functions, and cannot be used as general I/O. If you use this group of interfaces, the Magician end tool cannot be set as a gripper or a sucker.

EIO11 and EIO12 are recommended to interact with the PLC.

2.1.2 GP2 interface

GP2 interface is located at the base, as shown in the red box in Figure 2.2.

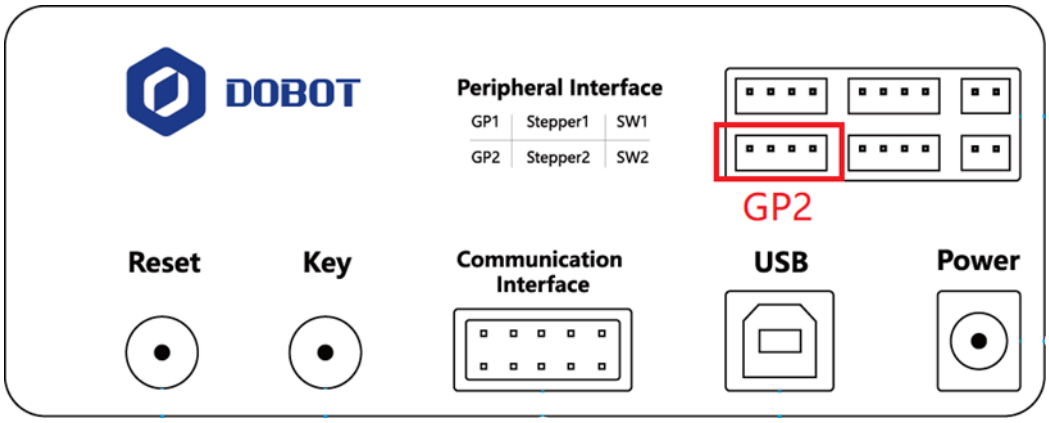

Figure 2.2 GP2 diagram

The four pins of the interface are (from left to right):

GND: universal ground (negative);

EIO13: 5V output, the default value is 0V;

EIO14: 3.3V input or output;

EIO15: 3.3V input or output.

As this group of interfaces has GND, input and output, and it has no special purpose, it is recommended to use. The 5V output is recommended for modules requiring large current.

EIO14 and EIO15 are recommended to interact with the PLC.

2.1.3 Communication interface

The communication interface is located at the base, including pins with different functions.

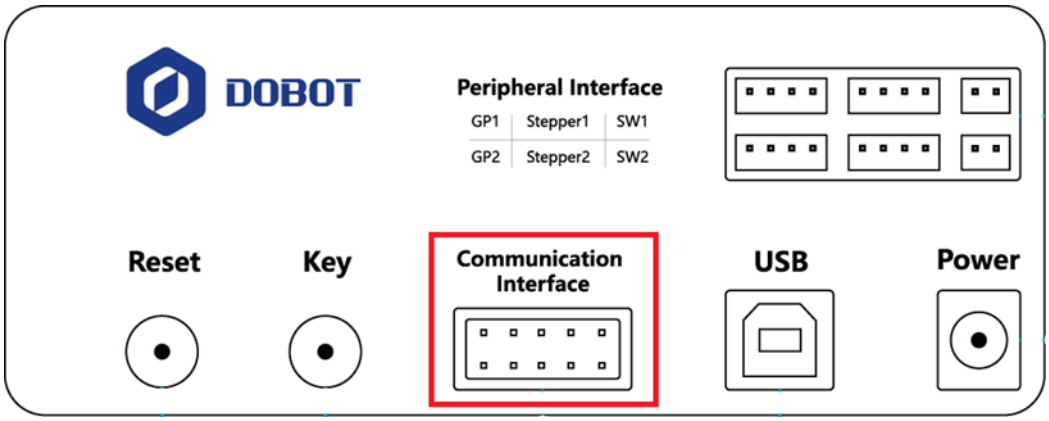

Figure 2.3 Communication interface

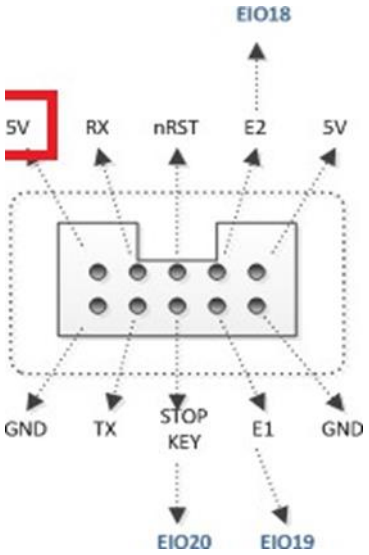

Figure 2.4 Pins of communication interface

5V: 5V power supply;

GND: universal ground (negative);

EIO18 (E2): 3.3V output, low level by default

EIO19 (E1): 3.3V input, high level by default

EIO20: 3.3V input, high level by default. The I/O may have special functions in the future, and compatibility is not guaranteed.

It is recommended to use the 5V pins, as shown in the red box in Figure 2.4, to supply power to the level conversion board.

EIO18 and EIO19 are recommended to interact with the PLC.

Table 2.1 Recommended available I/O

GP1	EIO11	3.3V output
	EIO12	3.3V input
GP2	EIO14	3.3V input or output
	EIO15	3.3V input or output
Communication Interface 10pin	EIO18	3.3V output
	EIO19	3.3V input
	EIO20	3.3V input

2.2 Selection of level conversion module

The conventional signal voltage of PLC is 24V, while the voltage of Dobot arm is 3.3V, so 24V to 3.3V and 3.3V to 24V conversion module need to be used.

2.2.1 24V to 3.3V level conversion module

The level conversion module converts PLC output signal (24V) to 3.3V signal, which can be received by the robot arm. Figure 2.5 shows the conversion module.

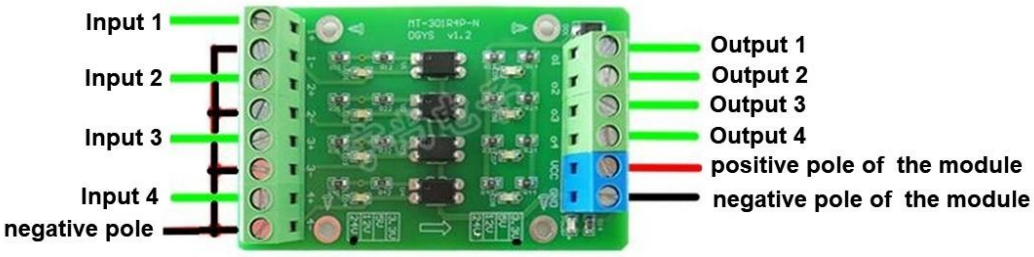

Figure 2.5 24V to 3.3V level conversion module

The input end of the conversion board can be connected with common anode, common cathode, differential signal, etc., and it can adapt to different kinds of PLC. For the output end, PNP output is recommended to adapt to the robot arm.

2.2.2 3.3V to 24V level conversion module

This level conversion module converts robot arm output signal (3.3V) into 24V signal, which can be received by PLC. Figure 2.6 shows the conversion module.

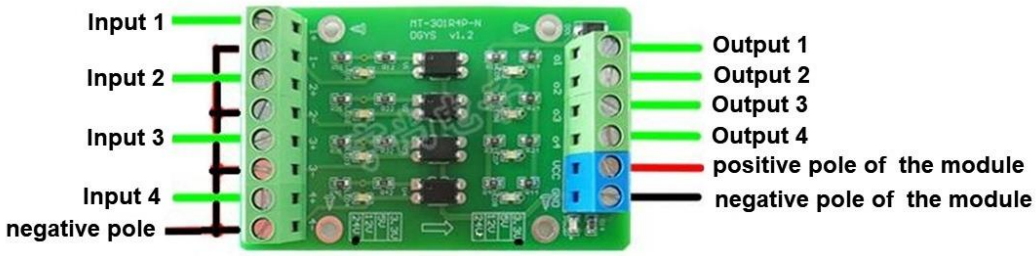

Figure 2.6 3.3V to 24V level conversion module

The signal input end of the module is connected to the 3.3V signal output of the robot arm. It is recommended to use the common cathode connection mode, that is, the negative electrode of input signal is connected to the GND of robot arm.

The positive and negative poles of the output module are connected to the positive and negative terminals of the 24V switching power supply. You can choose NPN output or PNP output conversion module according to the input type of PLC.

2.2.3 Purchase link in the example:

Purchase link:

https://item.taobao.com/item.htm?spm=a1z0k.7385993.1997994373.d4919385.51f82ad5SiAIHL&id=587937414115&_u=t2dmg8j26111

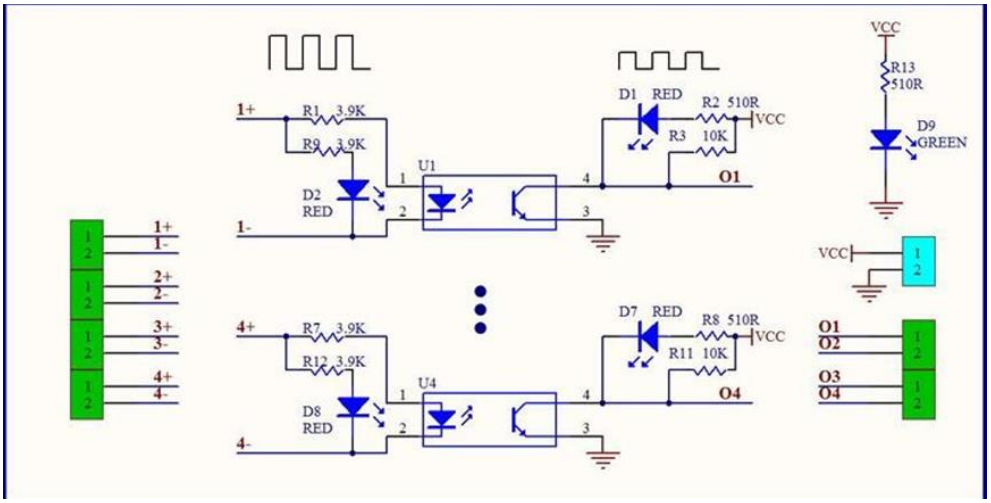

Figure 2.7 Internal structure of the module

2.3 Determine PLC input and output types

In determining the source type or leakage type of PLC, we distinguish in accordance with the conventional standard (Mitsubishi, etc.), specifically as follows:

Source type input and leakage type input are relative to the PLC input common end (COM or M). Current inflow is regarded as leakage type and current outflow as source type.

Source type output and leakage type output are relative to the PLC output common end (COM or M). The current inflow is regarded as source type, and current outflow as leakage type.

2.3.1 PLC for SIEMENS

When the PLC is Siemens S7-1200 DC/DC/DC series, you need to choose source type output and source type input, and 3.3V to 24V level conversion module of PNP. The connection diagram is as follows:

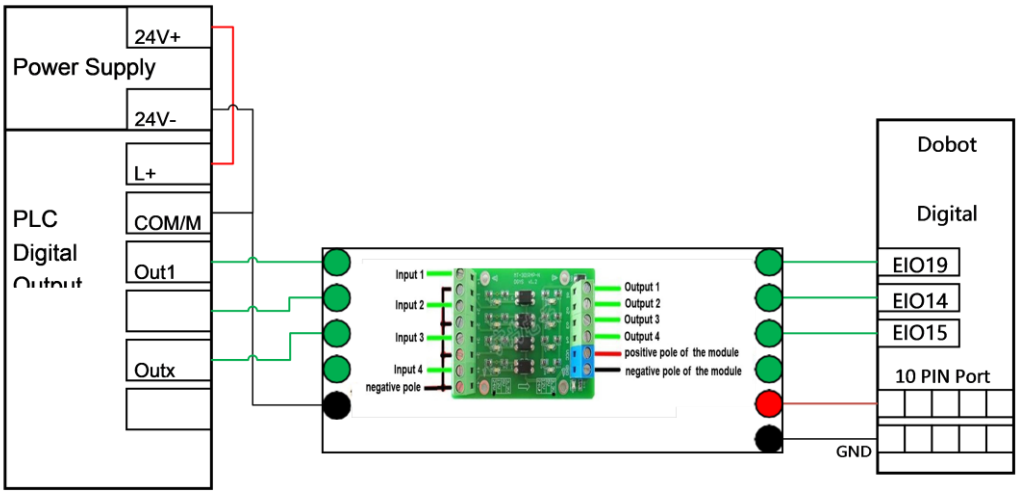

Figure 2.8 Diagram for PLC output and Magician input

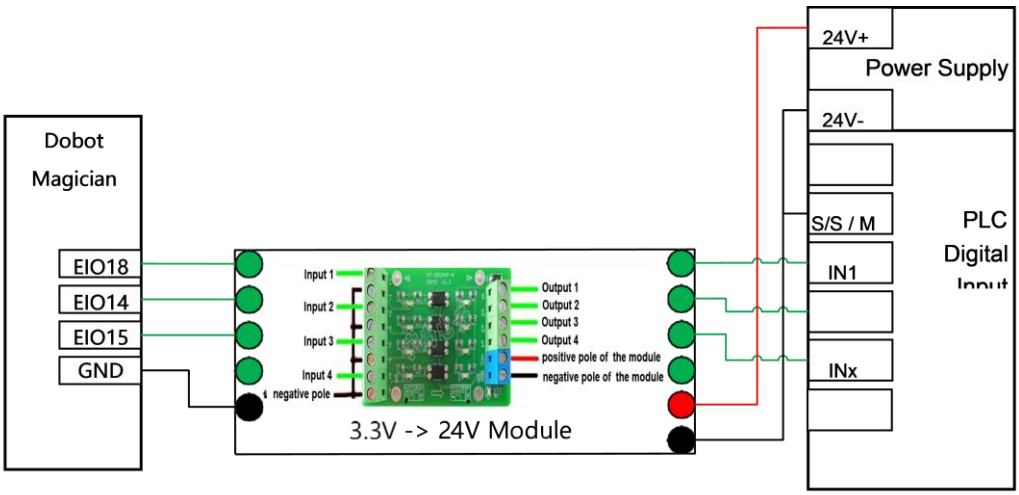

Figure 2.9 Diagram for Magician output and PLC input

2.3.2 PLC for Mitsubishi

If the PLC is Mitsubishi series, as the default level of EIO14 and EIO15 are not consistent, they cannot be used for input at the same time. The connection diagram is shown in Figure 2.10.

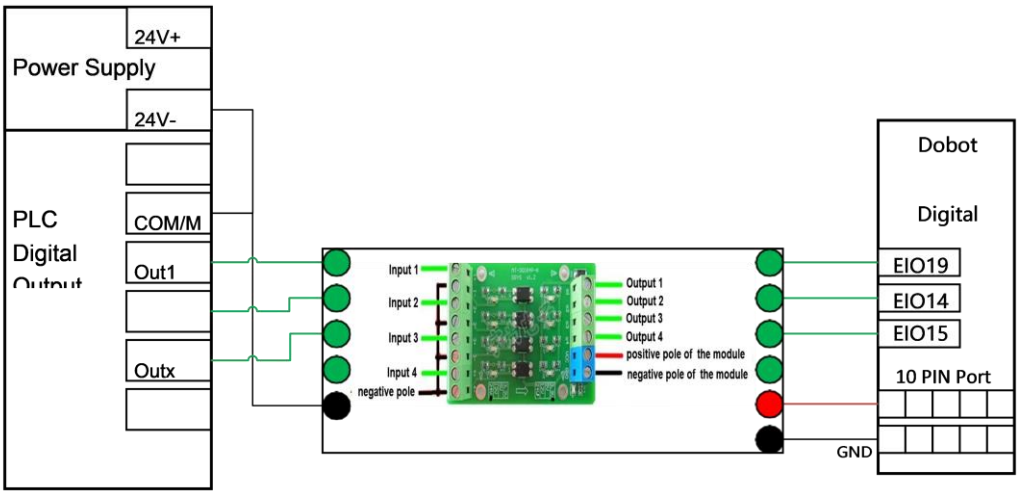

Figure 2.10 Connection diagram for PLC output and Magician input

As the default levels of EIO14 and EIO15 are not consistent, they cannot be used for output at the same time. You can use a multimeter to test before you determine their connection. The connection diagram is shown in Figure 2.11.

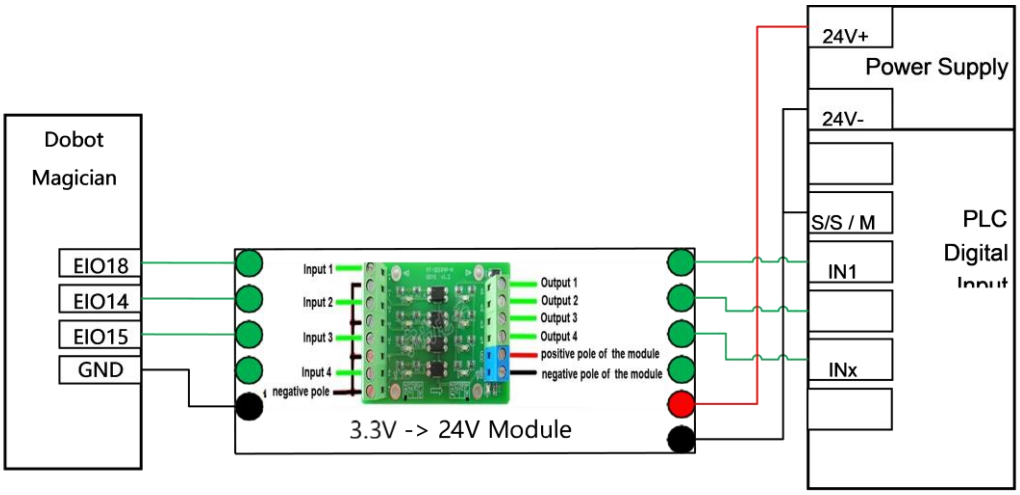

Figure 2.11 Connection diagram for Magician output and PLC input

